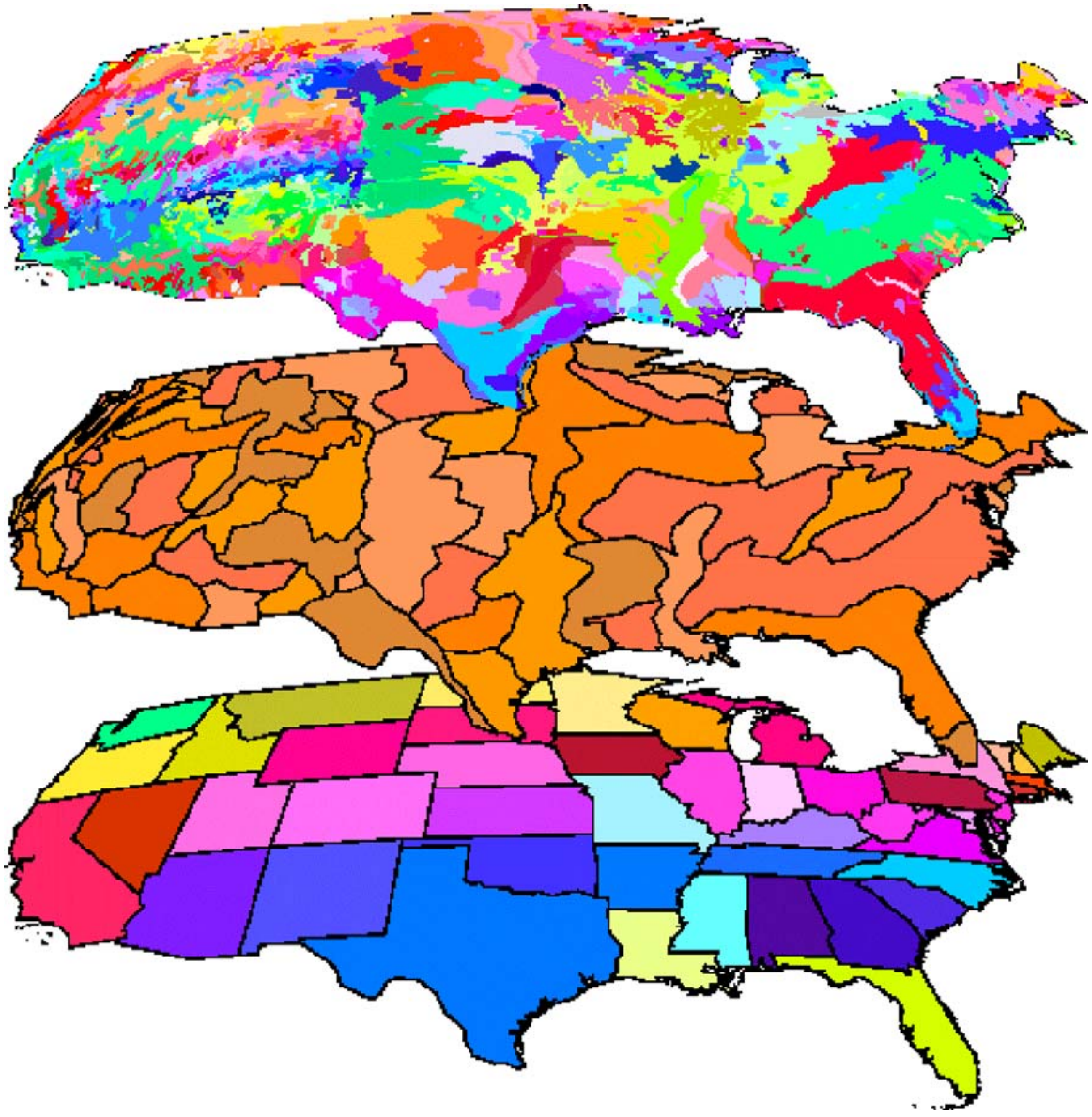
A GAP ANALYSIS OF NEBRASKA

Nebraska Final Report *June 2005*



A GEOGRAPHIC APPROACH TO PLANNING FOR BIODIVERSITY

THE NEBRASKA GAP ANALYSIS PROJECT

FINAL REPORT

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DEDICATION

To good people of Nebraska: may the "Good Life" be preserved and passed on!

EXECUTIVE SUMMARY

Nebraska is a leading agricultural state. According to the 2002 Census of Agriculture (USDA 2004), the total value of agricultural products sold in Nebraska was $9.7 billion (national ranking= 4th) of which $6.3 billion came from animal products and $3.4 billion from plant products. The extent of irrigated harvested cropland is vast: 7,508,900 ac (30,388 km^2) covers more than 15% of the land area of Nebraska and accounts for almost 15% of the national total (rank=2nd). Given the centrality of agriculture to the economy of Nebraska, it is not surprising that land holdings are overwhelmingly in private hands (>97%). Thus, biodiversity planning faces special challenges in the State of Nebraska, especially the issue of landscape connectivity in fragmented habitats.

On the path to becoming a leading agricultural state, Nebraska's landscapes have been repeatedly transformed since European settlement and are now dominated by human activities across a range of use intensities. Plowing and cultivation of the prairies, suppression of periodic wildfire, drainage of wetlands, channelization of rivers and streams, emplacement of reservoirs and ponds, planting of shelterbelts, extirpation of large carnivores, displacement of large herbivores and replacement by cattle, introduction of exotic and invasive species, intensive use of fertilizers and pesticides, expansion of irrigation, growth and development of human settlements, transportation corridors, and commercial and industrial activities—all these anthropogenic impacts on the Nebraska landscapes and wildlife have led up to the current situation in the early years of the 21st century.

To initiate a gap analysis of Nebraska, it was necessary to produce a land cover map using multiple data sources, primarily Landsat Thematic Mapper imagery from the period 1991-1993. The Nebraska GAP (NE-GAP) land cover product complements the USGS's National Land Cover Dataset (NLCD) map of Nebraska that using similar base image data but different cover classes. For example, the NE-GAP distinguishes among more grassland and wetland types than the NLCD product.

To develop models of the relationships between 332 wildlife species and their habitat, we developed a database of geospatial data that included a broad range of surrogate variables for habitat suitability and quality, e.g., land cover composition, aspects of climate, surficial soil texture, hydrology and terrain. This geodatabase was linked using advanced statistical modeling (a recursive partitioning algorithm) to species occurrence data obtained from biological surveys and museum voucher specimens. In the absence of a sufficient number of observations, wildlife-habitat relationship models were developed from the literature and implemented in the geodatabase. Accuracy assessment of the models was conducted using occurrence data not previously used and focused on the omission error rate (i.e., an estimate of the frequency of incorrectly designating an area as "not habitat"). Higher omission rates indicate poorer model performance. Considered across taxa (Birds vs. Reptiles and Amphibians vs. Mammals), the median values are almost always zero, while the average omission rates range from 2.6-27.5%. This discrepancy between the average and median indicates a highly skewed distribution of model performance which indicates that omission rates are generally quite low, but a few species have poorly performing models which affect the average but not the median.

By superimposing all the predicted species habitat maps, species richness maps were generated for each taxon and for total vertebrate biodiversity. The highest richness values were found in the southeastern part of Nebraska and the minimum values were found in the southwestern region. Overall, the total vertebrate richness map showed high values for the southeastern portion of Nebraska and linear branches throughout the state. These linear features follow the major rivers and streams of the State: the Platte River and its tributaries draining the middle of the state, the Niobrara River along the northern tier, the Missouri River on the eastern border, and the Republican in the south. Available water and a variety of habitat provided

by woodlands along the streams accounted for the higher species richness. Climatic gradients of the Great Plains—increased precipitation from west to east and increased temperature from north to south—largely accounted for higher species richness in southeastern Nebraska, even though most of the original prairies have been converted to agriculture with a profusion of trees in planted shelterbelts and expanding patches of eastern red cedar that thrive due to human suppression of wildfires. The Pine Ridge, in northwestern Nebraska, supports high richness because of significant elevational differences, which enables the occurrence of a ponderosa pine forest.

Areas of low species richness encompassed most of the grasslands mapped within the state of Nebraska. The grasslands provide a lesser diversity of habitats and are pervasive in the western Nebraska. Sources of available surface water are scarcer. Scattered pockets of high richness can be found within these grasslands and are indicative of perennial water bodies and smaller streams. Richness maps by taxon reflect the same general trends. The species richness maps produced through the wildlife-habitat relationship modeling show not the current state of biodiversity in Nebraska. Rather, they portray a potential biodiversity across the State.

The amount of land in Nebraska in the more protective stewardship categories is minute: only 1225 km^2 or 0.61% of the land area of the State. The top three land cover types with significant area in conservation stewardship are Aquatic Bed Wetlands (34 km^2 or 8.3% of that cover type), Emergent Wetlands (91 km^2 or 3.8%), Ponderosa Pine Forests and Woodland (30 km^2 or 2.8%). Together, these areas total 155 km^2 or just 0.08% of the land area of the State.

The NE-GAP project has revealed profound gaps in the network of stewardship needed to cover a representative selection of Nebraska's biodiversity. Yet, this conclusion could be gleaned from a glance at an atlas. The more significant result of the NE-GAP project has been a demonstration in the gaps in our knowledge base about the common species that inhabit Nebraska.

Periodic biodiversity surveys are a necessary complement to the kind of predictive modeling attempted here. It is well documented that animal range distributions across Nebraska have been changing in the past couple of decades. This is not necessarily surprising given the State's central location in the Great Plains and its predominantly west-to-east riparian corridors. What are the implications of these movements? What are the potential connections between shifting animal distributions, habitat quality, and climate change? Are there linkages between disease occurrence and habitat and climate change? How can these species habitat model be improved? These are a few of the questions that can begin to be addressed using the information produced by the NE-GAP project.

Just as there is need to conduct periodic biological surveys, land cover mapping requires periodic updating. Given recent advances in data accessibility, computer power, and classification techniques, the once-daunting task of fine resolution land cover mapping has become much less expensive, although it is still far from easy. The Nebraska Gap Analysis Project provides informational infrastructure to support development of strategic planning for biodiversity planning. It is a beginning.

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INTRODUCTION

How This Report is Organized

This report is a summation of a scientific project. While we endeavor to make it understandable for as general an audience as practicable, it reflects the complexity of the project it describes. A glossary of terms is provided to aid the reader in its understanding, and for those seeking a detailed understanding of the subjects, the cited literature should be helpful. The organization of this report follows the general chronology of project development, beginning with the production of the individual data layers and concluding with analysis of the data. It diverges from standard scientific reporting by embedding results and discussion sections within individual chapters. This was done to allow the individual data products to stand on their own as testable hypotheses and provide data users with a concise and complete report for each data and analysis product.

We begin with an overview of the Gap Analysis Program mission, concept, and limitations. We then present a synopsis of how the current biodiversity condition of the project area came to be, followed by land cover mapping, animal species distribution prediction, species richness, and land stewardship mapping and categorization. Data development leads to the Analysis section, which reports on the status of the elements of biodiversity (natural community alliances and animal species), for Nebraska. Finally, we describe the management implications of the analysis results and provide information on how to acquire and use the data.

The Gap Analysis Program Mission

The mission of the Gap Analysis Program is to prevent conservation crises by providing conservation assessments of biotic elements (plant communities and native animal species) and to facilitate the application of this information to land management activities. This is accomplished through the following five objectives:

1) map actual land cover as closely as possible to the alliance level (FGDC 1997).
2) map the predicted distribution of those terrestrial vertebrates and selected other taxa that spend any important part of their life history in the project area and for which adequate distributional habitats, associations, and mapped habitat variables are available.
3) document the representation of natural vegetation communities and animal species in areas managed for the long-term maintenance of biodiversity.
4) make all GAP project information available to the public and those charged with land use research, policy, planning, and management.
5) build institutional cooperation in the application of this information to state and regional management activities.

To meet these objectives, it is necessary that GAP be operated at the state or regional level but maintain consistency with national standards. Within the state, participation by a wide variety of cooperators is necessary and desirable to ensure understanding and acceptance of the data and forge relationships that will lead to cooperative conservation planning.

The Gap Analysis Concept

The Gap Analysis Program (GAP) brings together the problem-solving capabilities of federal, state, and private scientists to tackle the difficult issues of land cover mapping, animal habitat characterization, and biodiversity conservation assessment at the state, regional, and national levels. The program seeks to facilitate cooperative development and use of information. Throughout this report we use the terms

"GAP" to describe the national program, "GAP Project" to refer to an individual state or regional project, and "gap analysis" to refer to the gap analysis process or methodology.

Much of the following discussion was taken verbatim from Edwards et al. 1995, Scott et al. 1993, and Davis et al. 1995. The gap analysis process provides an overview of the distribution and conservation status of several components of biodiversity. It uses the distribution of actual vegetation and predicted distribution of terrestrial vertebrates and, when available, invertebrate taxa. Digital map overlays in a GIS are used to identify individual species, species-rich areas, and vegetation types that are unrepresented or underrepresented in existing management areas. It functions as a preliminary step to the more detailed studies needed to establish actual boundaries for planning and management of biological resources on the ground. These data and results are then made available to the public so that institutions as well as individual landowners and managers may become more effective stewards through more complete knowledge of the management status of these elements of biodiversity. GAP, by focusing on higher levels of biological organization, is likely to be both cheaper and more likely to succeed than conservation programs focused on single species or populations (Scott et al.1993).

Biodiversity inventories can be visualized as "filters" designed to capture elements of biodiversity at various levels of organization. The filter concept has been applied by The Nature Conservancy, which established Natural Heritage Programs in all 50 states. The Nature Conservancy employs a fine filter of rare species inventory and protection and a coarse filter of community inventory and protection (Jenkins 1985, Noss 1987). It is postulated that 85-90% of species can be protected by the coarse filter without having to inventory or plan reserves for those species individually. A fine filter is then applied to the remaining 15-10% of species to ensure their protection. Gap analysis is a coarse-filter method because it can be used to quickly and cheaply assess the other 85-90% of species. GAP is not designed to identify and aid protection of elements that are rare or of very restricted distribution; rather it is designed to help "keep common species common" by identifying risk far in advance of actual population decline. These concepts are further developed below.

The intuitively appealing idea of conserving most biodiversity by maintaining examples of all natural community types has never been applied, although numerous approaches to the spatial identification of biodiversity have been described (Kirkpatrick 1983, Margules and Nicholls 1988, Pressey and Nicholls 1989, Nicholls and Margules 1993). Furthermore, the spatial scale at which organisms use the environment differs tremendously among species and depends on body size, food habits, mobility, and other factors. Hence, no coarse filter will be a complete assessment of biodiversity protection status and needs. However, species that fall through the pores of the coarse filter, such as narrow endemics and wide-ranging mammals, can be captured by the safety net of the fine filter. Community-level (coarse-filter) protection is a complement to, not a substitute for, protection of individual rare species.

Gap analysis is essentially an expanded coarse-filter approach (Noss 1987) to biodiversity protection. The land cover types mapped in GAP serve directly as a coarse filter, the goal being to assure adequate representation of all native vegetation community types in biodiversity management areas. Landscapes with great vegetation diversity often are those with high edaphic variety or topographic relief. When elevational diversity is very great, a nearly complete spectrum of vegetation types known from a biological region may occur within a relatively small area. Such areas provide habitat for many species, including those that depend on multiple habitat types to meet life history needs (Diamond 1986, Noss 1987). By using landscape-sized samples (Forman and Godron 1986) as an expanded coarse filter, gap analysis searches for and identifies biological regions where unprotected or underrepresented vegetation types and animal species occur.

More detailed analyses were not part of this project, but are areas of research that GAP as a national program is pursuing. For example, a second filter could combine species distribution information to

identify a set of areas in which all, or nearly all, mapped species are represented. There is a major difference between identifying the richest areas in a region (many of which are likely to be neighbors and share essentially the same list of species) and identifying areas in which all species are represented. The latter task is most efficiently accomplished by selecting areas whose species lists are most different or complementary. Areas with different environments tend to also have the most different species lists for a variety of taxa. As a result, a set of areas with complementary sets of species for one higher taxon (e.g., mammals) often will also do a good job representing most species of other higher taxa (e.g., trees, butterflies). Species with large home ranges, such as large carnivores, or species with very local distributions may require individual attention. Additional data layers can be used for a more holistic conservation evaluation. These include indicators of stress or risk (e.g., human population growth, road density, rate of habitat fragmentation, distribution of pollutants) and the locations of habitat corridors between wildlands that allow for natural movement of wide-ranging animals and the migration of species in response to climate change.

General Limitations

Limitations must be recognized so that additional studies can be implemented to supplement GAP. The following are general project limitations; specific limitations for the data are described in the respective sections:

1. GAP data are derived from remote sensing and modeling to make general assessments about conservation status. Any decisions based on the data must be supported by ground-truthing and more detailed analyses.

2. GAP is not a substitute for threatened and endangered species listing and recovery efforts. A primary argument in favor of gap analysis is that it is proactive: it seeks to recognize and manage sites of high biodiversity value for the long-term maintenance of populations of native species and communities before they become critically rare. Thus, it should help to reduce the rate at which species require listing as threatened or endangered. Those species that are already greatly imperiled, however, still require individual efforts to assure their recovery.

3. GAP data products and assessments represent a snapshot in time generally representing the date of the satellite imagery. Updates are planned on a 5-10 year cycle, but users of the data must be aware of the static nature of the products.

4. GAP is not a substitute for a thorough national biological inventory. As a response to rapid habitat loss, gap analysis provides a quick assessment of the distribution of vegetation and associated species before they are lost, and provides focus and direction for local, regional, and national efforts to maintain biodiversity. The process of improving knowledge in systematics, taxonomy, and species distributions is lengthy and expensive. That process must be continued and expedited, however, in order to provide the detailed information needed for a comprehensive assessment of our nation's biodiversity. Vegetation and species distribution maps developed for GAP can be used to make such surveys more cost-effective by stratifying sampling areas according to expected variation in biological attributes.

The Study Area

Nebraska lies near the center of the Great Plains of North America (Figure 1.1). Total area, including land and water is 77,358 square miles (200,358 km^2) (NE Blue Book 2003). Nebraska measures 459 miles (740km) at its widest point. Elevation rises gradually from southeast to northwest in a series of rolling plateaus, with an average elevation of 2500ft (793m). The lowest point is in southeast Richardson County, at the Missouri River (840ft, 256m); the highest in southwestern Kimball County, near the Colorado and Wyoming borders (5424ft, 1654m).

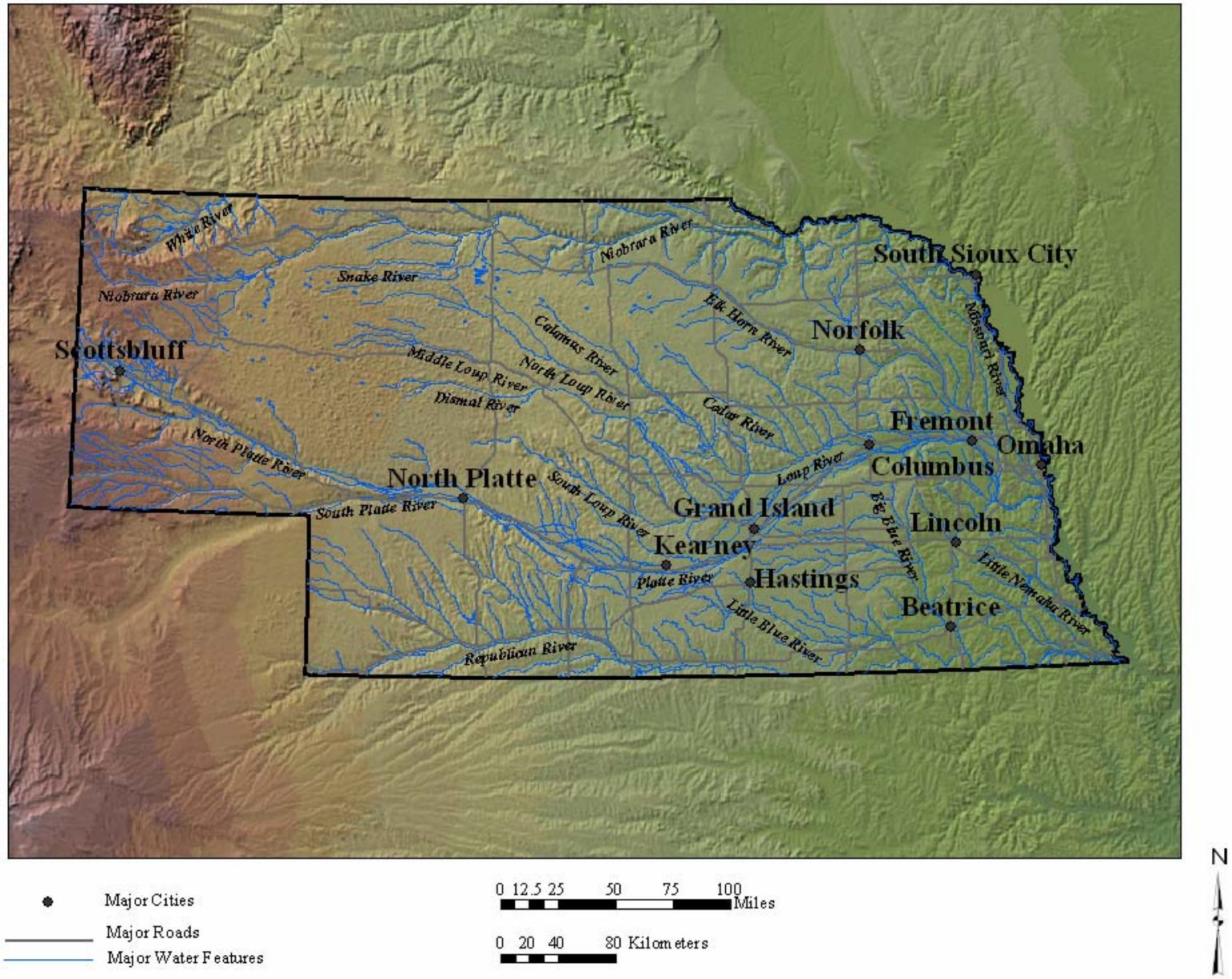


Figure 1.1. Major human and physiographic features in Nebraska.

Geographic Regions

Nebraska has two major geographic regions — the Dissected Till Plains and the Great Plains (Nebraska Blue Book 2003). The Dissected Till Plains cover the eastern fifth of Nebraska. They were formed when Ice Age glaciers left behind a rich soil-forming material called till. Windblown dust (loess) later settled on the till, and over the years, streams dissected the region, forming a rolling terrain. Along the Missouri River, the terrain includes bluffs and river-deposited lowlands. This combination makes the Dissected Till Plains well-suited for farming and fields of corn, soybeans, sorghum grain, and other crops blanket the region.

The Great Plains stretch west across the rest of the State into Wyoming and Colorado. They can be divided into smaller areas, among them the Loess Plains, the Loess Hills, the Sandhills and the High Plains. The Loess Plains cover about 7,948 square miles in south-central Nebraska. The flat to gently rolling plains were formed by deep deposits of windblown silt. Sink-like depressions occur throughout the region where water accumulations leached and concentrated clay particles in the subsoils to a thickness of six inches to six feet. When wet, the soil becomes plastic and nearly impervious to water. It is these layers of clay hardpan (locally called gumbo) that trap runoff water and explain the former abundance of natural marshes and lakes. The area, interspersed with lakes and wetlands, is often referred to as the "Rainwater Basin" and provides critical habitat in the spring for migrating waterfowl.

The Loess Hills lie north of the Platte River and south and east of the Sandhills. Here, windblown silt has formed rolling hills where farms and ranches predominate. The hills are composed of yellow loess soil overlying older debris left from the last ice age. They are characterized by sharp edged ridge crests, and slopes ranging from gentle to very steep. Cliffs cut into the erosion resistant soil by rivers, streams or road-builders a hundred years ago still remain.

The largest of the Great Plains subregions, comprising about one-quarter of the State, is the nearly 20,000 square miles of sand hills north of the North Platte and Platte rivers stretching to South Dakota. The Sand Hills is the largest sand dune area in the Western Hemisphere (Bleed and Flowerday 1990). This grass-stabilized dune region is characterized by relatively young (about 8,000 year old) dunes formed by wind whipping sand into hills and ridges interspersed with valleys that contain streams, lakes and wetlands. The abundant water and grasslands make this area ideal for raising cattle.

The High Plains lie northwest, southwest and due west of the Sandhills. Elevations of up to a mile above sea level occur in the west along the Wyoming border. In its 12,000 square miles are the scenic Wildcat Hills and Pine Ridge areas in the southern and northern Panhandle, respectively. A small area of the Badlands, which are mostly in South Dakota, extends into northwestern corner of Nebraska. This unusual landscape in the northwestern part of the State has been carved by erosion and is characterized by steep, mostly bare hills of siltstone and sandstone and by mushroom-like cap rocks on more narrow pedestals. Rougher sections of the High Plains are used for cattle grazing. The Wildcat and Pine Ridges are covered with evergreen trees.

Geology

Many times during the Paleozoic era shallow seas submerged the continental interior, leaving behind limestones, sandstones, and shales, with a record of ancient, mainly marine, life entombed within (Maher et al. 2003). Another sea, about 110 to 70 million years ago in Cretaceous time, flooded the continental interior and much and sometimes all of Nebraska. It left behind extensive deposits of sand, shale, and chalk with fossils of more advanced life forms such as large sea lizards.

The Rocky Mountains began to rise to the west as the Cretaceous sea receded, and by 38 million years ago sediment shed from the Rockies had spread into Nebraska. Sediment continued to build up until some 2 million years ago, reaching ¾ of the way across Nebraska. Then, during the Pleistocene ice ages, a bit

less than 2 million years ago, glaciers rearranged the landscape, diverting rivers to the south, forming lakes, and depositing debris in eastern Nebraska. The Missouri River developed in the path of a retreating glacial lobe. At times when the glaciers were farther north, winds blew across the plains. Grasslands trapped the dust, and built upward, accumulating locally thick loess deposits that mantled the older landscape.

Then, around 10,000 years ago and later, with the disappearance of the North American ice cap, much of central Nebraska became a stark sea of blowing and drifting sand – part of the largest dune field in the western hemisphere. As the climate changed and rainfall increased, grass covered and stabilized the dunes. The dunes marched again during intervals of decreased rainfall, most recently as 869 years ago.

The gently sloping surface across the western three-quarters of Nebraska is due primarily to the wedge of Tertiary sediment that built out from the Rocky Mountains. Erosion and deposition have significantly modified this surface. The valleys of the Platte, Republican, Loup and Elkhorn Rivers show well-developed floodplains and extensive drainage development. In contrast, the Niobrara River is entrenched, with narrower and deeper valleys. The western margins of glacial moraines can be seen south of the Platte River as an intricate drainage pattern developed on the tills to the east.

Soils

Soils in Nebraska have developed from various kinds of sediments deposited during several geologic periods and by different geologic processes (Elder 1969). The combination of precipitation pattern, rich parent material, and grasses have been the major factors producing the fertile and productive soils in Nebraska (Encarta 2004). The dominant soil parent materials are loess, eolian sand and glacial till. Leaching decreases toward the west because of the amount and pattern of precipitation. The predominant vegetation of grass has provided large amounts of organic material to the topsoil, increasing fertility. Most soils in Nebraska are classified as Mollisols, fertile soils used as cropland or rangeland. Mollisols occur throughout the south-central and eastern parts of the State. Sandy, less fertile Entisols (NRCS 2004) dominate the northcentral portion of the State. The Nebraska Panhandle is covered by a mixture of sandy and silty Entisols, Mollisols, and Inceptisols.

Vegetation

Prior to Euroamerican settlement, probably close to 90 percent of the land area of Nebraska was covered by native grasslands (Johnsgard 2001). Nebraska's landscape was dominated by grasslands, but there were also forests. Frequent prairie fires and rampaging rivers limited the distribution of these forests, resulting in a system of predominately young floodplain forests along the major river systems and relatively open pine forests in the west (Currier 1993). With settlement came the suppression of fire and damming of rivers. Nebraska forests today are more mature and densely wooded than they once were.

Much of the prairie in the eastern third and south-central part of the State has been replaced by cropland (Sharpe, et al. 2001). Prairie remnants remain as islands surrounded by agriculture. The grasslands of northcentral Nebraska, the Sandhills, still remain. Floodplain forests are much more widely distributed today, extending westward along Nebraska's streams and rivers, as a result of fire suppression. The montane coniferous forests of the Pine Ridge in the Panhandle, although having been selectively cut throughout the post-European settlement period, still retain much of their original distribution and character.

Rivers and Lakes

Nebraska is the only State that lies entirely within the drainage area of the Missouri River, which flows along Nebraska's northern and eastern borders for about 450 miles. Its major tributary in Nebraska is the Platte River, which flows across the State from west to east. The Platte River begins where the North and South Platte rivers meet near the city of North Platte.

The Platte, which is too shallow for navigation, was described as “a mile wide and an inch deep” by early explorers and pioneers crossing Nebraska. Today, the river is used for irrigation, municipal water supply, recreation and hydroelectric power production. The Platte’s main tributaries are the Loup and Elkhorn rivers, which originate in the Sandhills and flow southeast across north-central Nebraska. The Niobrara River drains northern Nebraska; the Republican, Big Blue, Little Blue and Nemaha rivers drain southern and southeastern Nebraska, respectively. Nebraska has about 2,500 small lakes, both natural and man-made. Hundreds of natural, shallow lakes dot the landscape of the Sandhills. Lake McConaughy, the State’s largest lake (about 55 square miles), was formed by the construction of the Kingsley Dam on the North Platte River. Other large man-made lakes include Jeffrey and Sutherland reservoirs on the Platte River system; Swanson, Medicine Creek and Harlan County reservoirs on the Republican River; Enders Reservoir on the Frenchman River; Calamus Reservoir on the Calamus River system; and Lewis and Clark Lake on the Missouri River system.

Climate

Nebraska’s weather is characterized by extremes in temperature and frequent changes in the weather (Sharpe et al. 2001). Tornadoes, thunderstorms, blizzards and hailstorms are part of hot summers and severely cold winters. Temperature and rainfall vary greatly during the year (Tables 1.1 and 1.2; interannual variability is also great. Temperature gradually drops from southeastern to northwestern Nebraska, except in the coldest part of the year (Nebraska Blue Book 2003). The highest temperature ever recorded in Nebraska, 118 ^{o}F (48 ^{o}C), was on July 15, 1934, at Geneva; on July 17, 1936, at Hartington; and on July 24, 1936, at Minden. The lowest temperature on record, -47 ^{o}F (-44 ^{o}C), was at Camp Clarke near Northport on Feb. 12, 1899, and at Oshkosh on Dec. 22, 1989.

The State’s precipitation pattern parallels its elevation gradient, with a gradual decrease from east to west. Years of abundant rainfall may alternate with extreme drought. Nebraska’s growing season ranges from about 165 days in the southeast to 120 days in the northwest. Killing frosts usually occur from about Oct. 15 to April 25 in the southeast and about Sept. 20 to May 20 in the northwest. Prevailing winds blow across Nebraska from the northwest between October and April, and from the south and southeast during other times. Average wind velocity is about 10 miles (16 kilometers) per hour. Tornadoes are not uncommon in the spring and summer. Averages of 37 are spotted every year, and some of them can cause extensive damage.

Table 1.1. Normal Temperature ^{o}F (based on 1971-2000 average)

Month	Pan-Handle	North-Central	North-East	Central	East-Central	South-West	South-Central	South-East
January	24.1	21.5	19.6	22.3	22.0	25.1	24.7	23.8
February	28.6	27.3	25.7	28.1	27.9	31.0	30.5	29.8
March	34.0	36.1	36.5	37.5	38.6	39.1	39.8	40.5
April	45.3	46.7	48.7	48.4	50.6	48.8	50.5	51.6
May	55.7	57.6	60.2	59.1	61.5	58.7	60.6	62.0
June	65.7	67.5	70.1	69.2	71.7	69.2	71.1	72.1
July	72.9	73.3	74.6	74.2	76.0	74.9	76.3	76.7
August	70.8	71.4	72.3	72.1	73.6	73.0	74.0	74.5
September	60.6	61.4	63.1	62.7	64.7	63.2	64.7	65.7
October	48.8	49.3	50.9	50.6	52.7	51.1	52.6	53.8
November	34.7	33.7	34.8	35.1	37.1	36.6	37.3	38.8
December	26.7	24.3	23.2	25.2	25.6	27.8	27.6	27.6
Average	**47.4**	**47.5**	**48.3**	**48.7**	**50.2**	**49.9**	**50.8**	**51.4**

Table 1.2. Normal Precipitation, inches (based on 1971-2000 average)

Month	Pan-Handle	North-Central	North-East	Central	East-Central	South-West	South-Central	South-East
January	0.40	0.45	0.54	0.51	0.67	0.47	0.46	0.73
February	0.44	0.58	0.70	0.61	0.71	0.52	0.56	0.81
March	1.08	1.47	2.01	1.86	2.24	1.34	1.92	2.38
April	4.85	2.32	2.81	2.56	2.94	1.97	2.25	2.90
May	3.10	3.64	4.05	3.89	4.51	3.30	4.07	4.42
June	2.67	3.40	4.01	3.78	4.05	3.18	5.42	3.85
July	2.39	3.32	3.41	3.42	3.60	3.03	3.70	4.30
August	1.70	2.46	3.01	2.80	3.35	2.44	3.07	3.49
September	1.43	2.06	2.42	2.14	2.83	1.40	2.11	3.20
October	1.07	1.52	1.91	1.51	2.12	1.25	1.47	2.22
November	0.64	1.04	1.51	1.27	1.68	0.86	1.27	1.80
December	0.41	0.48	0.68	0.57	0.85	0.43	0.53	0.93
Total	**17.18**	**22.74**	**27.06**	**24.92**	**29.58**	**20.19**	**24.83**	**31.03**

CHAPTER 2

LAND COVER CLASSIFICATION AND MAPPING

Introduction

Mapping natural land cover requires a higher level of effort than the development of data for animal species, agency ownership, or land management, yet it is no more important for gap analysis than any other data layer. Generally, the mapping of land cover is done by adopting or developing a land cover classification system, delineating areas of relative homogeneity (basic cartographic "objects"), then labeling these areas using categories defined by the classification system. More detailed attributes of the individual areas are added as more information becomes available, and a process of validating both spatial pattern and labels is applied for editing and revising the map. This is done in an iterative fashion, with the results from one step causing re-evaluation of results from another step. Finally, an assessment of the overall accuracy of the data is conducted. The final assessment of accuracy will show where improvements should be made in the next update (Stoms et al.1994).

In its "coarse filter" approach to conservation biology (e.g., Jenkins 1985, Noss 1987), gap analysis relies on maps of dominant natural land cover types as the most fundamental spatial component of the analysis (Scott et al. 1993) for terrestrial environments. For the purposes of GAP, most of the land surface of interest (natural) can be characterized by its dominant vegetation.

Vegetation patterns are an integrated reflection of the physical and chemical factors that shape the environment of a given land area (Whittaker 1965). They also are determinants for overall biological diversity patterns (Franklin 1993, Levin 1981, Noss 1990), and they can be used as a currency for habitat types in conservation evaluations (Specht 1975, Austin 1991). As such, dominant vegetation types need to be recognized over their entire ranges of distribution (Bourgeron et al. 1994) for beta-scale analysis (*sensu* Whittaker 1960, 1977). These patterns cannot be acceptably mapped from any single source of remotely sensed imagery, therefore, ancillary data, previous maps, and field surveys are used. The central concept is that the physiognomic and floristic characteristics of vegetation (and, in the absence of vegetation, other physical structures) across the land surface can be used to define biologically meaningful biogeographic patterns. There may be considerable variation in the floristics of subcanopy vegetation layers (community association) that are not resolved when mapping at the level of dominant canopy vegetation types (alliance), and there is a need to address this part of the diversity of nature. As information accumulates from field studies on patterns of variation in understory layers, it can be attributed to the mapped units of alliances.

Land Cover Classification

Land cover classifications must rely on specified attributes, such as the structural features of plants, their floristic composition, or environmental conditions, to consistently differentiate categories (Kuchler and Zonneveld 1988). The criteria for a land cover classification system for GAP are:

- an ability to distinguish areas of different actual dominant vegetation;
- a utility for modeling animal species habitats;
- a suitability for use within and among biogeographic regions;
- an applicability to Landsat Thematic Mapper (TM) imagery for both rendering a base map and from which to extract basic patterns (GAP relies on a wide array of information sources, TM

offers a convenient meso-scale base map in addition to being one source of actual land cover information);

- a framework that can interface with classification systems used by other organizations and nations to the greatest extent possible; and
- a capability to fit, both categorically and spatially, with classifications of other themes such as agricultural and built environments.

For GAP, the system that fits best is referred to as the National Vegetation Classification System (NVCS) (FGDC 1997). The origin of this system was referred to as the UNESCO/TNC system (Lins and Kleckner 1996) because it is based on the structural characteristics of vegetation derived by Mueller-Dombois and Ellenberg (1974), adopted by the United Nations Educational, Scientific, and Cultural Organization (UNESCO 1973) and later modified for application to the United States by Driscoll et al. (1983, 1984). The Nature Conservancy and the Natural Heritage Network (Grossman et al. 1994) have been improving upon this system in recent years with partial funding supplied by GAP. The basic assumptions and definitions for this system have been described by Jennings (1993).

Using the National Vegetation Classification System, an alliance list was developed for the State of Nebraska (Appendix A). After consultations with experts and preliminary image classifications, it was determined that mapping to an alliance level with Landsat TM imagery would prove to be problematic, if not impossible, for those vegetation alliances that depend upon understory vegetation descriptions (e.g., forests and woodlands) as well as those that typically occur as small patches (e.g., wetlands). Grouping alliances based on the NVCS hierarchical system developed a modified classification system. Most grasslands were mapped at the alliance level; whereas, wetland and woodland classes were grouped into broader classes. A final mappable land cover / alliance relationship (Table 2.1) was based upon a report from the Association for Biodiversity Information (2001) with expert guidance from ABI (S. Menard, personal communication 3/21/2001). The Nebraska land cover scheme was an intermediate step / stepping-stone for NatureServe's development of an ecological system classification that identifies mid-scale ecological units that are "readily mappable, often from remote imagery, and readily identifiable by conservation and resource managers in the field" (Comer et al 2003).

Methods

The Nebraska land cover map base data source is Landsat Thematic Mapper (TM) imagery from 1991-1993. A number of other data sources were utilized to augment the initial classified image. The following sections describe the image processing methodology and ancillary data sources**.**

Ponderosa Pine Forests and Woodlands

I.A.8.N.b.10 *Pinus ponderosa* forest alliance

II.A.4.N.a.32 *Pinus ponderosa* woodland alliance

Deciduous Forests and Woodlands

I.B.2.N.a.8 *Acer saccharum* - *Tilia americana* - (*Quercus rubra*) forest alliance

I.B.2.N.a.27 *Quercus alba* - (*Quercus rubra, Carya* spp.) forest alliance

I.B.2.N.a.33 *Quercus macrocarpa* forest alliance

I.B.2.N.b.3 *Betula papyrifera* forest alliance

II.B.2.N.a.20 *Quercus macrocarpa* woodland alliance

Juniper Woodlands

II.A.4.N.a.8 *Juniperus scopulorum* woodland alliance

Sandsage Shrubland

III.A.4.N.a.4 *Artemisia filfolia* shrubland alliance

Sandhills Upland Prairie

V.A.5.N.a.3 *Andropogon hallii* herbaceous alliance.

Lowland Tallgrass Prairie

V.A.5.N.a.1 *Andropogon gerardii* - (*Calamagrostis canadensis, Panicum virgatum*) herbaceous alliance

V.A.5.N.j.11 *Spartina pectinata* temporarily flooded herbaceous alliance

Upland Tallgrass Prairie

V.A.5.N.a.2 *Andropogon gerardii* - (*Sorghastrum nutans*) herbaceous alliance

Little Bluestem-Gramma Mixedgrass Prairie

V.A.5.N.c.20 *Schizachyrium scoparium - Bouteloua curtipendula* herbaceous alliance

V.A.5.N.c.29 *Hesperostipa comata - Bouteloua gracilis* herbaceous alliance

Western Wheatgrass Mixedgrass Prairie

V.A.5.N.c.27 *Pascopyrum smithii* herbaceous alliance

Western Shortgrass Prairie

V.A.5.N.e.9 *Bouteloua gracilis* herbaceous alliance

Barren/Sand/Outcrop

VII.A.1.N.a.6 Open cliff sparse vegetation alliance

VII.A.1.N.a.8 Rock outcrop sparse vegetation alliance

VII.C.3.N.b.7 Large eroding bluffs sparse vegetation alliance

Agricultural Field

Open Water

Fallow Agricultural Field

Aquatic Bed Wetland

V.A.5.N.c.27 *Pascopyrum smithii* intermittently flooded herbaceous alliance

V.A.5.N.j.5 *Distichlis spicata* - (*Hordeum jubatum*) temporarily flooded herbaceous alliance

V.A.5.N.j.12 *Polygonum* spp. - *Echinochloa* spp. temporarily flooded herbaceous alliance

V.C.2.N.a.14 *Potamogeton* spp. - *Ceratophyllum* spp. - *Elodea* spp. permanently flooded herbaceous alliance

Emergent Wetland

V.A.5.N.j.5 *Distichlis spicata* - (*Hordeum jubatum*) temporarily flooded herbaceous alliance

V.A.5.N.k.33 *Typha* spp. - (*Schoenoplectus* spp., *Juncus* spp.) seasonally flooded herbaceous alliance

V.A.5.N.k.53 *Carex pellita* seasonally flooded herbaceous alliance

V.A.5.N.l.6 *Schoenoplectus pungens* semipermanently flooded herbaceous alliance

V.A.5.N.l.9 *Typha* (*angustifolia, latifolia*) - (*Schoenoplectus* spp.) semipermanently flooded herbaceous alliance

V.A.5.N.m.19 *Carex* spp. - *Typha* spp. saturated herbaceous alliance

Riparian Shrubland

III.B.2.N.d.20 *Symphoricarpos occidentalis* temporarily flooded shrubland alliance

V.A.5.N.m.20 *Carex pellita* - (*Carex nebrascensis*) - *Schoenoplectus* spp. saturated herbaceous alliance

VII.C.2.N.c.1 Sand flats temporarily flooded sparse vegetation alliance

Riparian Woodland

I.B.2.N.d.15 *Populus deltoides* temporarily flooded forest alliance

II.B.2.N.a.20 *Quercus macrocarpa* woodland alliance

II.B.2.N.a.29 *Fraxinus pennsylvanica* - (*Ulmus americana*) woodland alliance

II.B.2.N.b.4 *Populus deltoides* temporarily flooded woodland alliance

Low Intensity Residential

High Intensity Residential/Commercial/Industrial/Transportation

Table 2.1. Nebraska GAP land cover classes and associated NVCS alliances.

Mapping Standards and Data Sources

The imagery was acquired through the Multi-Resolution Land Characteristics (MRLC) Consortium. Preprocessing was done at the Earth Resources Observation Systems (EROS) Data Center.

National map accuracy standards for USGS 1:100,000 scale maps were adopted by national GAP and NE-GAP (Thompson 1979). The minimum mapping unit (MMU) for the land cover map is 30 meters, which is the spatial resolution (pixel) of Landsat 5 TM data. Earlier GAP projects worked at a minimum mapping unit of 100 meters/hectares primarily because of limited computer resources and modeling techniques.

A total of 18 scenes are needed to cover the state of Nebraska. A multi-date classification technique was developed to generate the land cover map and ancillary datasets were subsequently used to improve the discrimination among land cover types (Figure 2.1).

Land Cover Map Development

Overview

Nebraska GAP developed the land cover map using a multi-date classification approach, which captured differences in plant phenology of grasslands and identification of croplands (Figure 2.1). Early spring and late summer dates were selected within the same year, when possible (Figure 2.2). If a suitable scene was not available from the same year, a scene from another year was selected from the image catalog archive. The image archive received from EROS was preprocessed but each selected image was reviewed for accuracy, and corrections were made as necessary.

The State was divided into 6 geographic categories based upon similar ecological watersheds to reduce image size and processing time and to constrain land cover class assignment possibilities (Figure 2.3). Each multi-date path/row combination was subset to the watershed boundaries and the Normalized Difference Vegetation Index (NDVI) was calculated to determine an agricultural and grassland mask to further segment the image. An unsupervised clustering algorithm was used to cluster each masked image and then assigned a land cover class. After class assignment, a mosaic of the State was created and ancillary data were used to further refine the classification. Images used for land cover classification were processed with ERDAS Imagine software.

Methodology

Preprocessing

Each selected Landsat 5 TM image was reviewed for accuracy and corrections made when necessary then reprojected to the Universal Transverse Mercator projection. Each image was subset to the intersecting watershed boundary (with 20km buffer). The two dates of imagery for each path/row were then "stacked" to create a 10 band multi-date image comprised of bands 2-5 and 7. Areas of cloud cover, jet contrails, and climatic anomalies were subset from images when necessary. In these instances, the subset areas were classified separately using the scene without cloud cover and these were not subject to the following image stratification technique.

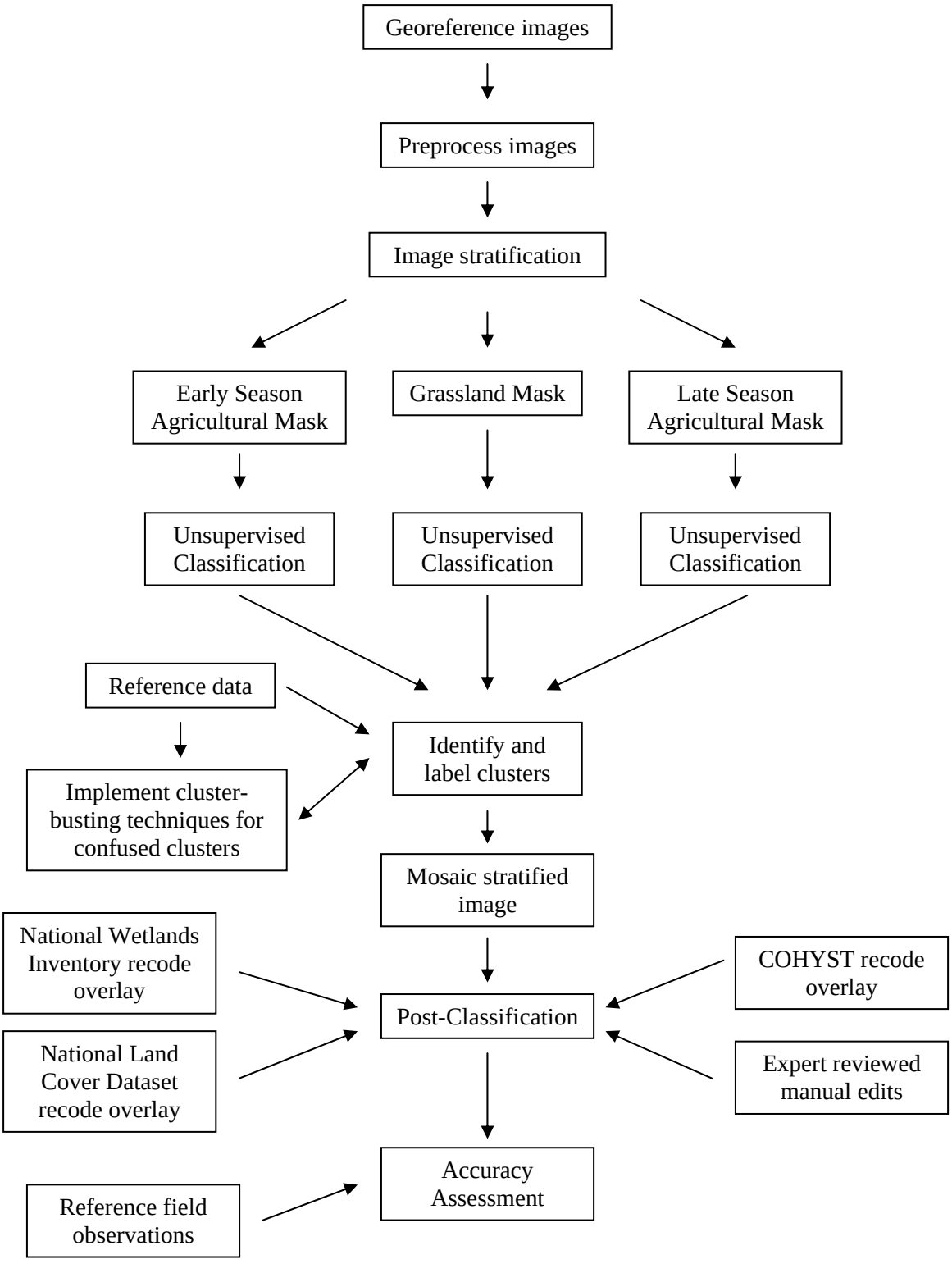
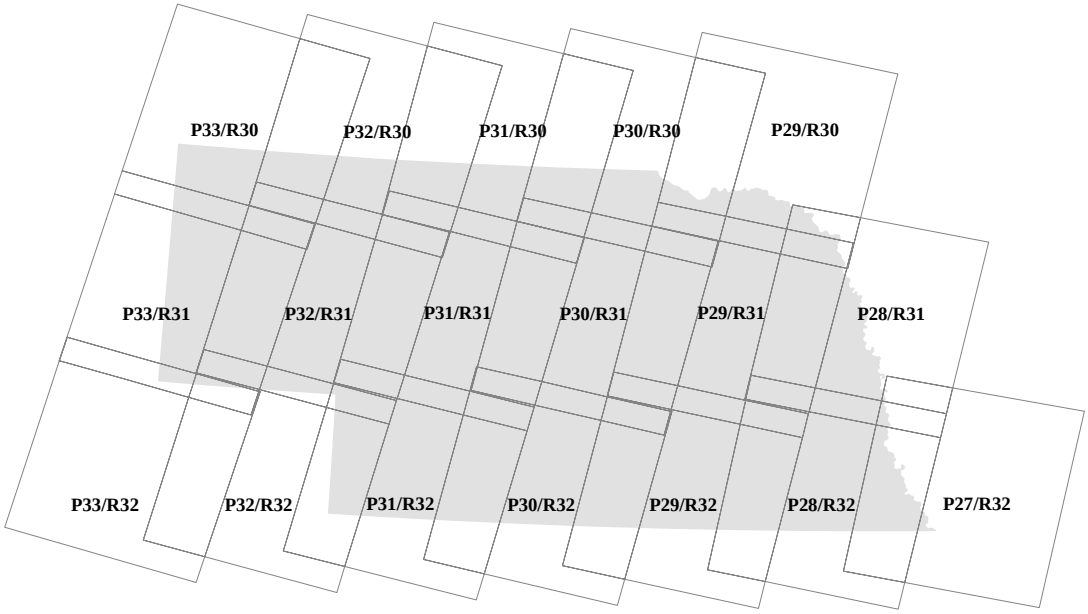


Figure 2.1. Flowchart of land cover classification technique.



Landsat WRS-2 Path/Row	Spring Image	Summer Image
27/32	X	08/21/92
28/32	04/04/91	08/26/91
29/32	04/16/93	08/19/92
30/32	04/04/92	07/28/93
31/32	04/27/92	07/14/91
32/32	X	09/09/92
33/32	X	08/15/92
28/31	04/04/91	08/26/91
29/31	04/16/93	08/19/92
30/31	04/04/92	07/28/93
31/31	04/27/92	07/14/91
32/31	05/20/92	09/09/92
33/31	05/11/92	08/15/92
29/30	04/16/93	08/19/92
30/30	04/04/92	07/28/93
31/30	04/27/92	07/14/91
32/30	05/20/92	08/06/91
33/30	05/11/92	08/15/92

Figure 2.2. Landsat TM WRS-2 Path/Row coordinates and scene dates used for the NE-GAP land cover map.

Figure 2.3 – Watershed divisions used to reduce image size, processing time, and land cover class assignment possibilities.

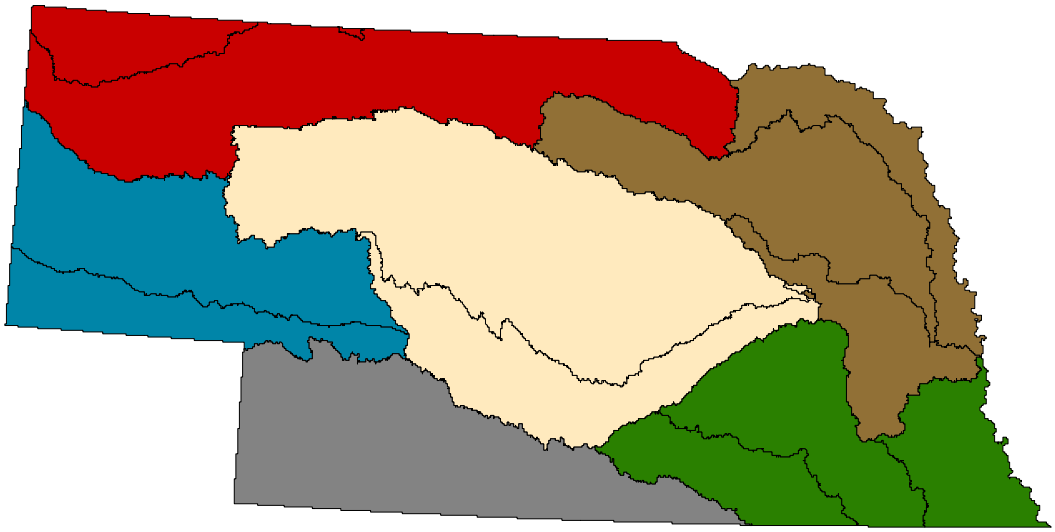


Image stratification

Prior to classification, the image was stratified with agricultural and grassland masks derived from a mathematical expression. Initial NDVI values were calculated for each date. The spring NDVI value was then subtracted from the summer NDVI value and output as a new image. The calculated values were recoded into three groups to create the masks. The agricultural masks are represented by values on either end of the numerical spectrum due to extreme differences in NDVI values resulting from agricultural practices. For example, crops harvested in late summer would have low NDVI values in the spring because of barren soil or minimal vegetative canopy, and by late summer a dense, vigorous canopy would have developed increasing the NDVI values. Spring crops would have the opposite properties. By contrast perennial grasslands have a smaller seasonal range of NDVI values because of the year-round canopy cover and lack of intensive cultivation practices. These masks were then applied to the raw image to create three images for processing.

Image Classification

An ISODATA (Iterative Self-Organizing Data Analysis Technique) unsupervised classification method was performed on the 10-band dataset for each masked image. The grassland image was separated into 50 clusters and each cropland image was separated into 10 clusters. Initial clusters were labeled based upon spectral and spatial characteristics. Aerial photography and field data were also used to label clusters.

If a cluster could not be identified, it was further processed using a technique termed “cluster busting” (Jensen et al 1987). This procedure subsets the cluster in question and the imagery is resubmitted through the classification algorithm and output into 10 clusters. These are then labeled in the same manner as described above.

Once all clusters are labeled for each stratified image, they are recombined to create a single thematic image. Once all images were classified, a statewide mosaic was generated.

Further Classification Techniques

Additional datasets were used to enhance the Nebraska GAP land cover map (Table 2.2).

Table 2.2. Ancillary data sets used for land cover mapping in Nebraska.

Data set	Source
Watershed Boundary	Nebraska Department of Natural Resources (DNR)
National Wetlands Boundary (NWI)	U.S. Fish and Wildlife Service
National Land Cover Dataset (NLCD)	U.S. Geological Survey - EROS Data Center
Cooperative Hydrology Study (COHYST)	CALMIT, COHYST
Omernik Ecoregions	U.S. Department of Agriculture - Forest Service

National Wetlands Inventory

The dataset was acquired from the Army Corps of Engineers as a statewide mosaic of all available digital coverages for the State of Nebraska. Edits to the dataset included the removal of quadrangle boundaries, closing open polygons, and altering the placement of some polygon labels for projection transformation.

The NWI codes were used to aggregate similar wetland types into a more identifiable classification scheme. Queries were run on the vector dataset to create five new classes: riparian woodland, riparian shrubland, emergent wetland, aquatic bed wetland, and open water. In the event two wetland types were coded for the same polygon, the polygon was recoded using a surface perspective from an aerial platform to determine class assignment. For example, if the NWI attribute had the class definition PFO/PEM (palustrine forest / palustrine emergent), it would be assigned to the riparian woodland class because the forested element would be the dominant feature from an aerial platform. (Refer to Appendix B for aggregation of NWI codes to selected NE-GAP land cover classes.) The recoded vector classes were converted into 30-meter grids and incorporated into the land cover mosaic.

Cooperative Hydrology Study (COHYST)

COHYST is a multi-agency project intended to improve understanding of hydrological conditions in the Platte River. The project involves assemblage and creation of numerous geospatial data layers to be used in modeling water resources. A detailed and accurate map of land cover and land use were generated using 1997 Landsat TM satellite imagery. Agricultural crop types were recoded to agricultural/fallow agricultural fields and incorporated into the Nebraska GAP land cover classification.

National Land Cover Dataset (NLCD)

Derived from the early to mid-1990s Landsat TM satellite data, the NLCD is a 21-class land cover classification scheme applied consistently over the United States. The urban land cover classes were incorporated into the GAP land cover classification.

Omernik Ecoregions

The dataset was used as a guide to identify where floristic transitions may occur. It was found to be particularly useful for initial identification of grasslands. Omernik's ecoregion map was used to create the western boundary of the Upland Tallgrass Prairie class due to spectral confusion of the Upland Tallgrass Prairie and Little Bluestem-Gramma Mixedgrass Prairie classes**.**

Nebraska Natural Resources Conservation Service (NRCS) Expert Review

County maps of the initial classification were sent to NRCS district conservationists for local expert review. Annotations detailing misclassification were made on the hard copy map by local experts and returned for interpretation. These remarks served as a surrogate for the land cover accuracy assessment.

Most of the misclassifications identified by the field experts were agricultural fields due to increasing agricultural activity in Nebraska.

To solicit expert assessment of the draft land cover map, the Nebraska Gap Analysis Project and the Nebraska State Office of the Natural Resources Conservation Service sent out relevant county-level maps to District Conservationist NRCS Offices. The District Conservationists coordinated review of the hard-copy maps utilizing staff from 81 NRCS Offices statewide. Local experts reviewed the draft maps and identified misclassifications by annotating the hard-copy map with a series of general and specific comments.

Of the 93 county maps sent out, 75 were returned, yielding a response rate of over 80%. While 10 maps indicated no change, 65 were annotated with specific comments. General and specific comments were recorded from each map. Specific comments, defined as comments noting misclassification of particular groups of pixels, were then tabulated into a special confusion matrix reporting only misclassification errors; thus, all elements of the matrix were located off the principal diagonal (cf. tables in Henebry et al. 2000).

Misclassifications identified on the draft land cover map were then compared against a subsequent version of the map that incorporated additional sources of information. A second special confusion matrix was generated to determine whether misclassifications had been corrected by incorporation of multiple data sources. Remaining misclassifications deemed significant were manually recoded. The decision to recode pixels into the "Agricultural Fields" class was made on a case-by-case basis. Adjustments were made by comparing the latest draft with the National Land Cover Data product, relevant DOQQs, and a map of Nebraska's native vegetation. A third special confusion matrix was then generated.

The inclusion of additional data sources took care of 302 (31%) of the specific comments. Manual editing of the significant misclassifications took care of 241 (35%) remaining comments. The two-stage revision eliminated 543 (55%) of the specific comments made by the expert reviewers. Of the remaining 446 misclassifications, 372 (83%) were identified by the reviewers as "Agricultural Fields". The classes contributing to most of this remaining error were "Barren/Sand/Outcrop" (144 or 39%) and "Lowland Tallgrass Prairie" (124 or 33%). The second most confused class was "Little Bluestem-Grama Mixedgrass Prairie" at 53 (12%) remaining comments. Two woodland classes contributed to most of the error remaining after revisions: "Deciduous Forest/Woodland" (26 or 49%) and "Evergreen Forest/Woodland" (21 or 40%).

Inclusion of additional data significantly improved the land cover map. Further revision by manual recoding yielded a reduction of misclassification by 55% from the original draft map.

Results

The final thematic map identifies 20 different land cover classes (Figure 2.4). Agricultural fields and grasslands (Figures 2.5 and 2.6) dominate the landscape of Nebraska. As Table 2.3 shows, almost 40% of the State is under cultivation. Much of the State's agricultural fields are maintained with irrigation systems. The most intensive use is found along the Platte River and south central Nebraska. The second most identifiable feature is the Sandhills Upland Prairie class (23%) found throughout the Nebraska Sandhills. The Sandhills are vegetated sand dunes that make cultivation difficult. The Sandhills Upland Prairie class and the 6 other grassland classes account for 54% of the State's land cover and are primarily managed for ranching purposes. Grazing and fire suppression have altered the vegetation composition of these grasslands.

Five woody vegetation classes cover 3% of the State. These classes are usually found along riparian corridors and canyons. Discrimination between forests and woodlands was not attempted because the scarcity of occurrence and linear pattern of distribution. Ponderosa Pine Forests and Woodlands are found along the Pine Ridge in northwest Nebraska and the Niobrara River. Of note, a man-made Ponderosa Pine Forest can be seen in the middle of the Sandhills. Deciduous Forests and Woodlands are largely found along rivers and streams. These stands have become more dense and extensive due to stream channelization and flood control. Juniper woodlands (mainly cedar) are increasing across the state due to the suppression of wildfires. Juniper woodlands are concentrated in valleys, canyons, and other protected lowlands and are usually mixed with deciduous woody vegetation.

Although open water and wetland classes cover only 2% of the State, these features figure prominently into vertebrate species distribution. Of note are the Platte River, which cuts across the middle of the State, and the various reservoirs found across the State. Wetlands fed by groundwater are found in the Sandhills and are important for waterfowl breeding. Other wetlands are found in the Rainwater Basin of South Central Nebraska. These wetlands are fed by runoff and are utilized by birds and waterfowl during migration along the Central Corridor. Only the largest wetlands are filled year-round.

Land Cover Classification of Nebraska

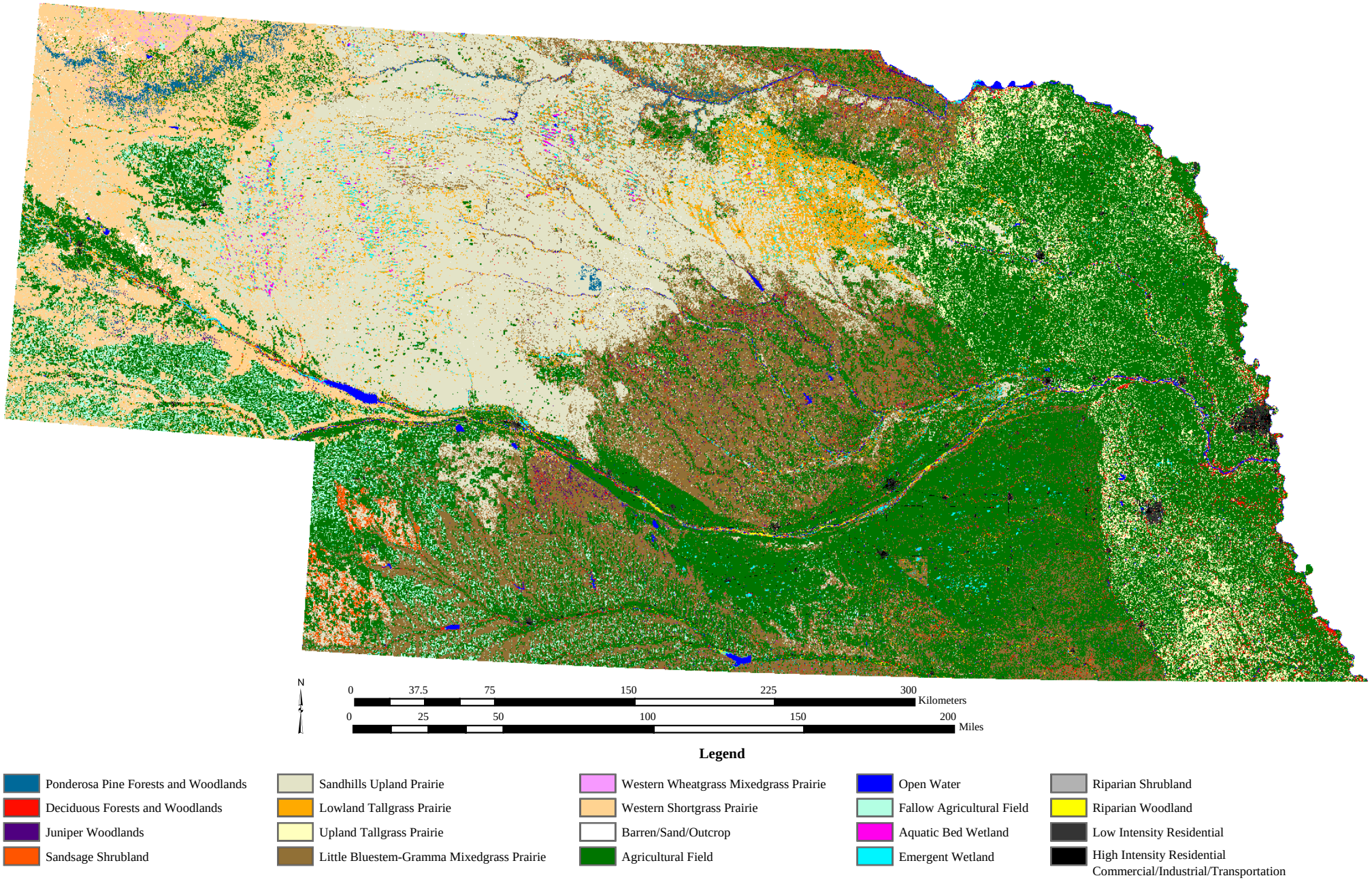


Figure 2.4. Nebraska GAP land cover map.

Dominant Land Cover of Nebraska

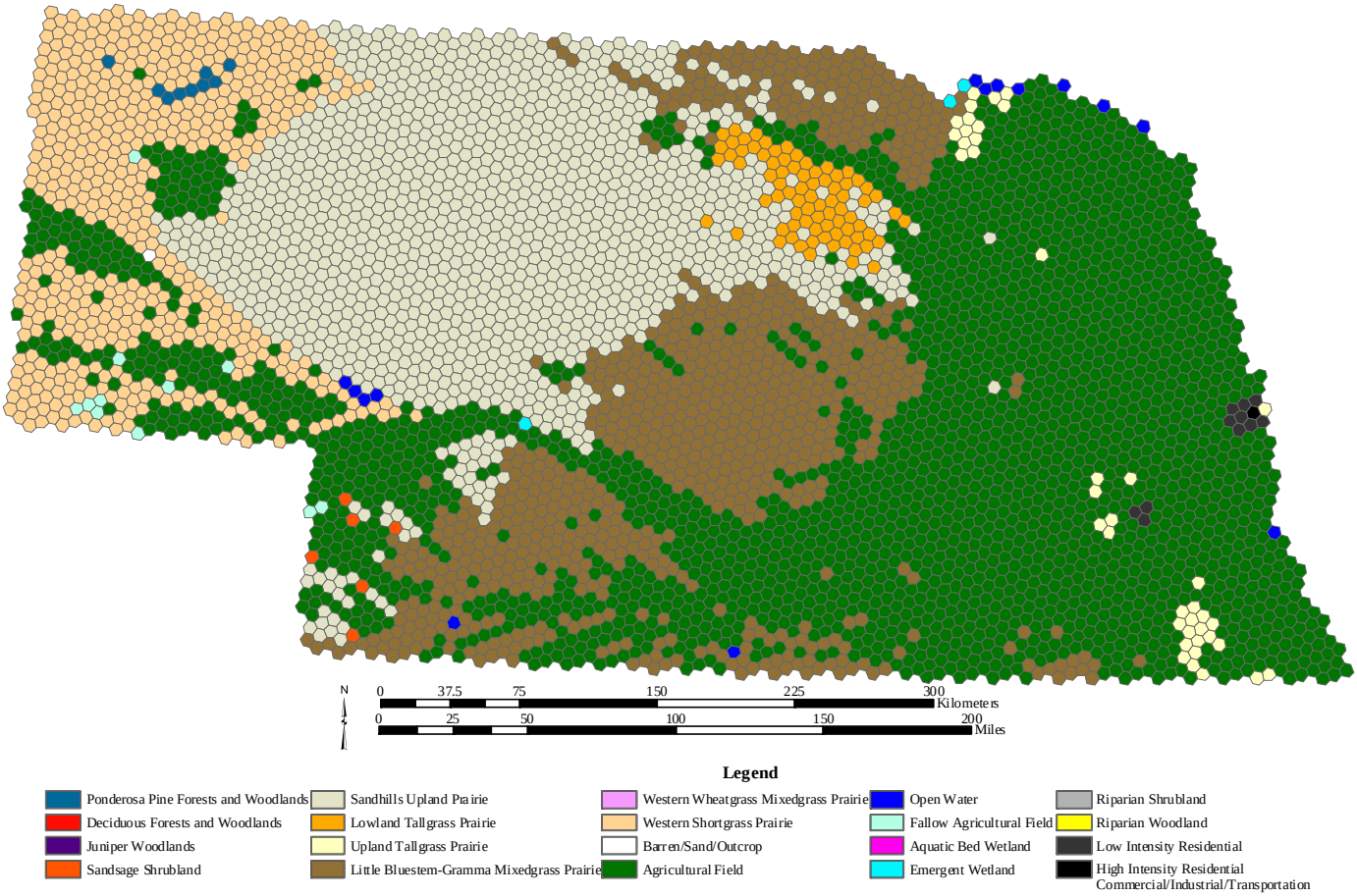


Figure 2.5. Dominant land cover classes.

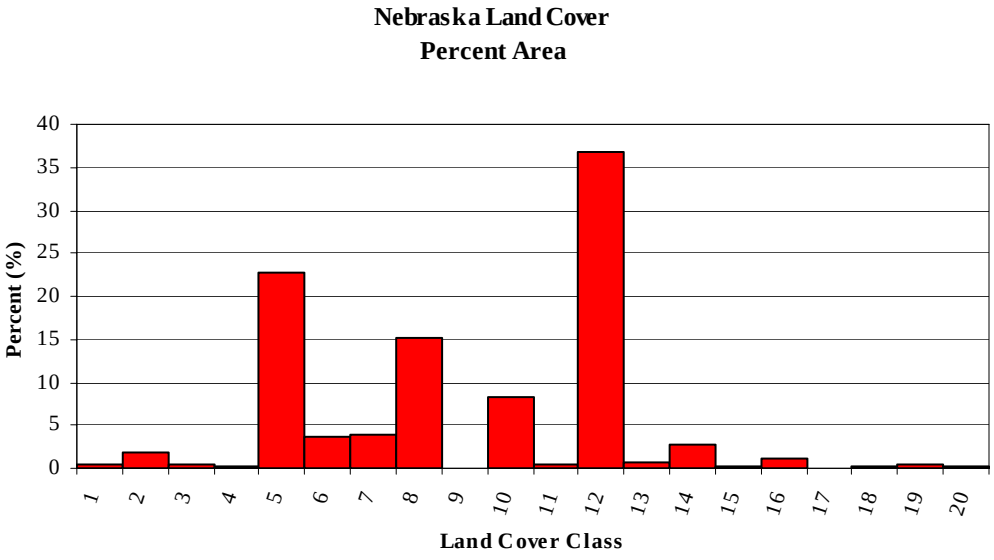


Figure 2.6. Proportional distribution among land cover classes.

Table 2.3. Mapped land cover types, total area, and percent area of the state

Cover Class	Land Cover Name	km^2	$mile^2$	Acre	Hectare	Percent
1	Ponderosa Pine Forests and Woodlands	1070.61	413.36	264551.67	107060.67	**0.53**
2	Deciduous Forest/Woodland	3484.83	1345.50	861117.80	348483.33	**1.74**
3	Juniper Woodland	1022.11	394.64	252568.64	102211.29	**0.51**
4	Sandsage Shrubland	677.44	261.56	167398.85	67744.17	**0.34**
5	Sandhills Upland Prairie	45572.45	17595.62	11261155.26	4557245.13	**22.74**
6	Lowland Tallgrass Prairie	7301.69	2819.20	1804280.52	730169.19	**3.64**
7	Upland Tallgrass Prairie	7885.88	3044.75	1948635.58	788587.83	**3.94**
8	Little Bluestem-Gramma Mixedgrass Prairie	30324.11	11708.20	7493221.34	3032410.59	**15.13**
9	Western Wheatgrass Mixedgrass Prairie	207.59	80.15	51297.62	20759.49	**0.10**
10	Western Shortgrass Prairie	16752.67	6468.24	4139658.60	1675266.75	**8.36**
11	Barren/Sand/Outcrop	926.94	357.89	229051.36	92694.15	**0.46**
12	Agricultural Fields	73618.49	28424.25	18191454.91	7361848.53	**36.74**
13	Open Water	1296.87	500.72	320461.30	129686.58	**0.65**
14	Fallow Agricultural Fields	5299.77	2046.25	1309595.54	529976.52	**2.64**
15	Aquatic Bed Wetland	404.11	156.03	99856.69	40410.72	**0.20**
16	Emergent Wetland	2384.78	920.77	589289.61	238477.95	**1.19**
17	Riparian Shrubland	219.53	84.76	54247.90	21953.43	**0.11**
18	Riparian Woodland	357.56	138.05	88354.02	35755.74	**0.18**
19	Low Intensity Residential	877.54	338.82	216842.82	87753.51	**0.44**
20	Commercial/Industrial/Transportation	686.36	265.01	169602.78	68636.07	**0.34**
	Total	**200371.32**	**77363.79**	**49512642.82**	**20037131.64**	**100.00**

Accuracy Assessment

Introduction: GAP land cover maps are primarily compiled to answer the fundamental question in gap analysis: what is the current distribution and management status of the nation's major natural land cover types and wildlife habitats? Besides giving a measure of overall reliability of the land cover map for Gap Analysis, the assessment also identifies which general classes or which regions of the map do not meet the accuracy objectives for the Gap Analysis Program. Thus the assessment identifies where additional effort will be required when the map is updated. We report the results of the accuracy assessment, believing that the map is the best map currently available for the project area.

The purpose of accuracy assessment is to allow a potential user to determine the map's "fitness for use" for their application. It is impossible for the original cartographer to anticipate all future applications of a land cover map, so the assessment should provide enough information for the user to evaluate fitness for their unique purpose. This can be described as the degree to which the data quality characteristics collectively suit an intended application. The information reported includes details on the database's spatial, thematic, and temporal characteristics and their accuracy.

Assessment data are valuable for purposes beyond their immediate application to estimating accuracy of a land cover map. The reference data is therefore made available to other agencies and organizations for use in their own land cover characterization and map accuracy assessments (see Data Availability for access information). The data set will also serve as an important training data source for later updates.

Even though we have reached an endpoint in the mapping process where products are made available to others, the gap analysis process should be considered dynamic. We envision that maps will be refined and updated on a regular schedule. The assessment data will be used to refine GAP maps iteratively by identifying where the land cover map is inaccurate and where more effort is required to bring the maps up to accuracy standards. In addition, the field sampling may identify new classes that were not identified at all during the initial mapping process.

Methods:
Our plans for land cover accuracy assessment were first linked to a multi-state EPA Region 7 land cover mapping project (cf. Nusser et al. 2001). Initial field data were collected in a pilot study during 1999 but, unfortunately, this project was not fully funded. This programmatic change necessitated alternative strategies for conducting an accuracy assessment.

During an initial phase of land cover mapping (1997-1998), teams were sent to sites across Nebraska to collect ground reference data that could be used in supervised classification. Since a later decision was made not to pursue a supervised classification, these "training" data were available to serve as potential ground referents for accuracy assessment. A total of 685 points were scouted. We refer to these data as Collection A. The final land cover classes had not yet been decided at the time these data were gathered. Once the classes were finalized, the field descriptions for these data were used to assign each point to an appropriate land cover class.

Following standard methods outlined in Congalton and Green (1999), an initial accuracy assessment yielded an overall accuracy of less than 30%. Surprised by this result, we examined more closely the patterns of land cover occurrences in Collection A. The appearance of several odd patterns led us to conclude that the quality of Collection A was sufficiently suspect that it should be supplemented with other sources of reference data.

Four other collections of ground reference data were available for use in the accuracy assessment. The dataset gathered in 1999 during the EPA pilot project was designated as Collection B. A project in 2002 to map the land cover along the Niobrara River generated ground reference data designated as Collection C. The tree cover in Loess Hills region in central Nebraska is complex with adjacent valleys being dominated either by deciduous or coniferous canopies. To facilitate cluster busting and labeling, in 2001 we collected ground reference data referred to as Collection D. In association with a NatureServe project, Dr. Kelly Kindscher (KU/Kansas Biological Survey) visited in 2002 a subset of the points in Collection A to evaluate the accuracies of the GAP land cover map and of Collection A. Dr. Kindscher's field data are referred to as Collection E. Figure 2.7 illustrates the Collections' geographic distribution.

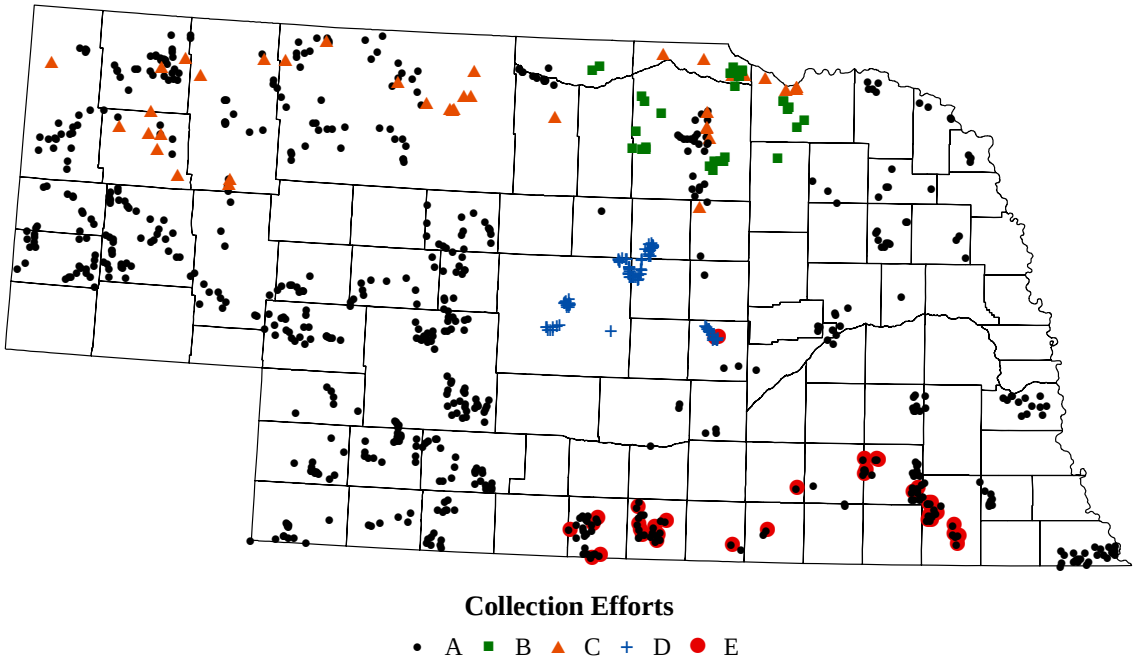


Figure 2.7 Locations of sampling sites for field reference data used in accuracy assessment.

Results:

Table 2.4 provides the confusion matrix using Collection A. The overall accuracy is 29% with a significant Kappa value of 0.201. While the classification is far from random (Khat z-score=12.74), there is considerable confusion between land cover classes, especially among the grassland types. Aggregating the cover classes into five broader categories leads to a significant increase in overall accuracy (61%; Table 2.5). These broader categories correspond to the landscape matrix within which organisms must find suitable habitat to persist. While the aggregation of the land cover classes into the broader categories is mostly straightforward, one category "Anthropolands" deserves some comment. Human influences on the landscape matrix and habitat availability can occur in many ways; however, the direct transformation of land to intensive human use is the most obvious. Anthropolands (from ανθρωπος, Greek for human) include the lands used for dense human settlement and commercial activity as well as active and fallow agricultural lands. Given the significant area covered by reservoirs, lakes, and farm ponds in Nebraska, it could be argued that class 13 "open water" should also be placed within the anthropolands category instead of the wetlands category. However, wildlife use of open water habitats is substantial and has more in common with wetlands than with lands intensively used by humans.

Challenging the aggregated classes with the field data from Collection B leads to an overall accuracy of 71% (Table 2.6). Overall accuracies are lower for Collections C (51%; Table 2.7), D (35%; Table 2.8), and E (38%; Table 2.9). Combining all of the field data into a confusion matrix on the aggregated classes leads to a higher overall accuracy of 60% (Table 2.10).

A fundamental assumption of an accuracy assessment is that the reference data are correct. While this assumption may be only partially valid for any of the five Collections, it was possible to evaluate a non-

random portion of Collection A by Collection E. Dr. Kindscher resurveyed 40 of the points from Collection A. In this sample only 13% (5/40) of the Collection A observations matched the GAP land cover classes. However, 41% (13/32) of the GAP land cover pixels corresponded to Kindscher's observations and eight more observations had no comparable GAP class: brome (2) and CRP (6).

A simple accuracy assessment treats each class as having equivalent importance. A more refined approach is to weight the columns of the confusion matrix by abundance or prevalence of the class. The aggregated categories have the following area extents: Grasslands (53.9%), Anthropolands (40.2%), Woodlands (3.0%), Wetlands (2.0%), and Shrublands (0.9%). (See Table 2.3 for the areal extents of the land cover classes.) Applying this approach to the aggregated categories significantly increases the overall accuracy to 73% using all Collections (Table 2.11) and to 79% using Collection B alone (data not shown). Furthermore, application of the weighted approach to the complete set of land cover classes using Collection A yields an overall accuracy assessment of 47% (Table 2.12), a substantial increase over the results in Table 2.4.

Limitations and Discussion

A survey of the errors is instructive. As expected there is considerable confusion among grassland cover types. Distinguishing among grassland types is very difficult because of smooth gradients of turnover in species composition between grassland communities. Differential phenologies in grassland species can aid in distinguishing among communities, but monitoring grassland phenology remains challenging at ground level, let alone from space (see Henebry 2003). The limited number of seasonal observations available in the Landsat TM imagery impaired achieving a more robust discrimination between grassland types. A potential way to address this limitation in the future is to combine high temporal resolution data from coarser spatial resolution synoptic sensors with the finer spatial resolution from the handful of nearly cloud-free Landsat scenes available for any particular area (Henebry et al. 2004; Viña et al. 2004).

Delineation of shrublands appears to be a weak spot in the land cover map. However, there were very few field reference samples among shrublands (28) and the aggregate category covered only 1824 km^2 or 0.9% of the land area in Nebraska. Thus, it is difficult to judge whether the shrublands are well-mapped. Clearly, this is a land cover type that needs more attention in any future mapping effort.

The dynamic nature of agriculture also poses significant problems for land cover mapping and assessment of accuracy. Field data were gathered in the late 1990's and early 2000's, but the imagery is from the early 1990's. Many of the misclassifications evident in the confusion matrix may arise from temporal decorrelation. Three phenomena will lead to problems: (1) expansion and/or intensification of agriculture, e.g., starting to irrigate; (2) contraction or deintensification of agriculture, e.g., enrolling fields into CRP; and (3) big shifts in crop phenology, e.g., from maize to winter wheat. At an earlier stage of the mapping process, we found substantial effects of temporal decorrelation associated with agricultural land uses (Henebry et al. 2000). While some of these problems were addressed at that stage, the data were incomplete. Changes in agriculture land use and management practices affect multiple classes, not just class 12, as is evident from the spread of field observations along the rows and columns in Tables 2.4 and 2.12. Note that the weighted producer accuracy for class 12 is 90%, but the unweighted user accuracy is only 54%.

Accuracy assessment of land cover mapping involves multiple steps and multiple assumptions. The model of Nebraska land cover embedded in the choice of class labels reflects a perhaps optimistic expectation that all of these classes could be distinguished. Despite imperfect field reference data, the accuracy assessment of the final land cover map has shown that while things are generally correct at a coarser resolution, the details are amiss. While accurate land cover mapping is an important step, the primary aim of GAP is not the production of a land cover map; rather, the objective is to model wildlife habitat relationships and identify potential gaps in habitat. With this primary goal in mind and with an eye

to the accuracy problems at the finer spatial scales, we decided to use the land cover map at a coarser spatial resolution for modeling the relationship between wildlife and habitat. This coarser spatial resolution does not, however, toss out the wealth of information at the finer resolution; it is retained through the use of compositional arrays. In other words, the land cover map used for animal modeling is a coarser grid with each grid cell containing a proportional mixture of land cover classes observed at the finer resolution. The thematic information is preserved, albeit aspatially.

Table 2.4. Accuracy assessment using ground reference data of Collection A

	Map																					
Field	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	row sum	**users' accuracy**
1	6				2			4		2	1										15	**0.40**
2	1	18	7		7		6	21				29	1				1	1			92	**0.20**
3	2	5	7		7	1		16					4								42	**0.17**
4				2	3	1		6		5		1	1	1						1	21	**0.10**
5					47	4		4		3	1	1		1		1					62	**0.76**
6		10			16	19	2	13		2		20	5	1		4				1	93	**0.21**
7		2			3	2	2	7		4		10									30	**0.07**
8		1	1	1	54	1	2	30		39	1	13		4						1	148	**0.20**
9					15	4		19		24	1	10		1							74	**0.00**
10					1			4		2		1									8	**0.25**
11					2					2		2									6	**0.00**
12		3	1	1	6	5	12	21		16		93		11		3				1	173	**0.54**
13		1			1										2						4	**0.00**
14																					0	**NaN**
15																					0	**NaN**
16			1		5	6	1	5		1		2	1		2	6					30	**0.20**
17					1																1	**0.00**
18																					0	**NaN**
19					2	1		1											5	2	11	**0.46**
20								1													1	**0.00**
column sum	9	40	17	4	172	44	25	152	0	100	4	182	12	19	4	14	1	1	5	6	811	**overall accuracy**
producer's accuracy	**0.67**	**0.45**	**0.41**	**0.50**	**0.27**	**0.43**	**0.08**	**0.20**	**NaN**	**0.02**	**0.00**	**0.51**	**0.00**	**0.00**	**0.00**	**0.43**	**0.00**	**0.00**	**1.00**	**0.00**		**0.29**

NaN = "Not a Number" results from division by zero (0).

Table 2.5. Accuracy assessment of aggregated classes using ground reference data of Collection A

	Map						
Field	**Woodlands**	**Grasslands**	**Shrublands**	**Wetlands**	**Anthropolands**	row sum	**users' accuracy**
Woodlands (1-3+18)	47	66	2	5	29	149	**0.32**
Grasslands (5-10)	14	323	4	10	64	415	**0.78**
Shrublands (4+11+17)	0	20	2	1	5	28	**0.07**
Wetlands (13+15+16)	2	19	0	11	2	34	**0.32**
Anthropolands (12+14+19+20)	4	65	1	3	112	185	**0.61**
column sum	67	493	9	30	212	811	**overall**
producer's accuracy	**0.70**	**0.66**	**0.22**	**0.37**	**0.53**		**0.61**

Table 2.6. Accuracy assessment of aggregated classes using ground reference data of Collection B

	Map						
Field	**Woodlands**	**Grasslands**	**Shrublands**	**Wetlands**	**Anthropolands**	row sum	**users' accuracy**
Woodlands (1-3+18)	17	17	0	3	4	41	**0.41**
Grasslands (5-10)	8	167	12	2	13	202	**0.83**
Shrublands (4+11+17)	0	0	0	0	0	0	**NaN**
Wetlands (13+15+16)	0	6	0	2	0	8	**0.25**
Anthropolands (12+14+19+20)	0	16	0	0	17	33	**0.52**
column sum	25	206	12	7	34	284	**overall**
producer's accuracy	**0.68**	**0.81**	**0.00**	**0.29**	**0.50**		**0.71**

NaN = “Not a Number” results from division by zero (0).

Table 2.7. Accuracy assessment of aggregated classes using ground reference data of Collection C

	Map						
Field	**Woodlands**	**Grasslands**	**Shrublands**	**Wetlands**	**Anthropolands**	row sum	**users' accuracy**
Woodlands (1-3+18)	0	0	0	0	0	0	**NaN**
Grasslands (5-10)	3	2	0	0	1	6	**0.33**
Shrublands (4+11+17)	0	0	0	0	0	0	**NaN**
Wetlands (13+15+16)	0	5	0	5	0	10	**0.50**
Anthropolands (12+14+19+20)	1	8	0	0	12	21	**0.57**
column sum	4	15	0	5	13	37	**Overall**
producer's accuracy	**0.00**	**0.13**	**NaN**	**1.00**	**0.92**		**0.51**

Table 2.8. Accuracy assessment of aggregated classes using ground reference data of Collection D

	Map						
Field	**Woodlands**	**Grasslands**	**Shrublands**	**Wetlands**	**Anthropolands**	row sum	**users' accuracy**
Woodlands (1-3+18)	23	36	1	4	14	78	**0.46**
Grasslands (5-10)	1	2	0	0	0	3	**0.67**
Shrublands (4+11+17)	0	0	0	0	0	0	**NaN**
Wetlands (13+15+16)	0	1	0	2	0	3	**0.67**
Anthropolands (12+14+19+20)	0	0	0	0	4	4	**1.00**
column sum	24	39	1	6	18	88	**overall**
producer's accuracy	**0.96**	**0.05**	**0.00**	**0.33**	**0.22**		**0.35**

NaN = “Not a Number” results from division by zero (0).

Table 2.9. Accuracy assessment of aggregated classes using ground reference data of Collection E

	Map						
Field	**Woodlands**	**Grasslands**	**Shrublands**	**Wetlands**	**Anthropolands**	row sum	**users' accuracy**
Woodlands (1-3+18)	3	0	0	0	2	5	**0.60**
Grasslands (5-10)	3	7	0	1	2	13	**0.54**
Shrublands (4+11+17)	0	0	0	0	0	0	**NaN**
Wetlands (13+15+16)	0	0	0	0	0	0	**NaN**
Anthropolands (12+14+19+20)	0	15	0	0	4	19	**0.21**
column sum	6	22	0	1	8	37	**overall**
producer's accuracy	**0.50**	**0.32**	**NaN**	**0.00**	**0.50**		**0.38**

Table 2.10. Accuracy assessment of aggregated classes using ground reference data from all Collections (A-E)

	Map						
Field	**Woodlands**	**Grasslands**	**Shrublands**	**Wetlands**	**Anthropolands**	row sum	**users' accuracy**
Woodlands (1-3+18)	90	125	3	12	47	277	**0.32**
Grasslands (5-10)	23	500	16	12	93	644	**0.78**
Shrublands (4+11+17)	0	20	2	1	5	28	**0.07**
Wetlands (13+15+16)	3	33	0	21	3	60	**0.35**
Anthropolands (12+14+19+20)	7	91	1	3	149	251	**0.59**
column sum	123	769	22	49	297	1260	**overall**
producer's accuracy	**0.73**	**0.65**	**0.09**	**0.43**	**0.50**		**0.60**

NaN = “Not a Number” results from division by zero (0).

Table 2.11. Area-weighted accuracy assessment of aggregated classes using ground reference data from all Collections (A-E)

	Map							
Field	**% area**	**Woodlands**	**Grasslands**	**Shrublands**	**Wetlands**	**Anthropolands**	**row sum**	**users' accuracy**
Woodlands	2.9610	2.66589	3.702625	0.088863	0.355452	1.392187	8.205017	**0.325**
Grasslands	53.922	12.40208	269.6105	8.627536	6.470652	50.14755	347.2583	**0.776**
Shrublands	0.910	0	0.18206	0.018206	0.009103	0.045515	0.254884	**0.071**
Wetlands	2.039	0.061173	0.672903	0	0.428211	0.061173	1.22346	**0.350**
Anthropolands	40.166	2.811655	36.55152	0.401665	1.204995	59.84809	100.8179	**0.594**
column sum	100.000	17.9408	310.7196	9.13627	8.468413	111.4945	457.7596	**overall**
weighted producers' accuracy		**0.149**	**0.868**	**0.002**	**0.056**	**0.537**		**0.727**

Table 2.12. Area-weighted accuracy assessment of classes using ground reference data from Collection A

		Map																				
Field	**% area**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**users' accuracy**
1	0.53	3.21				1.07			2.14		1.07	0.53										0.40
2	1.74	1.74	31.3	12.2		12.2		10.4	36.5				50.4	1.74				1.74	1.74			0.20
3	0.51	1.02	2.55	3.57		3.57	0.51		8.16					2.04								0.17
4	0.34				0.68	1.01	0.34		2.03		1.69		0.34	0.34	0.34						0.34	0.10
5	22.7					1069	91.0		91.0		68.2	22.7	22.7		22.7		22.7					0.76
6	3.64		36.4			58.3	69.2	7.29	47.4		7.29		72.9	18.2	3.64		14.6				3.64	0.20
7	3.94		7.87			11.8	7.87	7.87	27.5		15.7		39.4									0.07
8	15.1		15.1	15.1	15.1	817.	15.1	30.3	454.		590.	15.1	197.		60.5						15.1	0.20
9	0.10					1.55	0.41		1.97		2.49	0.10	1.04		0.10							0.00
10	8.36					8.36			33.4		16.7		8.36									0.25
11	0.46					0.92					0.93		0.93									0.00
12	36.7		110.	36.7	36.7	220.	184.	441.	772.		588.		3417		404.		110.				36.7	0.54
13	0.65		0.65			0.65										1.29						0.00
14	2.64																					NaN
15	0.20																					NaN
16	1.19			1.19		5.95	7.14	1.19	5.95		1.19		2.38	1.19		2.38	7.14					0.20
17	0.11					0.11																0.00
18	0.18																					NaN
19	0.44					0.88	0.44		0.42											2.19	0.88	0.45
20	0.34								0.34													0.00
weighted producer's accuracy		0.54	0.15	0.05	0.01	0.48	0.18	0.02	0.31	NaN	0.01	0.00	0.90	0.00	0.00	0.00	0.05	0.00	0.00	1.00	0.00	**0.471**

NaN = "Not a Number" results from division by zero (0).

CHAPTER 3

PREDICTED ANIMAL SPECIES DISTRIBUTIONS AND SPECIES RICHNESS

Introduction

All species range maps are predictions about the occurrence of those species within a particular area (Csuti 1994). Traditionally, the predicted occurrences of most species begin with samples from collections made at individual point locations. Most species range maps are small-scale (e.g., >1:10,000,000) and derived primarily from point data to construct field guides which are suitable, at best, for approximating distribution at the regional level or counties for example. The purpose of the GAP vertebrate species maps is to provide more precise information about the current predicted distribution of individual native species according to actual habitat characteristics within their general ranges and to allow calculation of predicted area of distributions and associations to specific habitat characteristics.

GAP maps are produced at a nominal scale of 1:100,000 or better and are intended for applications at the landscape or "gamma" scale (heterogeneous areas generally covering 1,000 to 1,000,000 hectares and made up of more than one kind of natural community). Applications of these data to site- or stand-level analyses (site--a microhabitat, generally 10 to 100 square meters; stand--a single habitat type, generally 0.1 to 1,000 ha; Whittaker 1977, see also Stoms and Estes 1993) will likely reveal the limitations of this process to incorporate differences in habitat quality (e.g., understory condition) or necessary microhabitat features such as standing dead trees.

Gap analysis uses the predicted distributions of animal species to evaluate their conservation status relative to existing land management (Scott et al. 1993). However, the maps of species distributions may be used to answer a wide variety of management, planning, and research questions relating to individual species or groups of species. In addition to the maps, great utility may be found in the consolidated specimen collection records and literature that are assembled into databases used to produce the maps. Perhaps most importantly, as a first effort in developing such detailed distributions, they should be viewed as testable hypotheses to be confirmed or refuted in the field. We encourage biologists and naturalists to conduct such tests and report their findings in the appropriate literature and to the Gap Analysis Program such that new data may improve future iterations.

Previous to this effort there were no maps available, digital or otherwise, showing the likely present-day distribution of species by habitat type across their ranges. Because of this, ordinary species (i.e., those not threatened with extinction or not managed as game animals) are generally not given sufficient consideration in land-use decisions in the context of large geographic regions or in relation to their actual habitats. Their decline, because of incremental habitat loss can, and does, result in one threatened or endangered species "surprise" after another. Frequently, the records that do exist for an ordinary species are truncated by state boundaries. Simply creating a consistent spatial framework for storing, retrieving, manipulating, analyzing, and updating the totality of our knowledge about the status of each animal species is one of the most necessary and basic elements for preventing further erosion of biological resources.

Commencing in the summer of 1999, NE-GAP terrestrial vertebrate modeling efforts were conducted by University of Nebraska-Lincoln in cooperation with the Nebraska Game and Parks Commission. To

predict species distributions, known ranges were delineated and potential habitat was modeled for all terrestrial vertebrates known to breed regularly in the state. The objective of NE-GAP vertebrate modeling was to identify potentially suitable habitats for each species across Nebraska.

Methods

In order to provide a transparent and durable modeling framework for the range distributions of vertebrate species, the Nebraska Gap Analysis project has used recursive partitioning to develop 'objective' semi-empirical models. Recursive partitioning algorithms predict membership of individual cases in classes of a categorical dependent variable from measurements of one or several independent variables. The motivation for using this strategy is two-fold: the resulting trees of decision points and values that form the models are readily understandable, debatable, and tunable; and the non-parametric modeling handles the multimodality common to regional species occurrence data. Although the best-known recursive partitioning algorithm is CART (Classification And Regression Trees; Breiman et al. 1984; De'ath and Fabricius 2000), we have used QUEST (Quick, Unbiased, and Efficient Statistical Trees), a recent improvement on CART that greatly speeds up searching of the data space and which is more robust in the face of categorical variables with many levels (Loh and Shih 1997; Lim et al. 2000; Shih 2002). Species occurrence data and environmental variables were submitted to the QUEST software program to develop wildlife habitat relationships. Explanatory factors included land cover class composition; surficial soils characteristics; climatic means, variance, and extremes; and terrain data.

While the recursive partitioning approach differs from previous GAP implementations, many of the same datasets are required. The significant difference are in how the data are used and what order they are processed. Of particular importance is the reliance of species occurrence data and environmental data that jointly determine the wildlife habitat relationship which then generates the range extent map. A general discussion of the dataset development and modeling technique is followed by a more detailed description of technique variations for each taxon due to input data limitations.

Species List

The initial step in the modeling process was to identify species that are 'regular breeders' in Nebraska. The GAP handbook suggested criterion of a regular breeder is a species that has breed in the state five out of the past ten years. The species list for the NE-GAP project was developed from reference material, observational data, and expert opinion. The identification of species TNC global rank, federal status, and state status can be found in Appendix C. NE-GAP identified 332 species (193 birds, 78 mammals, 14 amphibians, and 47 reptiles) that regularly breed within the State.

Wildlife Habitat Relationships

Species occurrence data and selected environmental variables were developed and submitted into the recursive partitioning algorithm software QUEST to develop wildlife habitat relationships. The following section describes the datasets created and the methods employed.

To develop output classification trees through recursive partitioning techniques, input data are used to identify relationships. In the case of the NE-GAP, species observations (as the dependent variable) and associated environmental parameters (as independent variables) were submitted to QUEST. A significant challenge to the process was to develop a manageable dataset while still maintaining the integrity of the original data. The construction of the dataset was thus driven by a few key observations between the various data, the modeling technique, and the required output. First, the dependent variable and independent variable are submitted to QUEST as a one-to-one relationship. The geospatial inaccuracy of occurrence data can pose problems for the validity of the imputed wildlife-habitat relationship. For example, the amphibian and reptile location points were georeferenced with a spatial accuracy of 0.65 hectare (6500m^2), which is coarser than the spatial resolution of the land cover map (30m^2). The discrepancy of spatial resolution and accuracy between these two datasets combined with the

shortcomings in the thematic accuracy of the landcover map (see Chapter 2) increase the likelihood that imputed species occurrence-environmental relationships are imprecise and/or inaccurate.

In an attempt to increase the probability of producing more robust and accurate models, we rescaled the resolution of all datasets while retaining as much information from the original data as feasible. Several factors were taken into account to determine an acceptable "modeling" resolution. At what point would the input data start to degrade or limit the description of the immediate environment? Would physiographic features be preserved (e.g., riparian corridors)? How would our final models be mapped? Such considerations resulted in the creation of a new hexagonal "modeling" grid with a resolution of approximately 40km^2 that conforms to the coarser EMAP "reporting" hexagonal grid. It is at this resolution that the NE-GAP wildlife habitat relationships were modeled and subsequently use to generate species range maps.

Mapping Standards and Data Sources

A number of data sources were required to create an extensive environmental variable table (Table 3.1). After initial data sets were created, they were then rescaled to the 40km^2 hexagonal coverage (Figure 3.1). These modeling hexagons were intersected with each variable dataset. Within each unique hexagon, values for each variable were calculated and then attributed to the intersecting hexagon. The final product is one table of all variables calculated for each unique hexagon that can be related to the modeling hexagonal coverage. A total of 101 environmental variables were used to identify and characterize wildlife-habitat relationships (Table 3.2). Relatively few of these variables were used in any one model.

Table 3.1. GIS coverages used in the animal species modeling process. Refer to the metadata accompanying the digital data for more complete descriptions.

Variable	Data Set	Source
Climate	historical data summaries	High Plains Regional Climate Center (HPRCC)
Land cover	Nebraska GAP land cover map	See Chapter 2
Soils	State Soil Geographic (STATSGO) data	USDA - Natural Resources Conservation Service
Terrain	Digital Elevation Model (DEM)	U.S. Geological Survey
Major streams	Digital Line Graphs (DLG)	U.S. Geological Survey

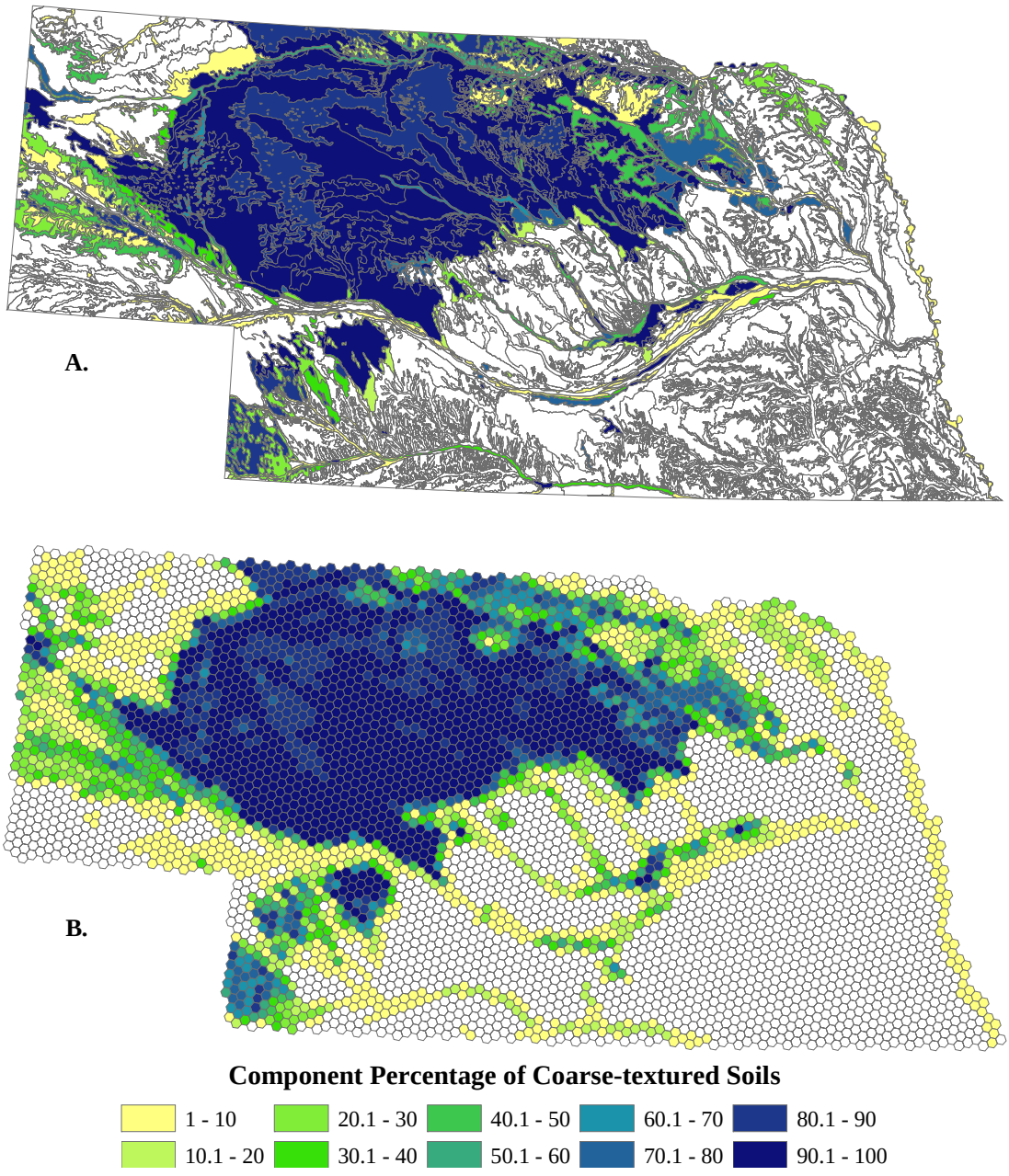


Figure 3.1. An example of a modeling variable depicted in its native resolution (A) and the same variable shown at the rescaled 40km^2 modeling hexagon resolution (B).

Table 3.2. List of environmental variables associated with species occurrences submitted to QUEST.

	Variables	Units
	Nebraska GAP land cover	
1	Ponderosa Pine Forests and Woodlands	%
2	Deciduous Forests and Woodlands	%
3	Juniper Woodlands	%
4	Sandsage Shrubland	%
5	Sandhills Upland Prairie	%
6	Lowland Tallgrass Prairie	%
7	Upland Tallgrass Prairie	%
8	Little Bluestem-Gramma Mixedgrass Prairie	%
9	Western Wheatgrass Mixedgrass Prairie	%
10	Western Shortgrass Prairie	%
11	Barren/Sand/Outcrop	%
12	Agricultural Fields	%
13	Open Water	%
14	Fallow Agricultural Fields	%
15	Aquatic Bed Wetland	%
16	Emergent Wetland	%
17	Riparian Shrubland	%
18	Riparian Woodland	%
19	Low Intensity Residential	%
20	High Intensity Residential/Commercial/Industrial/Transportation	%
	Soil Data	
21	Component percentage of coarse textured soils	%
22	Component percentage of moderately coarse textured soils	%
23	Component percentage of medium textured soils	%
24	Component percentage of moderately fine textured soils	%
25	Component percentage of fine textured soils	%
26	Component percentage of hydric soils	%
	Climate Data	
27	Total growing degree-days at 0^{o} C through JAN	degree-days
28	Total growing degree-days at 0^{o} C through FEB	degree-days
29	Total growing degree-days at 0^{o} C through MAR	degree-days
30	Total growing degree-days at 0^{o} C through APR	degree-days
31	Total growing degree-days at 0^{o} C through MAY	degree-days
32	Total growing degree-days at 0^{o} C through JUN	degree-days
33	Total growing degree-days at 0^{o} C through JUL	degree-days
34	Total growing degree-days at 0^{o} C through AUG	degree-days
35	Total growing degree-days at 0^{o} C through SEP	degree-days

36	Total growing degree days at 0^{o} C through OCT	degree-days
37	Total growing degree days at 0^{o} C through NOV	degree-days
38	JAN growing degree days weighted average coefficient of variation	%
39	FEB growing degree days weighted average coefficient of variation	%
40	MAR growing degree days weighted average coefficient of variation	%
41	APR growing degree days weighted average coefficient of variation	%
42	MAY growing degree days weighted average coefficient of variation	%
43	JUN growing degree days weighted average coefficient of variation	%
44	JUL growing degree days weighted average coefficient of variation	%
45	AUG growing degree days weighted average coefficient of variation	%
46	SEP growing degree days weighted average coefficient of variation	%
47	OCT growing degree days weighted average coefficient of variation	%
48	NOV growing degree days weighted average coefficient of variation	%
49	DEC growing degree days weighted average coefficient of variation	%
50	SEP 30 year average minimum temperature	^{o}C
51	OCT 30 year average minimum temperature	^{o}C
52	NOV 30 year average minimum temperature	^{o}C
53	DEC 30 year average minimum temperature	^{o}C
54	JAN 30 year average minimum temperature	^{o}C
55	FEB 30 year average minimum temperature	^{o}C
56	MAR 30 year average minimum temperature	^{o}C
57	SEP 30 year average minimum temperature coefficient of variation	%
58	OCT 30 year average minimum temperature coefficient of variation	%
59	NOV 30 year average minimum temperature coefficient of variation	%
60	DEC 30 year average minimum temperature coefficient of variation	%
61	JAN 30 year average minimum temperature coefficient of variation	%
62	FEB 30 year average minimum temperature coefficient of variation	%
63	MAR 30 year average minimum temperature coefficient of variation	%
64	MAR 30 year average maximum temperature	^{o}C

65	APR 30 year average maximum temperature	^{o}C
66	MAY 30 year average maximum temperature	^{o}C
67	JUN 30 year average maximum temperature	^{o}C
68	JUL 30 year average maximum temperature	^{o}C
69	AUG 30 year average maximum temperature	^{o}C
70	SEP 30 year average maximum temperature	^{o}C
71	MAR 30 year average maximum temperature coefficient of variation	%
72	APRl 30 year average maximum temperature coefficient of variation	%
73	MAY 30 year average maximum temperature coefficient of variation	%
74	JUN 30 year average maximum temperature coefficient of variation	%
75	JUL 30 year average maximum temperature coefficient of variation	%
76	AUG 30 year average maximum temperature coefficient of variation	%
77	SEP 30 year average maximum temperature coefficient of variation	%
78	MAR 30 year average precipitation	mm
79	APR 30 year average precipitation	mm
80	MAY 30 year average precipitation	mm
81	JUN 30 year average precipitation	mm
82	JUL 30 year average precipitation	mm
83	AUG 30 year average precipitation	mm
84	SEP 30 year average precipitation	mm
85	MAR 30 year average precipitation coefficient of variation	%
86	APR 30 year average precipitation coefficient of variation	%
87	MAY 30 year average precipitation coefficient of variation	%
88	JUN 30 year average precipitation coefficient of variation	%
89	JUL 30 year average precipitation coefficient of variation	%
90	AUG 30 year average precipitation coefficient of variation	%
91	SEP 30 year average precipitation coefficient of variation	%
92	Summed 30 year average precipitation for DEC-FEB	mm
93	Summed 30 year weighted coefficient of variation for DEC-FEB	%
94	Summed 30 year average precipitation for APR-SEP	mm
95	Summed 30 year weighted coefficient of variation for APR-SEP	%
96	Summed 30 year average precipitation for SEP-NOV	mm
97	Summed 30 year weighted coefficient of variation for SEP-NOV	%
98	Sum of frost-free days	days

	Terrain Data	
99	Elevation	m
100	Slope class	%
	Stream Data	
101	Major stream presence/absence	binary

Specimen Records

In an attempt to obtain enough observational records for modeling, NE-GAP acquired records from 1970 to current at time of data acquisition. In the case of amphibians, reptiles, and mammals the catalogue spans 30 years (1970-1999) and, in the case of birds, 31 years (1970-2000).

Locational records for mammals (Figure 3.2), amphibians and reptiles (Figure 3.3) were acquired from the Nebraska State Museum. The georeferenced points were transcribed from legal descriptions into latitude and longitude with a spatial precision of 0.65 hectare (one quarter-section). Individual records were retained for instances of multiple observations of the same species at the same location in an effort to introduce abundance information into the modeling process.

Observational records for birds were acquired from two different sources: Breeding Bird Survey and Christmas Bird Count (Figure 3.4). Not all locations were active for the entire observation period, but they were still retained in the dataset to increase the number of observations for input. For a more manageable dataset, route level and circle composites were created by summing the total number of observations of each species on every route or circle. Given the intensive repeated observations, if a species was not reported along a sampling unit during the study period, it was considered absent. The resulting summary table can be linked to the BBS routes and CBC circles to map the observed distribution for each species. It should be noted that the entire linear (BBS route) or polygonal (CBC circle) feature is treated as the observation area. The implication of this approach will be discussed below.

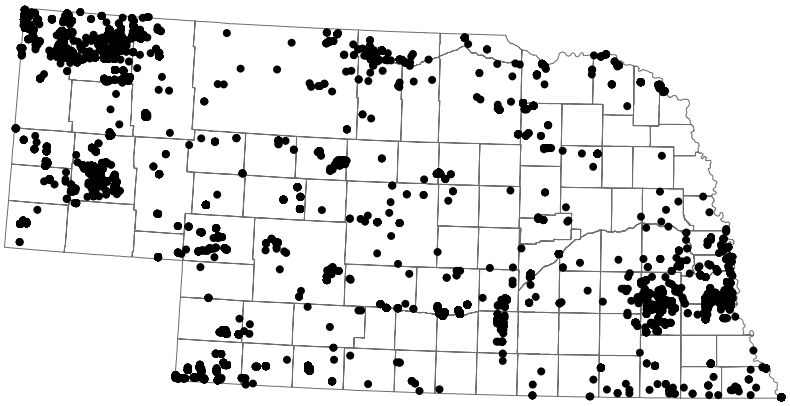


Figure 3.2. Distribution of georeferenced mammal voucher specimens from 1970 – 1999. Records obtained from the Nebraska State Museum.

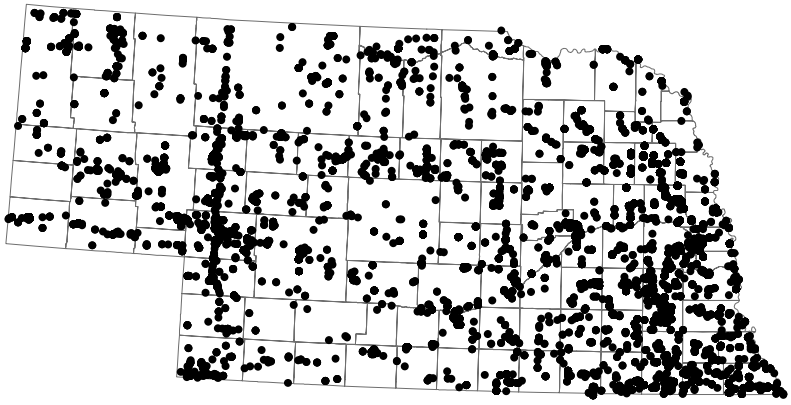


Figure 3.3. Distribution of georeferenced amphibian and reptile voucher specimens from 1970-1999. Records obtained from the Nebraska State Museum.

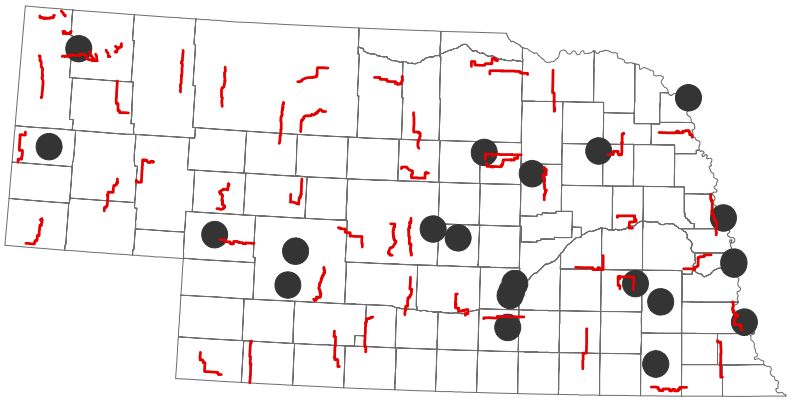


Figure 3.4. Location and extent of Breeding Bird Survey routes and Christmas Bird Count circles.

Land Cover Classification

The NE-GAP land cover map was used to identify vegetation type. Land cover classes were represented as a compositional array, i.e., the percentage area of each class within a hexagon.

Soils Data

Soils data were derived from the Nebraska State Soil Geographic Database (STATSGO). Surficial soil texture information was extracted and recoded into 5 different categories: coarse, moderately coarse, medium, moderately fine, and fine. Hydric soils were also identified. The surface textures and hydric soils were expressed as percent composition.

Climate Data

Weather station data were acquired from the High Plains Regional Climate Center for stations throughout the State of Nebraska and selected stations in surrounding states. Means and coefficients of variation (CV%) were calculated for monthly average precipitation and monthly average, minimum, and maximum temperatures. Total average quarterly and growing season precipitation, growing degree days, and number of frost-free days were also calculated. A robust interpolation algorithm (nngridr; Watson 1994) was applied to each climate variable point coverage to generate a raster coverage at 1500m resolution. When rescaled to the modeling hexagons, each climate variable was calculated as a mean.

Terrain Data

Digital Elevation Model (DEM) data were used to calculate elevation and percent slope. To conserve limited disk space, the calculations were performed at a spatial resolution of 150 meters. The slope data were divided into six classes: 0-2%, 2-5%, 5-10%, 10-15%, 15-20%, and >20%. These data were summarized as a compositional array, thereby retaining the finer resolution data at the coarser scale.

Streams

A coverage of Nebraska's major streams was buffered to a distance of 0.5 km and intersected with the modeling hexagonal coverage to produce a binary variable indicating presence or absence of stream and/or riparian habitat.

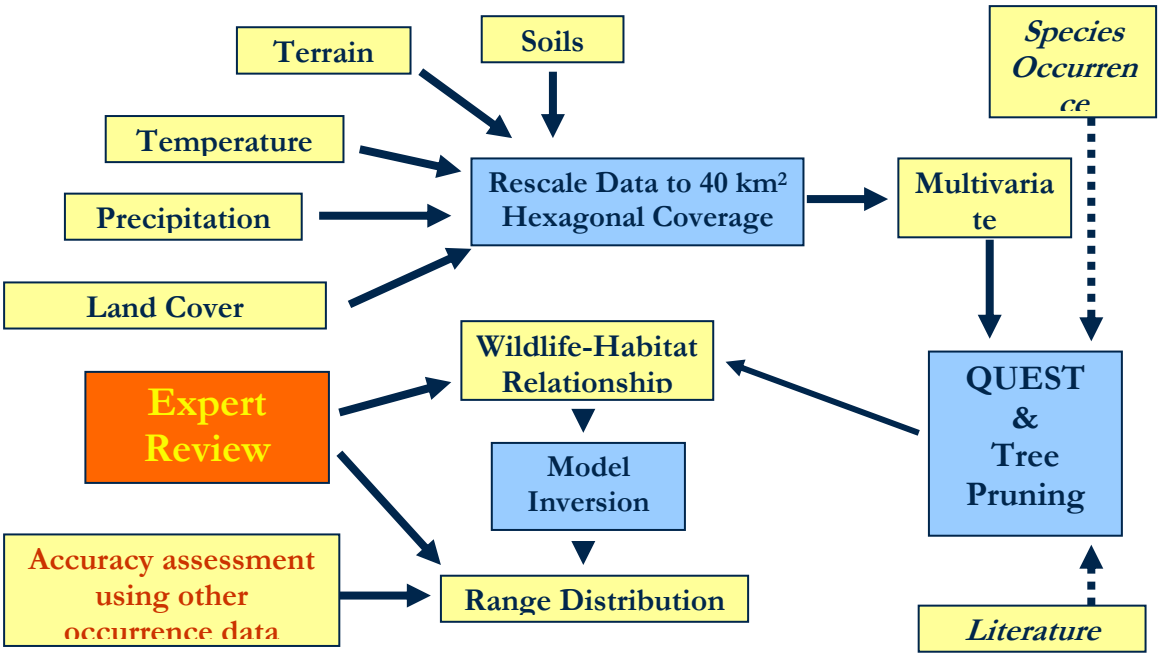


Figure 3.5. Flowchart of habitat modeling technique using statistical trees.

Modeling Method

Any species with 10 or more observations was considered a suitable candidate for modeling by recursive partitioning. In general, the species to model and the associated specimen records were intersected with the modeling hexagon coverage to identify the unique environmental variable set (Figure 3.5). This intersection was essentially a spatial query to subset environmental data associated with the known locations of species occurrences. The new dataset was output and then submitted to QUEST.

The output from QUEST was a classification tree and serves as an objective guide in the process of developing the wildlife-habitat relationship. The tree is a visual interpretation of the predicted membership of cases or objects in the classes of a categorical dependent variable from their measurements on one or more predictor variables. Recursive-partitioning algorithms allocate each occurrence to a terminal node. While this enables multimodal distributions to be fit, it can also lead to an over-specified model. In most instances, model refinement through leaf-trimming was necessary. Ancillary sources, including reference articles, other cited specimen observations, and previously published range maps in conjunction with interactive querying of the environmental database were used to trim the leaves (or terminal nodes) to produce a model of sufficient generality and understandability. It was this part of the modeling process that was the most time consuming and the one in which subjectivity and ecological understanding played key roles. The final wildlife-habitat relationship definition for each species can be found in the species atlases (Appendix D for Birds, Appendix E for Reptiles and Amphibians, and Appendix F for mammals).

While it was a goal to model all species through the method described, it was necessary to implement alternative modeling methods as well (Table 3.3). For species that lacked a sufficient number of observations or for which a suitable model could not be extracted through recursive partitioning, we turned to the literature gestalt approach to determine the wildlife-habitat relationship. Also, wildlife-habitat relationships were not defined for statewide species. Habitat descriptions are cited in the species atlas.

Table 3.3 Wildlife-habitat relationship modeling methods by taxon

	Occurrence Data	Data Type	Modeling Method
Birds	BBS & CBC for 1970-2000	Presence/Absence	QUEST on P/A
Reptiles & Amphibians	NE Museum vouchers for 1970-1999	Presence only	QUEST on aggregates
Mammals	NE Museum vouchers for 1970-1999	Presence only	Literature gestalt

Birds

Due to intensive repeated observations of the sampling units, the dataset is considered to provide occurrences of absence as well as presence. Thus, were a species not observed along a sampling route during the entire study period, this species was considered to be absent from the route. Repeated sampling can produce multiple observations of species occurrence along a given route. By summing these route-level observations across the entire study period, it was possible to treat abundance data as weighting factors in the modeling process.

The georeferenced sampling localities enabled the input environmental dataset to be reduced. Since the sampling routes or circles represented an area that potentially covered several modeling hexagons (and associated environmental data), the environmental variables of each intersecting hexagon were aggregated in the same manner in which the original datasets were aggregated to the reporting hexagon coverage. This reduced dataset allowed the environmental variables to be easily joined to the observational data of each species within a relational database. As a result, it improved the efficiency of variable submission to QUEST.

Reptiles and Amphibians

The locality records for reptiles and amphibians are voucher specimens that indicate presence only. Due to the lack of repeated sampling, absence of a species cannot be inferred where no observations exist. The lack of absence data was overcome by submitting aggregates species locality records to QUEST. Multiple species were submitted together with the species name as the dependent variable category for QUEST to classify. Aggregates needed to have a blend of locational differences to enable QUEST to separate out particular species from the aggregate. Trial runs showed that the spatial arrangement of observational records and the number of observations of each species influenced the final classification tree. An example of a species aggregate used for modeling is shown in Figure 3.6. Finding species aggregates that produced a manageable and meaningful classification tree proved to be difficult at times and was another subjective element in the modeling process.

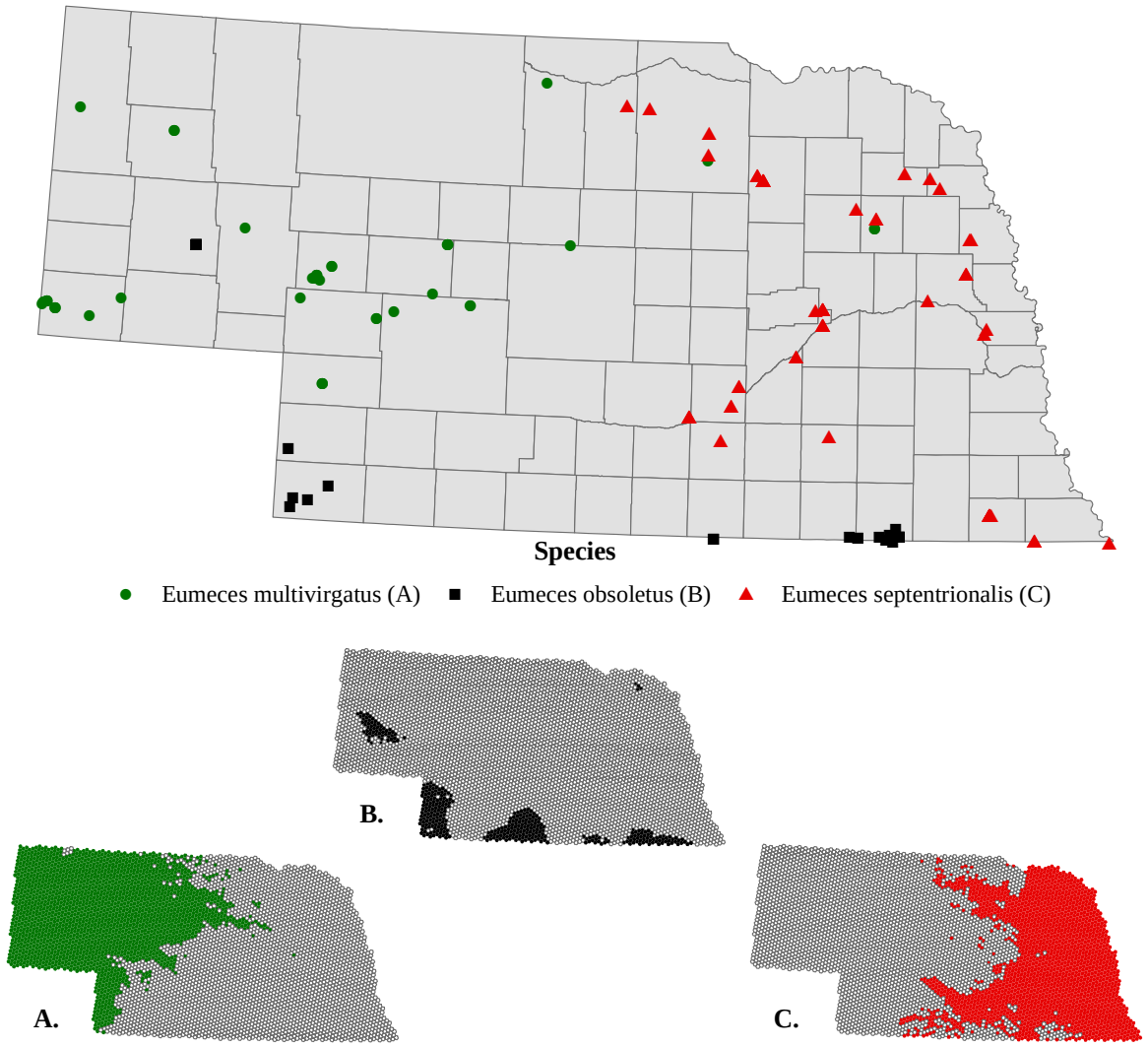


Figure 3.6. Example of a species aggregate used to create amphibian and reptile wildlife habitat relationships. Distribution of voucher specimens of three skinks and their respective output models.

Mammals

It was not possible to use QUEST to determine wildlife-habitat relationships for mammals because of the highly clustered pattern of available mammal voucher specimens (Fig. 3.2). Therefore all relationships were developed through literature reviews, known range extent maps, and interactive querying of the environmental geospatial database.

Mapping Habitat Range Extent

Range map extents were created by inversing the final classification tree that described the wildlife-habitat relationship model in terms of set of environmental variables. This inversion was accomplished by querying the environmental dataset at the modeling hexagon resolution according to the variable splits of the final classifications tree (Figure 3.7). A habitat range extent coverage for each species was output as a binary map (suitable habitat = 1, unsuitable habitat = 0). A binary habitat range map was also

produced at the coarser reporting hexagon resolution. Habitat was determined to be present if any portion of a modeling hexagon fell within the coarser reporting hexagon. These maps were generated within a relational database. It is important to note that each species's modeled range distribution indicates the presence (or absence) of the conditions associated with the modeled habitat, not species presence/absence or abundance directly.

Species atlas reports were sent to experts for review and commentary. All comments received were documented in a database (Appendix G). Few models were found to be insufficient. In most instances, the altered models are for species that were found to be statewide in occurrence. Models that were altered are indicated in the database.

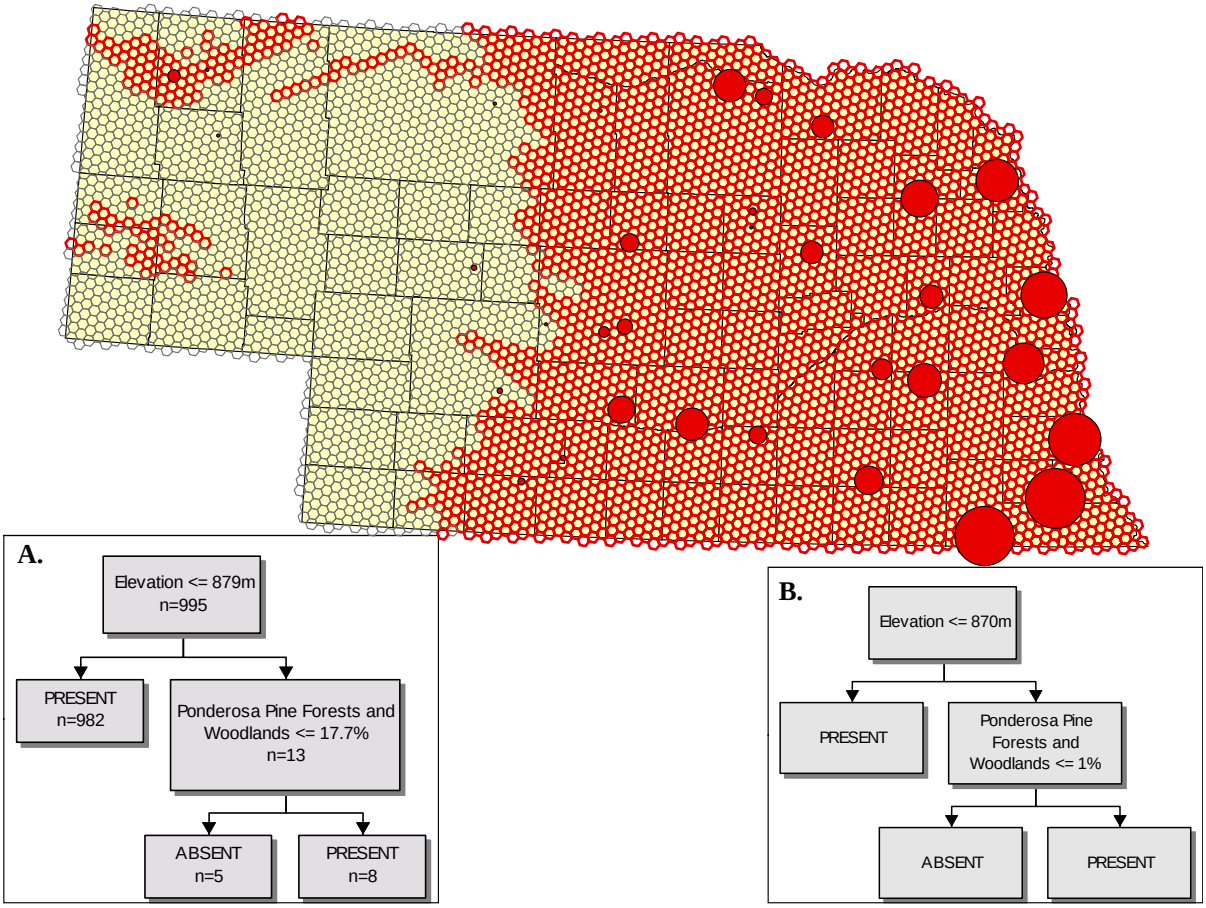


Figure 3.7. Gray Catbird habitat distribution map. The map shows the distribution of the modeled habitat and the proportional representation of observed specimens and their locations. Box A depicts the original classification tree output from QUEST while box B shows the modified classification tree used to create the habitat distribution map. By convention, lower-valued splits at nodes fall to the left.

Results

Literature review, wildlife habitat relationships, and habitat range maps for each species can be found in the appropriate taxon atlas. The wildlife-habitat relationship models provide a quasi-objective framework from which to predict range distributions; there remains considerable subjectivity in the pruning stage that is necessary for model generality. These models also provide a means through which to assess the gaps in knowledge about species habitat requirements, tolerances, and limits.

The spatial pattern of species occurrences largely determine how successfully a wildlife-habitat relationship can be identified and encapsulated in a succinct model (Table 3.4). Species that occur statewide show no particular affinity to specific habitat variables; thus, it is difficult to build a model for these generalists other than to declare their potential ubiquity. Species range distributions may be delimited within Nebraska as a simple function of latitude, longitude, or elevation or a more complex interactive function of these geospatial coordinates. Species distributions may be delimited to particular patches or along riparian corridors. Species may occur only at the periphery of Nebraska in either a regular or erratic pattern. In addition to spatial distribution, the abundance of a species at sampling locations or density of species occurrences within an area contributes strongly to the modeling success. Species may occur commonly, sporadically, rarely, or not at all.

Table 3.4. Interaction of abundance and distribution on modeling effort

	Statewide	**Delimited**	**Peripheral**
Common	Very Hard	Very Easy	Easy
Sporadic	Very Hard	Easy to Moderate	Easy to Hard
Rare	Very Hard	Easy to Moderate	Easy to Hard

Birds:

The relatively high number (193) of bird species modeled meant a wide range of abundance by distribution interactions were encountered. For example, compare Figure 3.7 (Gray Catbird) with Figures 3.8 (Willet), 3.9 Red-tailed Hawk), and 3.10 (Mourning Dove). Resulting distribution of modeling methods was QUEST=90, Literature=68, and Statewide=35. Many range delimitations involved the interannual variability of weather variables in the transitional months (March and April, September and October). See the bird species atlas for details (Appendix D).

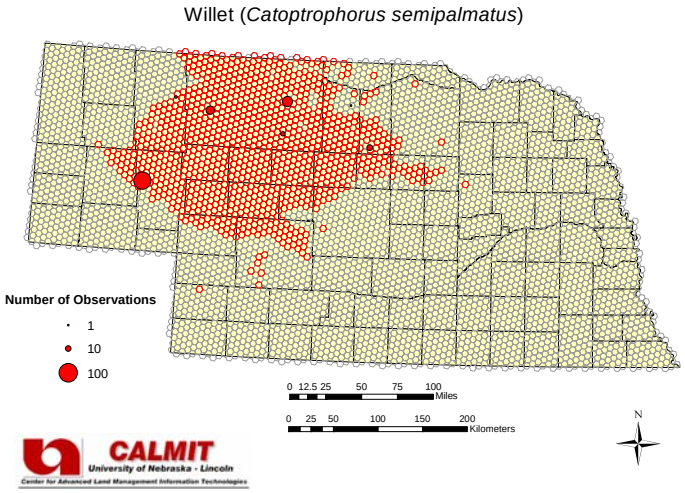


Figure 3.8. QUEST modeled distribution using the variable 'Land Cover class Sandhills Upland Prairie > 55%'.

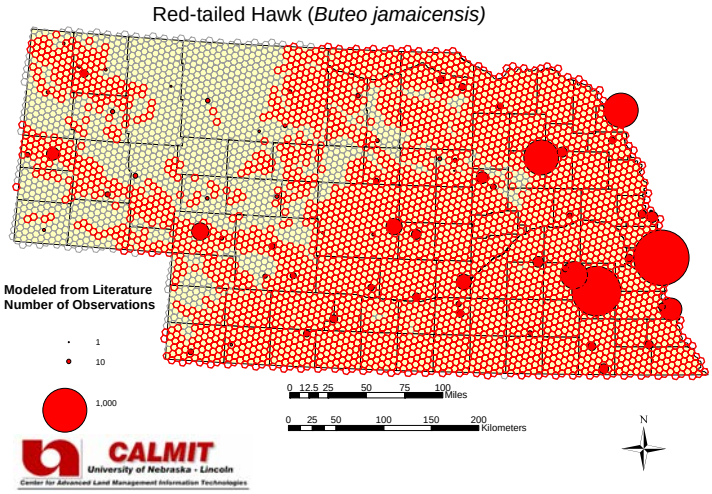


Figure 3.9. Modeled from literature using the variable 'Land Cover class Deciduous Forests and Woodlands is present'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.

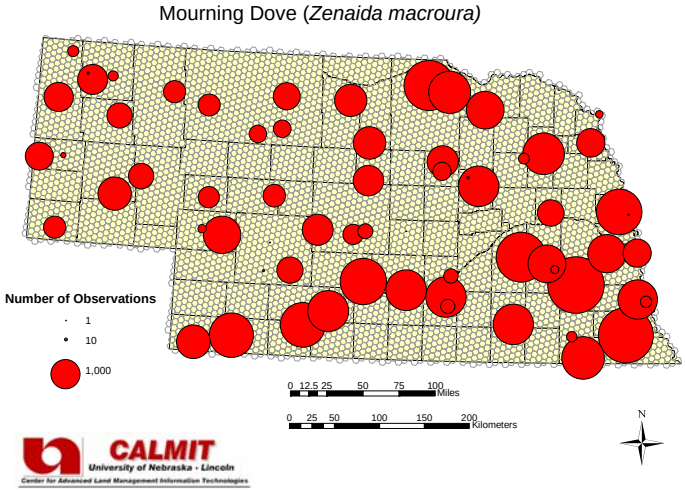


Figure 3.10. Statewide distribution precluded specific model development.

Reptiles:

Snakes were a big challenge to model concisely: they were distributed patchily and/or at the periphery; they were few voucher specimens; and they required a larger set of surrogate variables (e.g., Figure 3.11, Western Fox Snake). Turtles, lizards, and skinks were more straightforward (e.g., Figure 3.12, Fence Lizard). Resulting distribution of modeling methods was QUEST=26, Literature=19, and Statewide=2. Many range delimitations involved the weather extremes especially in the transitional months. See the amphibian and reptile species atlas for details (Appendix E).

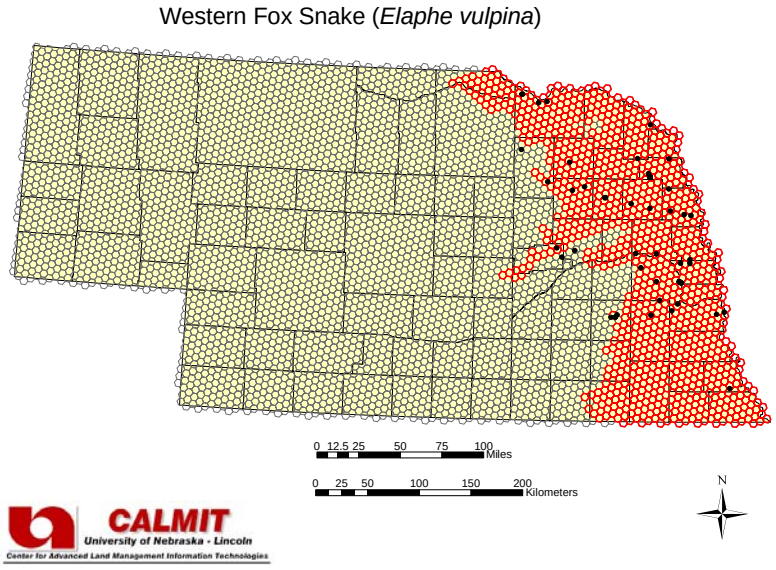


Figure 3.11. QUEST modeled distribution using the set of variables 'Elevation ≤ 550 m' AND 'Total Growing Degree Days at 0°C through September > 3550 days' AND 'Elevation ≤ 450 m' OR 'Elevation > 550 m' AND 'Total Growing Degree Days at 0°C through September > 3550 days'

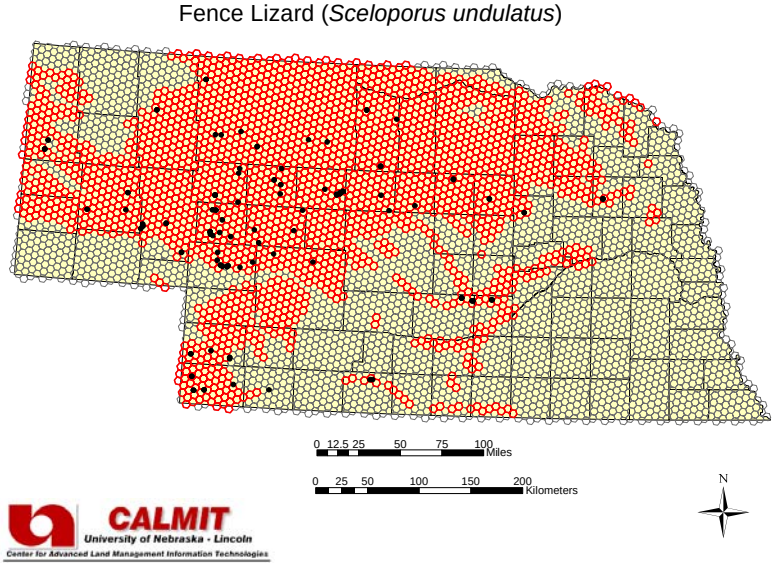


Figure 3.12. QUEST modeled distribution using the variable 'Percentage of Coarse-textured Soils > 10%'.

Amphibians:

Amphibian species tended to be either almost everywhere surface water was available (Figure 3.13, Woodhouse's Toad) or on the periphery (Figure 3.14, Cope's Gray Treefrog). Resulting distribution of modeling methods was QUEST=5, Literature=8, and Statewide=1. Many range delimitations involved the weather extremes especially in the transitional months. See the amphibian and reptile species atlas for details (Appendix E).

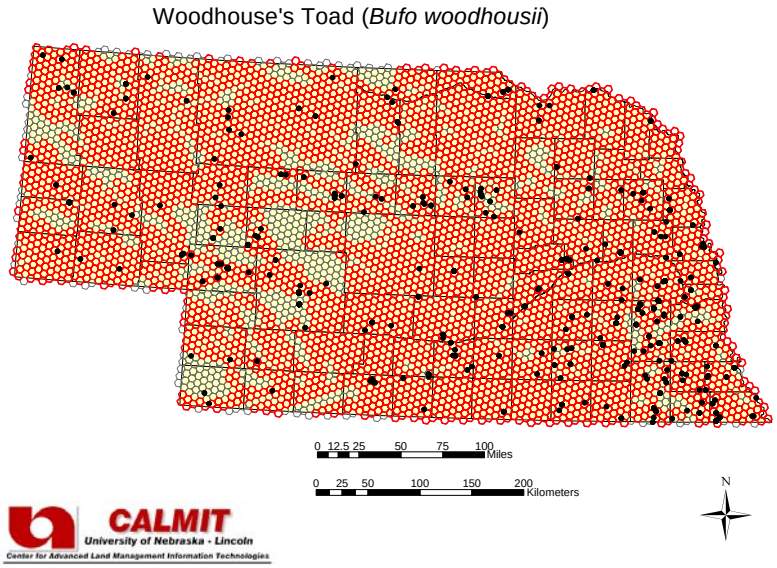


Figure 3.13. Distribution was modeled from literature using the set of variables 'Stream class is present' OR 'Land Cover class Aquatic Bed Wetland is present'.

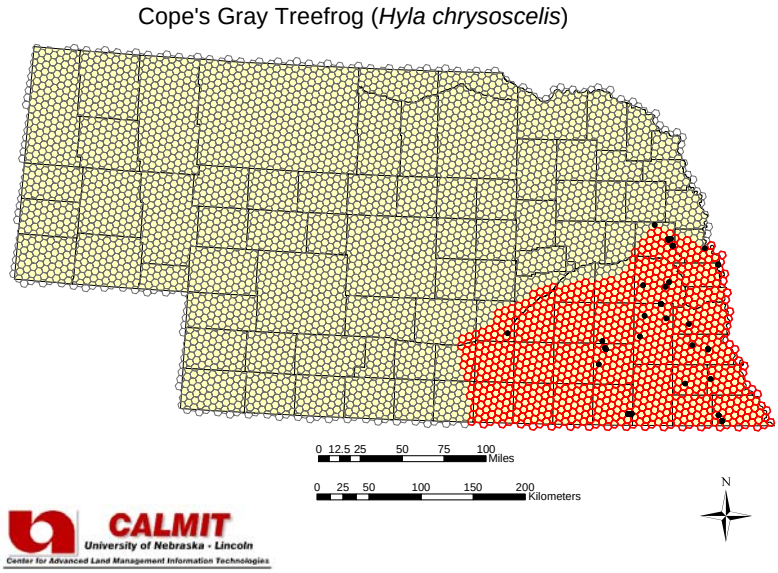


Figure 3.14. QUEST modeled distribution using the set of variables '30-year Average Maximum Temperature Coefficient of Variation for April ≤ 6.7%' AND '30-year Average Precipitation for March > 47.5 mm'.

Mammals:
Mammal models tended to rely either on land cover variables (Figure 3.15, Desert Cottontail) or on climatic variables (3.16, Elliot's Short-tailed Shrew). The distribution of modeling methods was Literature=51 and Statewide=27. See the mammal species atlas for details (Appendix F).

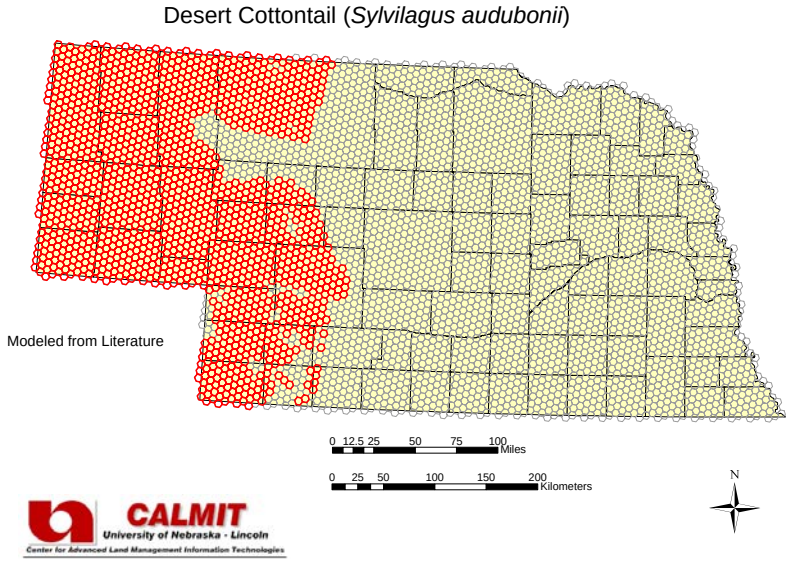


Figure 3.15. Modeled from literature using the set of variables 'Land Cover class Western Mixedgrass Prairie is present' OR 'Land Cover class Sandsage Shrubland is present'.

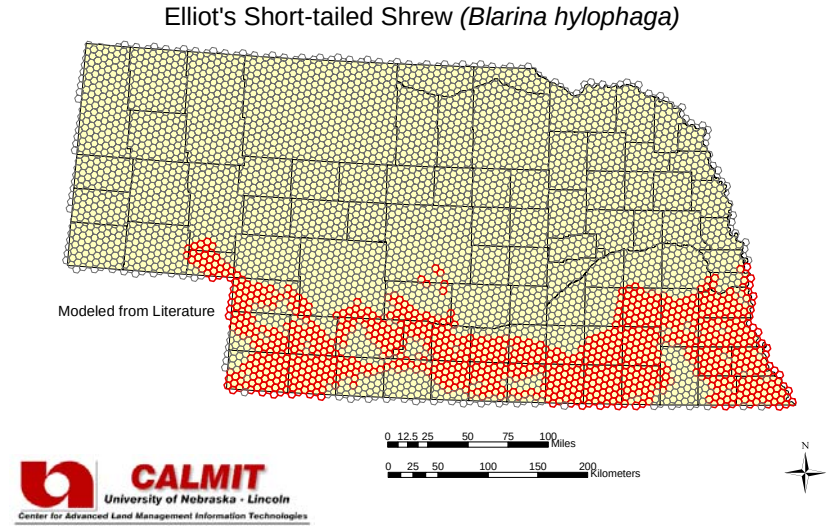


Figure 3.16. Modeled from literature using the set of variables '30-year Average Maximum Temperature for April <= 6.5ºC' AND '30-year Average Maximum Temperature for March < 13ºC' AND 'Hydric Soils are present'.

Species Richness
GAP has often been associated with the mapping of species-rich areas or "hotspots." Richness maps identify the number of species that are modeled to occur in the same location or, in our case, the same grid cell. These are color coded or shaded in intensity from the highest numbers of co-occurrence (most rich) to the lowest (least rich). While researchers continue to perform this useful pattern analysis, it is only one of many that may be conducted using distribution data. The richest areas may not correspond to the best conservation opportunities. They may occur in already protected areas or may represent mostly

already protected species or those not at risk. Still, maps of species richness are often a useful starting point to examine conservation opportunities. They may be useful for other rewarding applications such as identifying areas of interest for wildlife observation and study.

Species richness maps are shown for all modeled taxa (Figures 3.17 and 3.18) and by taxonomic group (Figures 3.19 – 3.24). These maps represent the sum of all species that, according to the models, occur within each unique hexagon at the modeling (Figs. 3.17, 3.19, 3.21, 3.23) and reporting resolutions (Figures 3.18, 3.20, 3.22, 3.24). Both spatial resolutions show the same geographic trends; however, the finer resolution of the modeling hexagons allows critical riparian habitats to be depicted and emphasizes the reliance of biodiversity in Nebraska on water resources and freshwater habitats. The four colors in the maps correspond to the four quartiles of the richness distribution. Yellow indicates the first quartile or the lowest 25% of the distribution; these areas have the fewest number of modeled species habitats. Green and cyan indicate the second and third quartiles of the distribution. Considered together the second and third quartiles show where the middle 50% of the species richness occurs. The dark blue indicates the fourth quartile or the top 25% of the distribution; these areas have the most number of different species habitats according to the models.

Terrestrial Vertebrate Richness

Of the 332 species modeled, the highest richness values are found in the southeastern part of Nebraska and the minimum values of the modeling and reporting hexagons are found in the southwestern region. Overall, the total vertebrate richness map shows high values for the southeastern portion of Nebraska and linear branches throughout the state. These linear features follow the major rivers and streams of the State: the Platte River and its tributaries draining the middle of the state, the Niobrara River along the northern tier, the Missouri River on the eastern border, and the Republican in the south. Available water and a variety of habitat provided by woodlands along the streams account for the high species richness. Climatic gradients of the Great Plains—increased precipitation from west to east and increased temperature from north to south—largely account for higher species richness in southeastern Nebraska, even though most of the original prairies have been converted to agriculture with a profusion of trees in planted shelterbelts and expanding patches of eastern red cedar that thrive due to human suppression of wildfires. The Pine Ridge, in northwestern Nebraska, supports high richness because of significant elevational differences, which enables the occurrence of a ponderosa pine forest.

Areas of low species richness encompass most of the grasslands mapped within the state of Nebraska. The grasslands provide a lesser diversity of habitats and are pervasive in the western Nebraska. Sources of available surface water are scarcer. Scattered pockets of high richness can be found within these grasslands and are indicative of perennial water bodies and smaller streams. Richness maps by taxa reflect the same general trends.

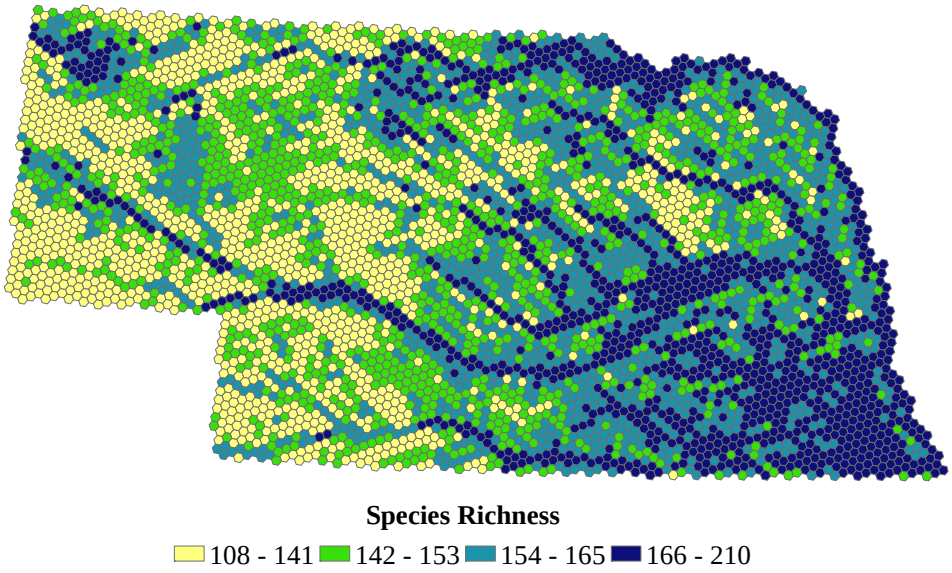


Figure 3.17. Total species richness distribution by quartile (modeling hexagon).

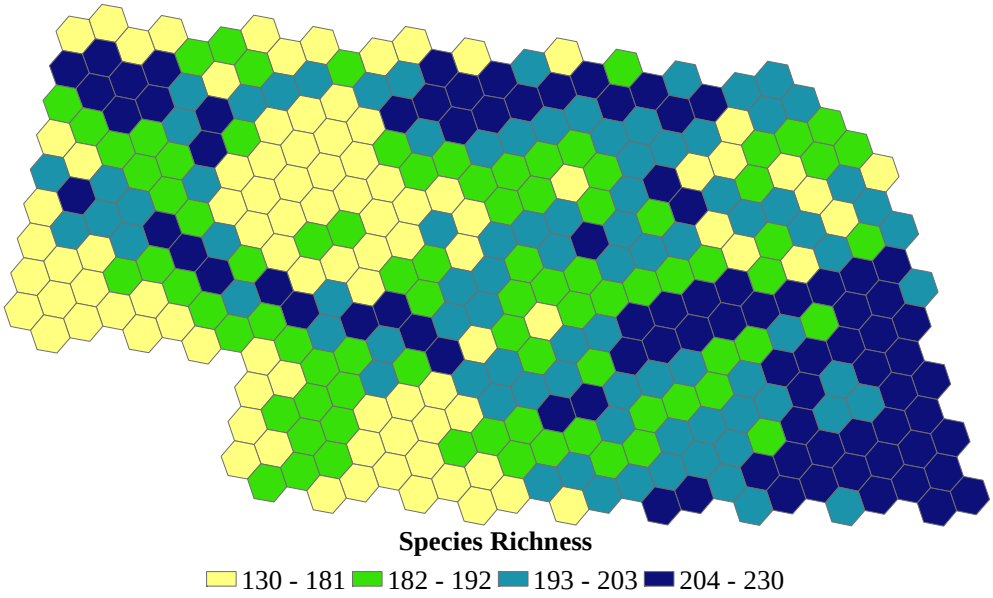


Figure 3.18. Total species richness distribution by quartile (reporting hexagon).

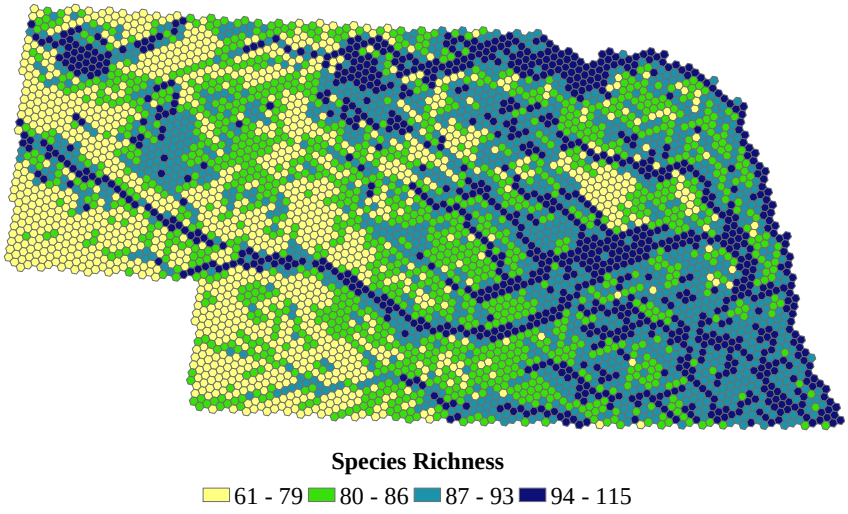


Figure 3.19. Bird species richness - modeling hexagon. Distribution by quartile.

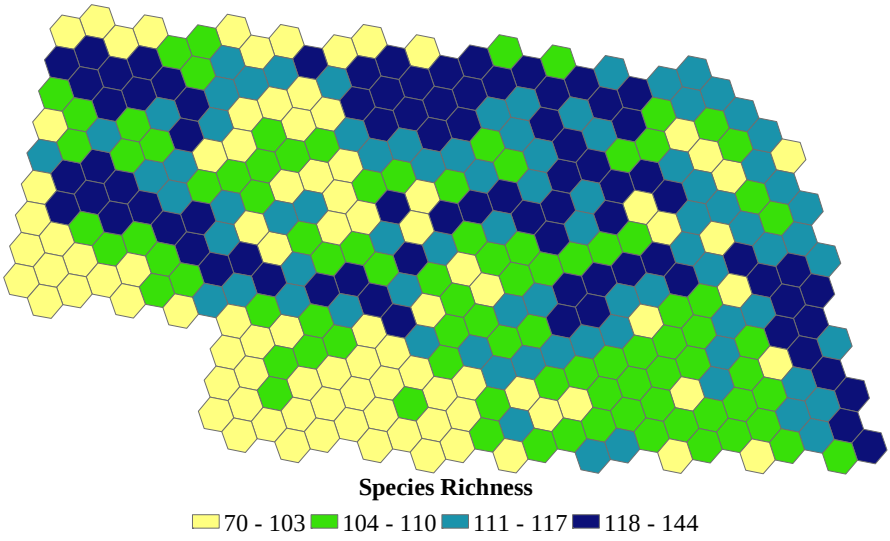


Figure 3.20. Bird species richness distribution by quartile (reporting hexagon).

Bird Richness

The richness distribution of modeled birds shows a strong preference for woodlands, wetlands, and riparian habitats. The distribution strongly influences the total species richness map due to the large number of bird species modeled for the NE-GAP project.

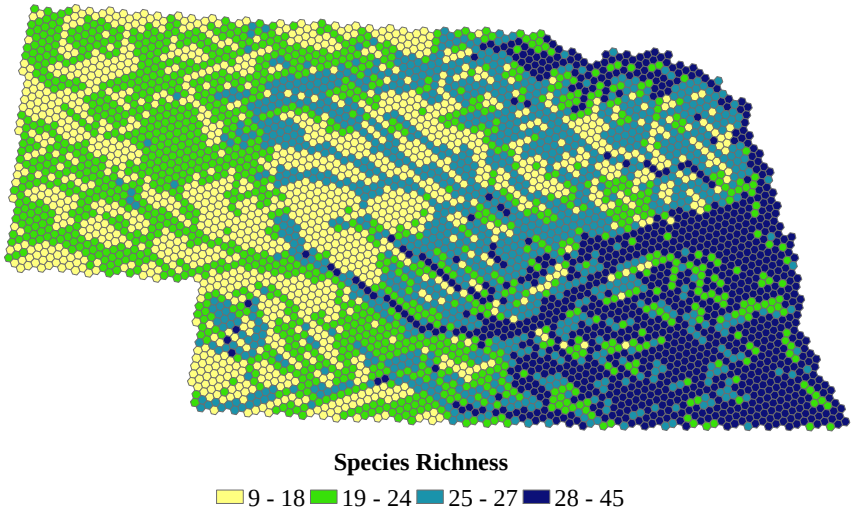


Figure 3.21. Amphibian and reptile species richness distribution by quartile (modeling hexagon).

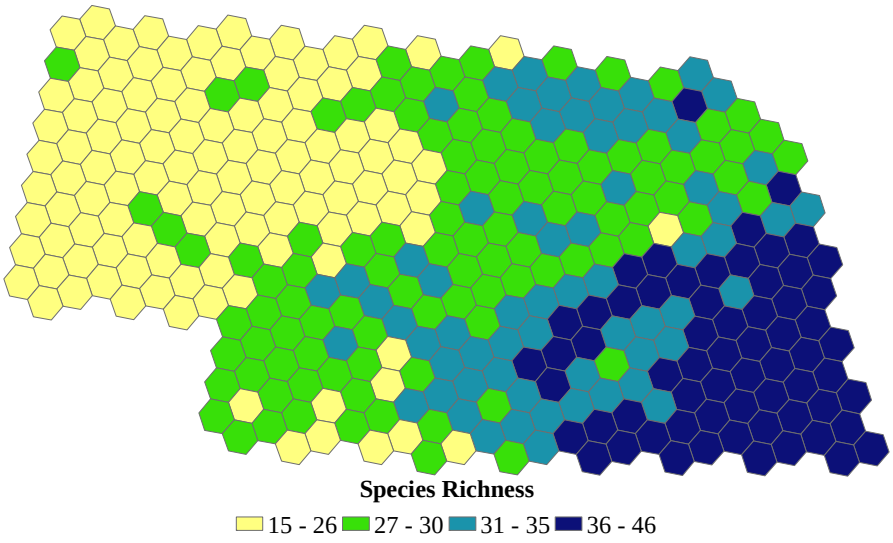


Figure 3.22. Amphibian and reptile species richness distribution by quartile (reporting hexagon).

Amphibian and Reptile Richness

These species are strongly influenced by the overall climatic pattern of Nebraska. Poikilotherms tend to favor warmer temperatures and amphibians are associated with moister habitats. Note that the agriculturally more productive eastern Nebraska also encompasses the richer half of the amphibian and reptile habitats. The amphibian and reptile species richness patterns do not appear as severely affected as that of the mammals. Man-made water structures, such as farm and soil conservation ponds, may actually create more habitat opportunities than they destroy; although the quality of those new habitats may not be comparable. Furthermore, the spatial scale of terrestrial reptile and amphibian home ranges tend to be much smaller than those of mammals.

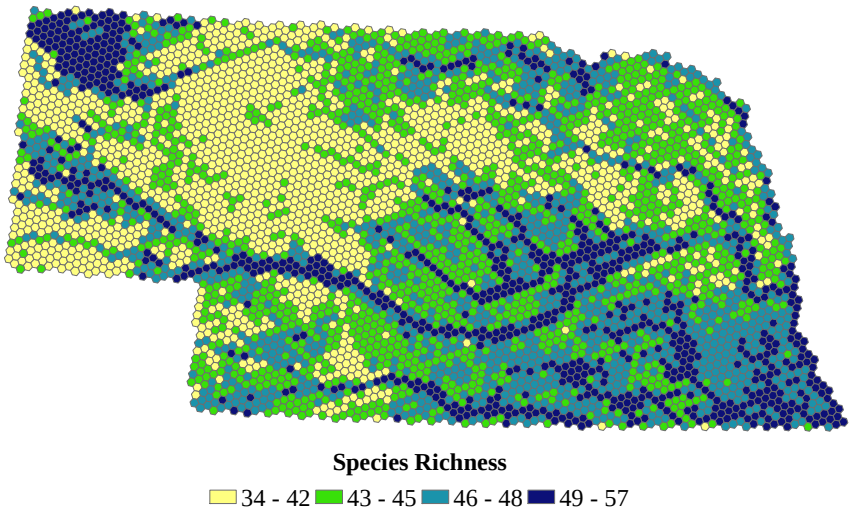


Figure 3.23. Mammal species richness distribution by quartile (modeling hexagon).

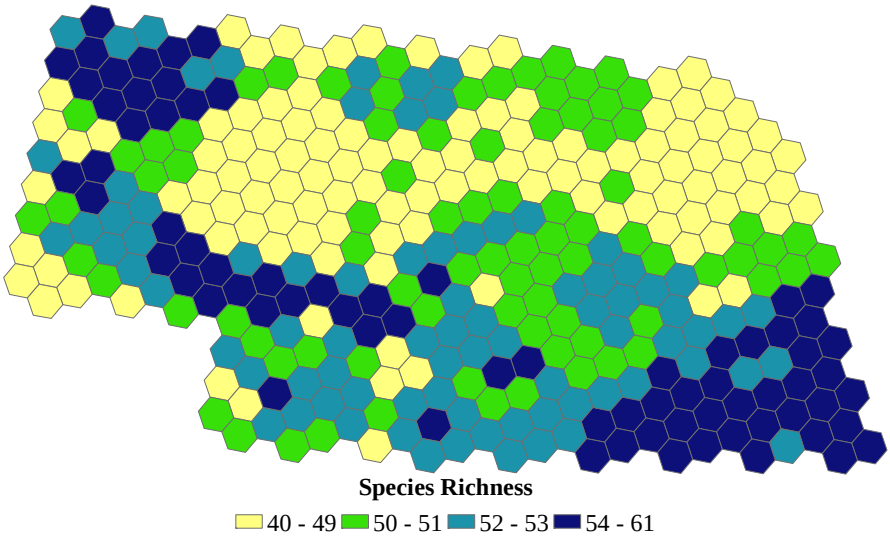


Figure 3.24. Mammal species richness distribution by quartile (reporting hexagon).

Mammal Richness

The mammal richness distribution also shows a preference for habitats with higher woodlands and wetlands concentrations. A noticeable difference is the lack of high richness of species along the Missouri River in the northeastern part of the state. This pattern may be due to the high concentration of agricultural lands and management practices used to discourage crop damage.

Accuracy Assessment

Assessing the accuracy of the predicted vertebrate distributions is subject to many of the same problems as assessing land cover maps, as well as a host of more serious challenges related to both the behavioral aspects of species and the logistics of detecting them. These are described further in the Background section of the GAP Handbook on the national GAP home page. It is, however, necessary to provide some measure of confidence in the results of the gap analysis for species collectively, if not individually or by taxonomic group (comparison to stewardship and management status), and to allow users to judge the suitability of the distribution maps for their own uses. We, therefore, feel it is important to provide users with a statement about the accuracy of GAP-predicted vertebrate distributions within the limitations of available resources and practicalities of such an endeavor. We acknowledge that distribution maps are never finished products but are continually updated as new information is gathered. This reflects not only an improvement over the modeling process, but also the opportunity to map true changes in species distributions over time. However, we feel that assessing the accuracy of the current maps provides useful information about their reliability to potential users.

Our goal was to produce maps that predict distribution of terrestrial vertebrates and from that, total species richness and species content with an accuracy of 80% or higher. Failure to achieve this accuracy indicates the need to refine the data sets and models used for predicting distribution. There is a conscious effort in the GAP process, however, to err on the side of commission. In other words, to attribute species as possibly present when they are not. There are two primary reasons for doing so: first, few species have systematic, unbiased known ranges and we believe science is best served by identifying a greater potential for sampling and investigation than a conservative approach that may miss such opportunities; second, in conducting the analysis of conservation representation (see the Analysis section), we believe it most appropriate to identify a species that may need additional conservation attention that is then refuted by further investigation rather than identifying a species as sufficiently protected that is discovered not to be by its subsequent loss.

The methods for validating and assessing the accuracy of the vertebrate distribution maps are presented below along with the results.

Methods:

Several challenges exist in the accuracy assessment of the NE-GAP species models. First, there are a limited number of sources and records to select from. In many cases these data represent a general area (e.g., county or survey route) rather than the actual location of the observation. Second, we chose to use two spatial resolutions and thus separate assessments are necessary. Third, commission error, i.e., falsely attributing presence, is not possible to estimate from presence-only data. Thus, we focused instead omission error, i.e., falsely attributing absence. Finally, to avoid inflating accuracies, we have excluded in the assessment any species with a statewide distribution.

Data used for the assessment of species were collected from a variety of museums (Table 3.5). In addition, we used the data collected in a resurvey of Nebraska ponds (McLeod 1999). Field observations or voucher specimens were obtained for 275 species (82.8% of species modeled). No observations were available for 57 species (17.2%). Species with statewide distributions (n=65; 19.6%) were not included in the accuracy assessments. The assessment tested each model with any unique observation at the route or county level or more than 4 unique observations at the scale of the modeling hexagons.

Table 3.5. Museum voucher specimen data used for model accuracy assessments

Museum	*Taxa*
Berkeley Museum of Vertebrate Zoology	Birds, Mammals, Amphibians & Reptiles
California Academy of Sciences	Amphibians & Reptiles
Cornell University	Mammals
Field Museum of Natural History, Chicago	Birds, Amphibians & Reptiles
Florida Museum of Natural History	Mammals
Florida State Museum	Amphibians & Reptiles
Illinois Natural History Survey	Mammals
Nebraska State Museum	Birds, Mammals, Amphibians & Reptiles
Smithsonian Institution	Mammals
Texas Tech. University	Mammals
University of Illinois Museum Natural History	Amphibians & Reptiles
University of Kansas Natural History Museum	Mammals
University of Michigan Museum of Zoology	Birds

Due to disparate observation types and sources, a significant amount of data formatting had to be done to create an efficient environment to run model accuracies. For example, each museum reported its species records in a different manner (e.g., date format, column headings), had inherent spelling errors, outdated nomenclature, and other issues. To help overcome these issues a relational database was established. This allowed tables to be developed and formatted for our purposes but also retained the original data. The use of a relational database was also used to capture, maintain, and exploit spatial relationships between NE-GAP species models and observation records (counties, survey routes, points). The output dataset is a one to one relationship between the models and the observation datasets. In the case of the museum dataset, all observations were referenced to its associated county. The models (richness tables) were collapsed from the hexagonal coverage to the county level resolution with a rule stating that if at least one model hexagon indicates a species habitat is present within a county, then the entire county is similarly attributed. These two binary tables were brought into a spreadsheet to create a matrix to identify four possible outcome pairs: (1) Map=Absence & Field=Absence; (2) Map=Absence & Field=Presence; (3) Map=Presence & Field=Absence; and (4) Map=Presence & Field=Absence. Omission error is captured in pair #2 while commission error is captured in the pair #3. The omission error rate is calculated as the number of missed occurrences in the map divided by the total number of occurrences in the field observations. This error rate can be obtained from both presence/absence data like BBS as well as from presence only data like voucher specimens. The same procedures (with minor alterations) were utilized to create tables for BBS and georeferenced observations.

Results:

Table 3.6 provides a grand summary for the mean and median omission error rates by taxon, modeling method, reference source, and modeling resolution. Higher omission rates indicate poorer model performance. Note that the median values are almost all zero, while the mean omission rates range from 2.6-27.5%. This discrepancy between the mean and median indicates a highly skewed distribution of model performance across the taxa. In general omission rates are low but a few species have models with high omission rates that affect the mean but not the median.

Table 3.6. Mean and median omission error rates by taxon, method, scale, and resolution for species with five or more observations

Taxon / Method / Scale	Modeling Hexagons Omission Rates (%) Mean	Median	n	Reporting Hexagons Omission Rates (%) Mean	Median	n
Birds						
QUEST						
BBS	7.6	0.0	82	3.7	0.0	82
County	27.5	0.0	80	24.7	0.0	80
Literature						
BBS	6.6	0.0	44	5.7	0.0	44
County	19.2	0.0	50	16.7	0.0	50
Overall						
BBS	7.2	0.0	126	4.4	0.0	126
County	24.3	0.0	130	21.6	0.0	130
Mammals						
Literature/Overall						
NSM points	19.9	13.6	33	11.0	0.0	45
County	7.1	0.0	45	4.3	0.0	45
Amphibians and Reptiles						
QUEST						
County	2.6	0.0	19	2.6	0.0	19
Literature						
County	4.6	0.0	24	4.6	0.0	24
Overall						
County	3.7	0.0	43	3.7	0.0	43

Amphibians and Reptiles:
Field observations or voucher specimens were obtained for 13 amphibian species (92.9% of species modeled in the taxon). No observations were available for 1 species (7.1%). The one species with an inferred statewide distribution—*Bufo cognatus*, the Great Plains Toad—was not included in the accuracy assessments. Field observations or voucher specimens were obtained for 33 reptilian species (70.2% of species modeled in the taxon). No observations were available for 14 species (29.8%). Two snake species with inferred statewide distributions— *Pituophis catenifer*, the Gopher Snake and *Lampropeltis triangulum*, the Milk Snake—were not included in the accuracy assessments. Tables 3.7 and 3.8 detail the omission error rate results for amphibians and reptiles respectively. Figure 3.25 illustrates the histogram of omission rates for amphibians and reptiles using the county level data. QUEST models appear to perform marginally better than literature models. Models perform comparably on both hexagon types.

Table 3.7. Amphibian omission error rate results

Amphibians	County Level Omission Error Rate			Q=QUEST; L=Literature; S=Statewide
Species Name	**Modeling Hexagon**	**Reporting Hexagon**	**n**	**Model Type**
Acris crepitans	0.0	0.0	7	Q
Ambystoma texanum	60.0	60.0	5	L
Ambystoma tigrinum	0.0	0.0	39	L
Bufo americanus	0.0	0.0	1	L
Bufo cognatus	*	*	3	S
Bufo woodhousii	0.0	0.0	42	L
Gastrophryne olivacea	0.0	0.0	2	L
Hyla chrysoscelis	0.0	0.0	12	Q
Hyla versicolor	-	-	0	Q
Pseudacris triseriata	0.0	0.0	47	L
Rana blairi	0.0	0.0	31	Q
Rana catesbeiana	0.0	0.0	21	L
Rana pipiens	0.0	0.0	21	Q
Spea bombifrons	0.0	0.0	39	L

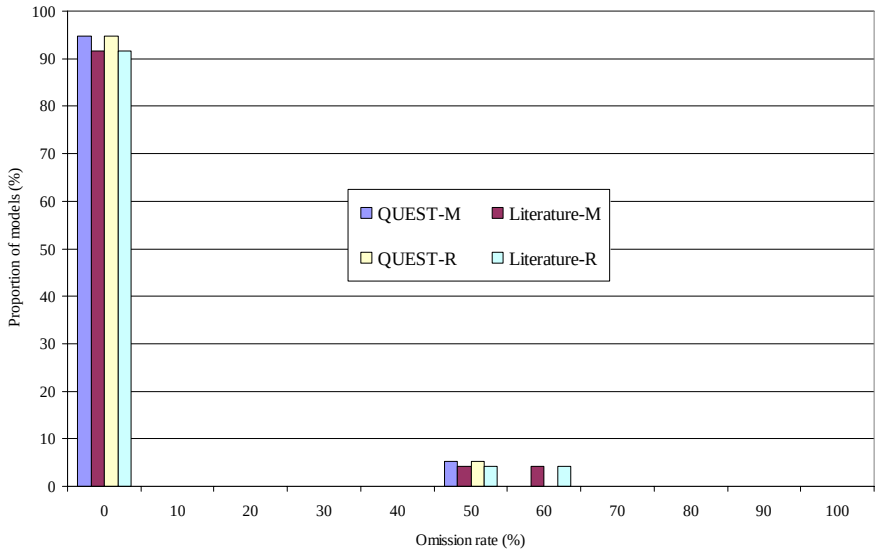


Figure 3.25. Histogram of omission error rates for amphibians and reptile models using county data. M=modeling; R=reporting.

Table 3.8. Reptile omission error rate results

Reptiles	County Level Omission Error Rate			Q=QUEST; L=Literature; S=Statewide
Species Name	**Modeling Hexagon**	**Reporting Hexagon**	**n**	**Model Type**
Agkistrodon contortrix	0.0	0.0	1	L
Apalone mutica	-	-	0	Q
Apalone spinifera	0.0	0.0	2	Q
Arizona elegans	50.0	50.0	2	L
Carphophis vermis	0.0	0.0	3	L
Chelydra serpentina	0.0	0.0	3	L
Chrysemys picta	0.0	0.0	2	L
Cnemidophorus sexlineatus	0.0	0.0	2	Q
Coluber constrictor	0.0	0.0	5	L
Crotalus horridus	0.0	0.0	3	L
Crotalus viridus	0.0	0.0	3	Q
Diadophis punctatus	0.0	0.0	1	Q
Elaphe emoryi	-	-	0	Q
Elaphe obsoleta	-	-	0	Q
Elaphe vulpina	0.0	0.0	2	Q
Emydoidea blandingii	0.0	0.0	1	Q
Eumeces fasciatus	0.0	0.0	1	L
Eumeces multivirgatus	-	-	0	Q
Eumeces obsoletus	-	-	0	Q
Eumeces septentrionalis	0.0	0.0	4	Q
Graptemys pseudogeographica	-	-	0	Q
Heterodon nasicus	0.0	0.0	5	Q
Heterodon platirhinos	-	-	0	Q
Holbrookia maculata	0.0	0.0	1	Q
Kinosternon flavescens	0.0	0.0	4	Q
Lampropeltis calligaster	0.0	0.0	1	Q
Lampropeltis getula	0.0	0.0	3	L
Lampropeltis triangulum	*	*	3	S
Liochlorophis vernalis	0.0	0.0	3	L
Masticophis flagellum	0.0	0.0	4	L
Nerodia sipedon	0.0	0.0	1	Q
Phrynosoma douglasii	-	-	0	Q
Pituophis catenifer	*	*	0	S
Regina grahamii	-	-	0	Q
Sceloporus graciosus	-	-	0	L
Sceloporus undulatus	0.0	0.0	3	Q
Sistrurus catenatus	0.0	0.0	2	L
Storeria dekayi	-	-	0	Q
Storeria occipitomaculata	-	-	0	L

Reptiles	County Level Omission Error Rate			Q=QUEST; L=Literature; S=Statewide
Species Name	**Modeling Hexagon**	**Reporting Hexagon**	**n**	**Model Type**
Tantilla nigriceps	0.0	0.0	2	L
Terrapene ornata	0.0	0.0	2	Q
Thamnophis elegans	-	-	0	Q
Thamnophis proximus	0.0	0.0	2	L
Thamnophis radix	0.0	0.0	6	L
Thamnophis sirtalis	0.0	0.0	7	L
Trachemys scripta	50.0	50.0	2	Q
Tropidoclonion lineatum	-	-	0	L

Birds:

Field observations or voucher specimens were obtained for 161 avian species (83.4% of species modeled in the taxon). No observations were available for 32 species (16.6%). The 35 (18.1%) species with inferred statewide distributions were not included in the accuracy assessments. Table 3.9 details the omission error rate results for the bird models and Figures 3.26 and 3.27 illustrate the histograms of omission rates for the bird models using BBS and county level data, respectively. QUEST models perform marginally better than literature models when assessed with the BBS data. Models perform comparably on modeling and reporting hexagons. Literature models perform better than QUEST when assessed using the voucher specimen data rescales to the county level. With these coarser data, commission error starts to become evident: the reporting hexagons perform better than the model hexagons.

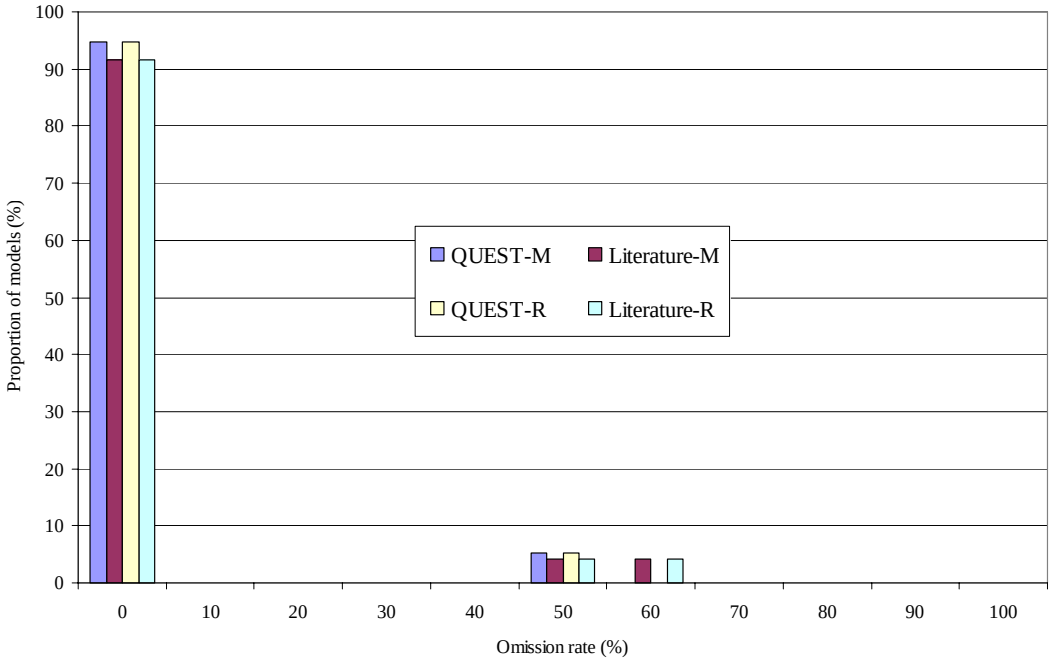


Figure 3.26. Histogram of omission error rates for bird models using BBS data. M=modeling; R=reporting.

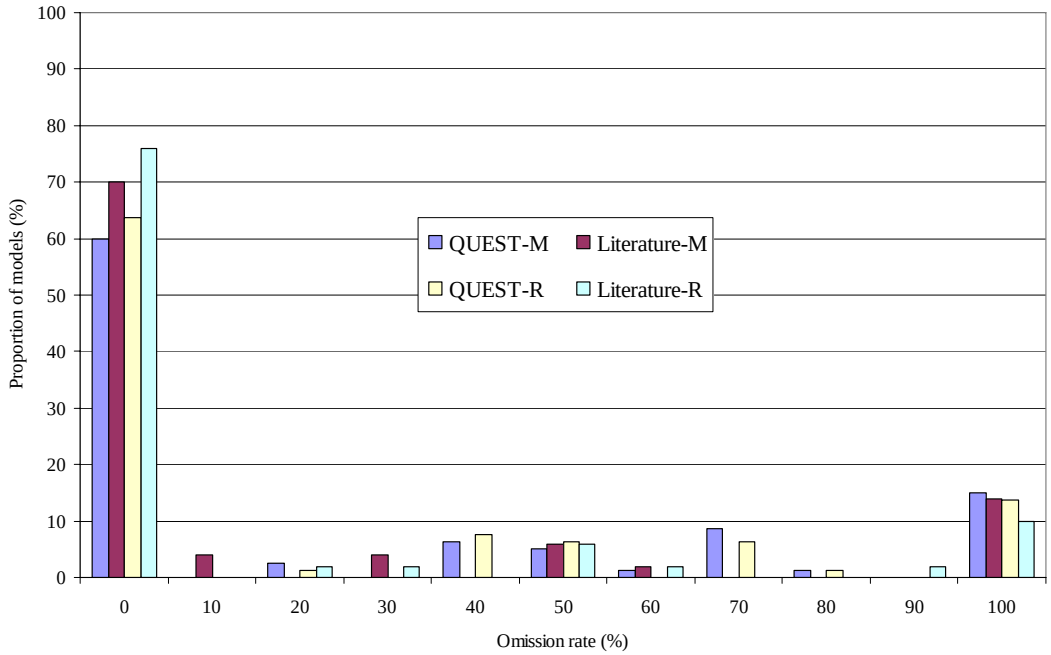


Figure 3.27. Histogram of omission error rates for bird models using county level data. M=modeling; R=reporting.

Table 3.9. Bird model omission error rate results

Q=QUEST
L=Literature
S=Statewide

Birds	BBS Route Level Omission Error Rate			County Level Omission Error Rate			
Species Name	**Modeling Hexagon**	**Reporting Hexagon**	**n**	**Modeling Hexagon**	**Reporting Hexagon**	**n**	**Model Type**
Accipiter cooperii	-	-	0	0.0	0.0	16	L
Accipiter striatus	-	-	0	95.0	90.0	20	L
Actitis macularia	100.0	0.0	1	0.0	0.0	1	Q
Aechmophorus clarkii	-	-	0	0.0	0.0	1	Q
Aechmophorus occidentalis	0.0	0.0	1	0.0	0.0	1	L
Aeronautes saxatalis	-	-	0	0.0	0.0	1	L
Agelaius phoeniceus	*	*	39	*	*	5	S
Aimophila cassinii	0.0	0.0	2	0.0	0.0	1	Q
Aix sponsa	9.1	0.0	11	0.0	0.0	2	Q
Ammodramus savannarum	*	*	33	*	*	4	S
Anas acuta	0.0	0.0	6	0.0	0.0	2	L
Anas americana	-	-	0	0.0	0.0	2	Q
Anas clypeata	0.0	0.0	3	0.0	0.0	1	L
Anas crecca	0.0	0.0	1	50.0	0.0	2	Q
Anas cyanoptera	-	-	0	-	-	0	L
Anas discors	0.0	0.0	10	0.0	0.0	1	L

Q=QUEST
L=Literature
S=Statewide

Birds	BBS Route Level Omission Error Rate			County Level Omission Error Rate			
Species Name	**Modeling Hexagon**	**Reporting Hexagon**	**n**	**Modeling Hexagon**	**Reporting Hexagon**	**n**	**Model Type**
Anas platyrhynchos	*	*	23	*	*	6	S
Anas strepera	20.0	20.0	5	100.0	100.0	2	Q
Aquila chrysaetos	0.0	0.0	1	50.0	50.0	2	Q
Archilochus colubris	0.0	0.0	1	50.0	50.0	2	L
Ardea herodias	10.5	0.0	19	0.0	0.0	6	L
Asio flammeus	*	*	0	*	*	11	S
Asio otus	-	-	0	6.3	0.0	16	L
Athene cunicularia	0.0	0.0	4	16.7	16.7	6	Q
Aythya affinis	100.0	100.0	1	100.0	100.0	1	L
Aythya americana	0.0	0.0	2	66.7	66.7	3	Q
Aythya valisineria	100.0	0.0	1	-	-	0	Q
Baeolophus bicolor	0.0	0.0	3	0.0	0.0	1	Q
Bartramia longicauda	6.5	3.2	31	0.0	0.0	3	L
Bombycilla cedrorum	7.7	0.0	13	0.0	0.0	7	Q
Botaurus lentiginosus	0.0	0.0	4	100.0	100.0	2	Q
Branta canadensis	0.0	0.0	5	0.0	0.0	3	L
Bubo virginianus	*	*	7	*	*	43	S
Bubulcus ibis	0.0	0.0	1	100.0	0.0	1	Q
Buteo jamaicensis	6.3	0.0	32	0.0	0.0	48	L
Buteo lineatus	-	-	0	0.0	0.0	1	L
Buteo regalis	0.0	0.0	6	66.7	66.7	9	Q
Buteo swainsoni	0.0	0.0	15	25.0	16.7	24	L
Butorides virescens	-	-	0	0.0	0.0	1	L
Calamospiza melanocorys	0.0	0.0	16	0.0	0.0	3	L
Calcarius mccownii	0.0	0.0	1	-	-	0	Q
Calcarius ornatus	0.0	0.0	3	-	-	0	Q
Caprimulgus carolinensis	-	-	0	-	-	0	L
Caprimulgus vociferus	-	-	0	-	-	0	L
Cardinalis cardinalis	0.0	0.0	19	0.0	0.0	4	Q
Carduelis pinus	0.0	0.0	1	100.0	100.0	3	Q
Carduelis tristis	*	*	37	*	*	2	S
Carpodacus mexicanus	0.0	0.0	16	0.0	0.0	1	L
Cathartes aura	12.5	6.3	16	0.0	0.0	7	L
Catoptrophorus semipalmatus	0.0	0.0	5	33.3	33.3	3	Q
Certhia americana	100.0	100.0	1	100.0	0.0	1	L
Ceryle alcyon	0.0	0.0	4	0.0	0.0	2	L
Chaetura pelagica	0.0	0.0	19	0.0	0.0	1	Q
Charadrius melodus	-	-	0	0.0	0.0	4	L
Charadrius montanus	0.0	0.0	1	-	-	0	L
Charadrius vociferus	*	*	38	*	*	3	S
Chlidonias niger	0.0	0.0	5	100.0	100.0	1	Q

Birds	BBS Route Level Omission Error Rate			County Level Omission Error Rate			Q=QUEST L=Literature S=Statewide
Species Name	**Modeling Hexagon**	**Reporting Hexagon**	**n**	**Modeling Hexagon**	**Reporting Hexagon**	**n**	**Model Type**
Chondestes grammacus	*	*	29	*	*	4	S
Chordeiles minor	*	*	20	*	*	6	S
Circus cyaneus	0.0	0.0	11	0.0	0.0	13	L
Cistothorus palustris	0.0	0.0	1	66.7	66.7	3	Q
Cistothorus platensis	33.3	33.3	3	-	-	0	Q
Coccyzus americanus	0.0	0.0	11	0.0	0.0	11	Q
Coccyzus erythropthalmus	0.0	0.0	4	33.3	33.3	3	Q
Colaptes auratus	*	*	7	*	*	9	S
Colinus virginianus	0.0	0.0	21	0.0	0.0	7	Q
Columba livia	*	*	18	*	*	2	S
Contopus sordidulus	0.0	0.0	4	0.0	0.0	2	Q
Contopus virens	0.0	0.0	9	0.0	0.0	2	Q
Corvus brachyrhynchos	*	*	37	*	*	3	S
Cyanocitta cristata	*	*	28	*	*	3	S
Cygnus buccinator	0.0	0.0	1	40.0	40.0	10	Q
Dendroica coronata	-	-	0	75.0	75.0	4	Q
Dendroica dominica	-	-	0	-	-	0	L
Dendroica petechia	*	*	25	*	*	4	S
Dolichonyx oryzivorus	0.0	0.0	24	0.0	0.0	4	Q
Dumetella carolinensis	9.5	4.8	21	16.7	0.0	6	Q
Empidonax traillii	0.0	0.0	3	0.0	0.0	2	Q
Empidonax virescens	-	-	0	0.0	0.0	1	L
Eremophila alpestris	*	*	27	*	*	6	S
Euphaus caynocephalus	0.0	0.0	4	0.0	0.0	1	Q
Falco columbarius	0.0	0.0	1	100.0	100.0	6	L
Falco mexicanus	100.0	100.0	1	90.9	90.9	11	Q
Falco sparverius	4.5	0.0	22	0.0	0.0	24	L
Fulica americana	0.0	0.0	5	0.0	0.0	2	Q
Gallinago gallinago	0.0	0.0	6	100.0	100.0	1	Q
Geothlypis trichas	*	*	31	*	*	3	S
Guiraca caerulea	*	*	24	*	*	3	S
Gymnorhinus cyanocephalus	0.0	0.0	1	50.0	50.0	2	Q
Haliaeetus leucocephalus	100.0	100.0	1	0.0	0.0	1	Q
Himantopus mexicanus	-	-	0	0.0	0.0	1	L
Hirundo rustica	*	*	38	*	*	4	S
Hylocichla mustelina	-	-	0	0.0	0.0	1	Q
Icteria virens	0.0	0.0	2	66.7	66.7	3	Q
Icterus bullockii	0.0	0.0	5	50.0	50.0	2	Q
Icterus galbula	3.8	0.0	26	0.0	0.0	5	L
Icterus spurius	*	*	34	*	*	4	S
Ixobrychus exilis	-	-	0	0.0	0.0	2	L

Birds	BBS Route Level Omission Error Rate			County Level Omission Error Rate			Q=QUEST L=Literature S=Statewide
Species Name	**Modeling Hexagon**	**Reporting Hexagon**	**n**	**Modeling Hexagon**	**Reporting Hexagon**	**n**	**Model Type**
Junco hyemalis	-	-	0	100.0	100.0	4	L
Lanius ludovicianus	*	*	25	*	*	5	S
Loxia curvirostra	0.0	0.0	2	40.0	40.0	5	Q
Melanerpes carolinus	0.0	0.0	11	0.0	0.0	1	Q
Melanerpes erythrocephalus	0.0	0.0	28	0.0	0.0	11	L
Meleagris gallopavo	0.0	0.0	19	-	-	0	L
Melospiza georgiana	0.0	0.0	1	100.0	100.0	2	L
Melospiza melodia	0.0	0.0	15	0.0	0.0	2	Q
Mimus polyglottos	0.0	0.0	8	-	-	0	L
Mniotilta varia	0.0	0.0	1	66.7	66.7	3	Q
Molothrus ater	*	*	38	*	*	4	S
Myadestes townsendi	0.0	0.0	1	-	-	0	L
Myiarchus crinitus	0.0	0.0	12	0.0	0.0	3	Q
Numenius americanus	0.0	0.0	12	0.0	0.0	4	Q
Nycticorax nycticorax	0.0	0.0	3	100.0	100.0	1	Q
Oporornis formosus	-	-	0	-	-	0	L
Otus asio	0.0	0.0	1	5.3	0.0	19	L
Oxyura jamaicensis	0.0	0.0	1	100.0	100.0	2	Q
Parula americana	-	-	0	-	-	0	L
Passer domesticus	*	*	28	*	*	2	S
Passerculus sandwichensis	0.0	0.0	1	100.0	100.0	2	L
Passerina amoena	0.0	0.0	2	0.0	0.0	1	Q
Passerina cyanea	0.0	0.0	12	0.0	0.0	3	Q
Pelecanus erythrorhynchos	0.0	0.0	4	66.7	50.0	6	Q
Perdix perdix	-	-	0	0.0	0.0	1	Q
Petrochelidon pyrrhonota	*	*	17	*	*	2	S
Phalacrocorax auritus	0.0	0.0	10	0.0	0.0	3	Q
Phalaenoptilus nuttallii	-	-	0	25.0	25.0	4	L
Phalaropus tricolor	25.0	25.0	4	0.0	0.0	1	Q
Phasianus colchicus	*	*	36	*	*	5	S
Pheucticus ludovicianus	0.0	0.0	10	0.0	0.0	5	Q
Pheucticus melanocephalus	0.0	0.0	3	0.0	0.0	1	Q
Pica pica	0.0	0.0	9	-	-	0	Q
Picoides pubescens	0.0	0.0	16	0.0	0.0	2	L
Picoides villosus	0.0	0.0	3	-	-	0	L
Pipilo erythrophthalmus	25.0	25.0	8	-	-	0	L
Pipilo maculatus	14.3	14.3	7	50.0	50.0	2	L
Piranga ludoviciana	0.0	0.0	1	0.0	0.0	1	Q
Piranga olivacea	-	-	0	-	-	0	L
Plegadis chihi	0.0	0.0	1	-	-	0	Q
Podiceps nigricollis	0.0	0.0	1	100.0	100.0	1	Q

Birds	BBS Route Level Omission Error Rate			County Level Omission Error Rate			Q=QUEST L=Literature S=Statewide
Species Name	**Modeling Hexagon**	**Reporting Hexagon**	**n**	**Modeling Hexagon**	**Reporting Hexagon**	**n**	**Model Type**
Podilymbus podiceps	0.0	0.0	3	66.7	33.3	3	Q
Poecile atricapillus	*	*	21	*	*	3	S
Polioptila caerulea	0.0	0.0	1	60.0	60.0	5	L
Pooecetes gramineus	8.3	0.0	12	0.0	0.0	1	Q
Porzana carolina	50.0	0.0	2	55.6	44.4	9	Q
Progne subis	0.0	0.0	3	0.0	0.0	1	Q
Protonotaria citrea	-	-	0	-	-	0	L
Quiscalus mexicanus	0.0	0.0	2	0.0	0.0	1	L
Quiscalus quiscula	5.3	0.0	38	0.0	0.0	1	L
Rallus elegans	-	-	0	-	-	0	L
Rallus limicola	-	-	0	0.0	0.0	3	L
Recurvirostra americana	0.0	0.0	3	0.0	0.0	2	Q
Riparia riparia	0.0	0.0	5	0.0	0.0	1	Q
Salpinctes obsoletus	0.0	0.0	2	0.0	0.0	1	Q
Sayornis phoebe	0.0	0.0	10	-	-	0	Q
Sayornis saya	0.0	0.0	6	0.0	0.0	1	Q
Seiurus aurocapillus	0.0	0.0	3	100.0	100.0	2	Q
Seiurus motacilla	-	-	0	-	-	0	L
Setophaga ruticilla	0.0	0.0	3	0.0	0.0	2	Q
Sialia currucoides	0.0	0.0	2	-	-	0	Q
Sialia sialis	0.0	0.0	22	0.0	0.0	3	L
Sitta canadensis	0.0	0.0	3	100.0	100.0	1	Q
Sitta carolinensis	14.3	14.3	7	0.0	0.0	2	Q
Sitta pygmaea	-	-	0	0.0	0.0	1	Q
Spiza americana	*	*	31	*	*	6	S
Spizella breweri	0.0	0.0	1	-	-	0	Q
Spizella passerina	8.7	0.0	23	0.0	0.0	3	Q
Spizella pusilla	*	*	20	*	*	5	S
Stelgidopteryx ruficollis	0.0	0.0	21	-	-	0	L
Sterna antillarum	0.0	0.0	1	0.0	0.0	7	L
Sterna forsteri	0.0	0.0	2	-	-	0	Q
Strix varia	-	-	0	0.0	0.0	9	Q
Sturnella magna	0.0	0.0	14	0.0	0.0	3	Q
Sturnella neglecta	*	*	39	*	*	6	S
Sturnus vulgaris	*	*	33	*	*	5	S
Tachycineta bicolor	15.4	7.7	13	0.0	0.0	1	Q
Tachycineta thalassina	0.0	0.0	2	0.0	0.0	1	Q
Thryothorus ludovicianus	-	-	0	0.0	0.0	1	Q
Toxostoma rufum	*	*	35	*	*	8	S
Troglodytes aedon	*	*	32	*	*	5	S
Turdus migratorius	*	*	37	*	*	6	S

Birds	BBS Route Level Omission Error Rate			County Level Omission Error Rate			Q=QUEST L=Literature S=Statewide
Species Name	**Modeling Hexagon**	**Reporting Hexagon**	**n**	**Modeling Hexagon**	**Reporting Hexagon**	**n**	**Model Type**
Tympanuchus cupido	0.0	0.0	8	0.0	0.0	3	Q
Tympanuchus phasianellus	0.0	0.0	5	0.0	0.0	3	Q
Tyrannus tyrannus	*	*	39	*	*	8	S
Tyrannus verticalis	*	*	30	*	*	5	S
Tyrannus vociferans	-	-	0	0.0	0.0	1	L
Tyto alba	0.0	0.0	1	41.7	41.7	12	L
Vireo bellii	0.0	0.0	14	0.0	0.0	2	L
Vireo flavifrons	0.0	0.0	2	0.0	0.0	1	L
Vireo gilvus	0.0	0.0	22	0.0	0.0	2	L
Vireo olivaceus	16.7	0.0	12	33.3	33.3	3	Q
Vireo plumbeus	0.0	0.0	1	-	-	0	L
Xanthocephalus xanthocephalus	0.0	0.0	9	0.0	0.0	1	L
Zenaida macroura	*	*	39	*	*	1	S

Mammals

Field observations or voucher specimens were obtained for 68 mammalian species (87.2% of species modeled in the taxon). No observations were available for 18 species (12.8%). The 27 (34.6%) species with inferred statewide distributions were not included in the accuracy assessments. Table 3.10 details the omission error rate results for the mammal models and Figures 3.28 and 3.29 illustrate the histograms of omission rates for the mammal models using voucher specimen and county level data, respectively. Mammal model performance on the point occurrences of the voucher specimens is not impressive, but the radical shift in the histogram for the coarser reporting hexagons suggest that georeferencing of the voucher specimens may be contributing to the apparently poor model performance. Using the much coarser county level data the accuracy assessment rivals the performance of the models of other taxa.

Table 3.10. Mammal model omission error rate results

Mammals	Voucher Specimen Omission Error Rate				County Level Omission Error Rate			Q=QUEST; L=Literature; S=Statewide
Species Name	**Modeling Hexagon**	**n**	**Reporting Hexagon**	**n**	**Modeling Hexagon**	**Reporting Hexagon**	**n**	**Model Type**
Antilocapra americana	-	0	-	0	-	-	0	L
Blarina brevicauda	19.6	56	0.0	29	0.0	0.0	20	L
Blarina hylophaga	17.6	34	12.5	16	10.0	0.0	10	L
Canis latrans	*	65	*	47	*	*	33	S
Castor canadensis	-	4	0.0	4	0.0	0.0	3	L
Cervus elaphus	-	1	100.0	1	100.0	0.0	1	L
Chaetodipus hispidus	*	49	*	33	*	*	20	S
Corynorhinus townsendii	-	0	-	0	-	-	0	L
Cryptotis parva	33.3	6	0.0	6	0.0	0.0	5	L
Cynomys ludovicianus	0.0	7	0.0	5	0.0	0.0	6	L
Dasypus novemcinctus	-	3	0.0	3	0.0	0.0	3	L
Didelphis virginiana	0.0	8	0.0	6	0.0	0.0	3	L
Dipodomys ordii	9.4	53	7.9	38	0.0	0.0	23	L

Mammals	Voucher Specimen Omission Error Rate				County Level Omission Error Rate			Q=QUEST; L=Literature; S=Statewide
Species Name	**Modeling Hexagon**	**n**	**Reporting Hexagon**	**n**	**Modeling Hexagon**	**Reporting Hexagon**	**n**	**Model Type**
Eptesicus fuscus	*	36	*	22	*	*	15	S
Erethizon dorsatum	-	3	0.0	4	0.0	0.0	4	L
Geomys bursarius	*	77	*	41	*	*	29	S
Glaucomys volans	-	1	0.0	1	0.0	0.0	1	L
Lasionycteris noctivagans	*	16	*	13	*	*	8	S
Lasiurus borealis	7.7	13	0.0	11	0.0	0.0	9	L
Lasiurus cinereus	*	22	*	16	*	*	9	S
Lepus californicus	*	1	*	1	*	*	2	S
Lepus townsendii	0.0	7	0.0	7	0.0	0.0	6	L
Lontra canadensis	33.3	6	0.0	6	0.0	0.0	6	L
Lynx rufus	*	81	*	59	*	*	35	S
Marmota monax	33.3	9	0.0	8	0.0	0.0	9	l
Mephitis mephitis	*	2	*	2	*	*	2	S
Microtus ochrogaster	*	127	*	64	*	*	36	S
Microtus pennsylvanicus	*	67	*	46	*	*	32	S
Microtus pinetorum	-	2	0.0	2	0.0	0.0	2	L
Mus musculus	*	31	*	23	*	*	20	S
Mustela frenata	*	15	*	14	*	*	13	S
Mustela nivalis	13.6	22	0.0	15	0.0	0.0	11	L
Mustela vison	*	5	*	5	*	*	5	S
Myotis ciliolabrum	18.8	16	8.3	12	0.0	0.0	7	L
Myotis lucifugus	19.0	21	0.0	9	0.0	0.0	4	L
Myotis septentrionalis	42.9	7	33.3	6	20.0	20.0	5	L
Myotis thysanodes	11.1	9	0.0	6	0.0	0.0	3	L
Myotis volans	14.3	14	0.0	8	0.0	0.0	3	L
Neotoma cinerea	12.5	16	9.1	11	0.0	0.0	6	L
Neotoma floridana	5.6	18	0.0	14	0.0	0.0	9	L
Nycticeius humeralis	71.4	7	71.4	7	40.0	40.0	5	L
Odocoileus hemionus	-	0	-	0	-	-	0	L
Odocoileus virginianus	*	6	*	6	*	*	6	S
Ondatra zibethicus	*	9	*	8	*	*	6	S
Onychomys leucogaster	*	39	*	24	*	*	22	S
Perognathus fasciatus	7.7	13	0.0	10	0.0	0.0	5	L
Perognathus flavescens	5.3	19	0.0	16	0.0	0.0	14	L
Perognathus flavus	16.7	12	9.1	11	50.0	33.3	6	L
Peromyscus leucopus	0.0	107	0.0	60	0.0	0.0	36	L
Peromyscus maniculatus	*	202	*	85	*	*	44	S
Pipistrellus subflavus	-	3	0.0	2	0.0	0.0	2	L
Procyon lotor	*	13	*	11	*	*	9	S
Puma concolor	-	0	-	0	-	-	0	L
Rattus norvegicus	*	4	*	4	*	*	3	S
Reithrodontomys megalotis	*	130	*	65	*	*	42	S
Reithrodontomys montanus	*	38	*	28	*	*	19	S
Scalopus aquaticus	*	22	*	18	*	*	19	S
Sciurus carolinensis	-	1	100.0	1	100.0	100.0	1	L
Sciurus niger	0.0	23	0.0	14	0.0	0.0	10	L
Sigmodon hispidus	-	1	100.0	1	0.0	0.0	1	L

Mammals	Voucher Specimen Omission Error Rate				County Level Omission Error Rate			Q=QUEST; L=Literature; S=Statewide
Species Name	**Modeling Hexagon**	**n**	**Reporting Hexagon**	**n**	**Modeling Hexagon**	**Reporting Hexagon**	**n**	**Model Type**
Sorex cinereus	7.6	66	4.2	48	0.0	0.0	30	L
Sorex merriami	66.7	6	20.0	5	0.0	0.0	3	L
Spermophilus elegans	-	0	-	0	-	-	0	L
Spermophilus franklinii	-	3	0.0	3	0.0	0.0	2	L
Spermophilus spilosoma	0.0	6	0.0	5	0.0	0.0	2	L
Spermophilus tridecemlineatus	*	47	*	33	*	*	22	S
Spilogale putorius	*	1	*	1	*	*	1	S
Sylvilagus audubonii	-	2	0.0	2	0.0	0.0	2	L
Sylvilagus floridanus	*	17	*	14	*	*	11	S
Synaptomys cooperi	50.0	6	16.7	6	0.0	0.0	5	L
Tamias minimus	50.0	10	0.0	5	0.0	0.0	2	L
Tamias striatus	-	0	-	0	-	-	0	L
Taxidea taxus	*	13	*	13	*	*	10	S
Thomomys talpoides	40.0	5	0.0	4	0.0	0.0	3	L
Urocyon cinereoargenteus	33.3	6	0.0	6	0.0	0.0	5	L
Vulpes velox	-	3	0.0	3	0.0	0.0	3	L
Vulpes vulpes	11.1	9	0.0	9	0.0	0.0	7	L
Zapus hudsonius	4.0	25	4.3	23	0.0	0.0	18	L

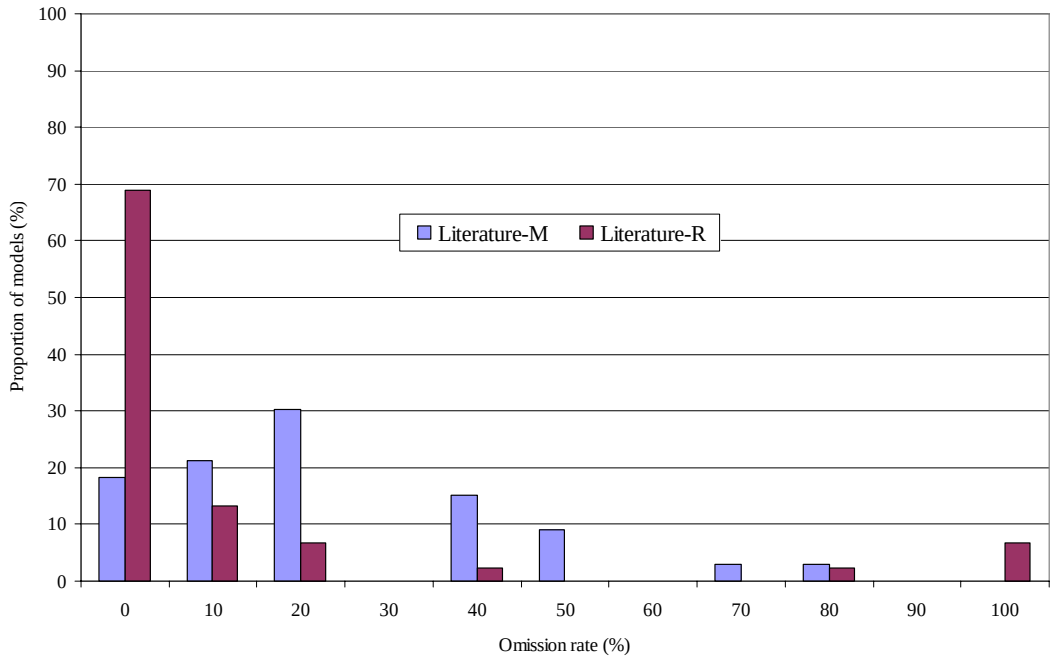


Figure 3.28. Histogram of omission error rates for mammal models using voucher specimen data. M=modeling; R=reporting.

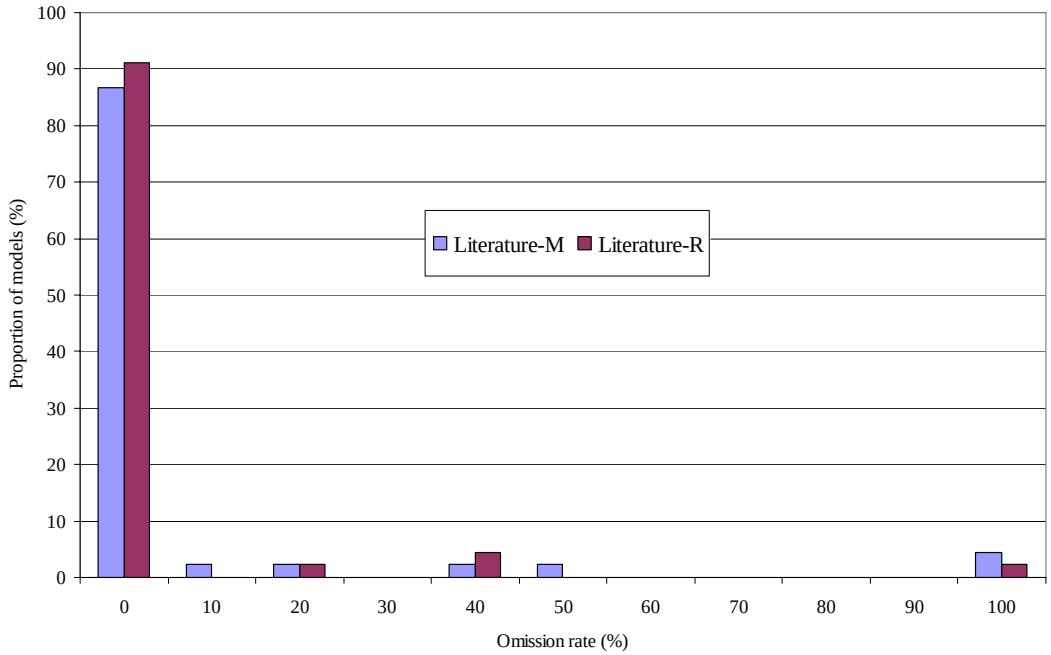


Figure 3.29. Histogram of omission error rates for mammal models using county level data. M=modeling; R=reporting.

Limitations and Discussion

Recent national efforts to regionalize species models by mosaicking range distributions of adjacent states have revealed significant differences in predicted species distributions both within and across state borders (Brannon 2000). A primary reason for this lack of concordance is variation in modeling methodologies. To generate seamless regional and national range distribution, unified and generalizable approaches to modeling are required. NE-GAP's development of wildlife habitat definitions from classification trees provides a framework for a more uniform modeling technique. Classification trees provide a greater degree of objectivity to the modeling process. However, in most cases they can also lead to an over-specified model. To enhance the transparency and robustness of the models, subjective ecological decisions are implemented to refine the models.

When reviewing the models created for NE-GAP, several caveats must be taken into account. First, inverting the habitat model to forecast range distribution predicts occurrence of the modeled habitat, ***not*** species presence/absence or abundance. Second, the habitat models do not explicitly address habitat quality. Third, the habitat models address neither the shorter term fluctuations nor longer term trends of species population dynamics.

Accuracy assessment is a challenge for wildlife-habitat relationship models. Our reliance on species occurrence data both for model development and accuracy assessment has enabled us to exploit an undervalued high-quality resource that improves our model precision and accuracy. Nevertheless, modeling habitat through surrogate variables is fraught with uncertainty and imprecision. While this approach may not be appropriate for tactical management of species, at a biodiversity analysis at a coarser resolution it offers a baseline assessment for strategic development of natural resources. Such models also provide a means through which to assess the gaps in knowledge about species habitat requirements, tolerances, and limits (Henebry et al. 2001). Future work in modeling species occurrences

and predicting range distributions must integrate the temporal dimension into geospatial data, but there are significant challenges for this task (Henebry and Merchant 2002). Predicting species occurrences needs to become an iterative process that is performed periodically as new data, management tools, and policy objectives become available.

CHAPTER 4

LAND STEWARDSHIP

Introduction

To fulfill the analytical mission of GAP, it is necessary to compare the mapped distribution of elements of biodiversity with their representation in different categories of land ownership and management. As will be explained in the next chapter, these comparisons do not measure viability, but are a start to assessing the likelihood of future threat to a biotic element through habitat conversion--the primary cause of biodiversity decline. We use the term "stewardship" in place of "ownership" in recognition that legal ownership does not necessarily equate to the entity charged with management of the resource, and that the mix of ownership and managing entities is a complex and rapidly changing condition not suitably mapped by GAP. At the same time, it is necessary to distinguish between stewardship and management status in that a single category of land stewardship such as a national forest may contain several degrees of management for biodiversity.

The purpose of comparing biotic distribution with stewardship is to provide a method by which land stewards can assess their relative amount of responsibility for the management of a species or plant community and identify other stewards sharing that responsibility. This information can reveal opportunities for cooperative management of that resource, which directly supports the primary mission of GAP to provide objective, scientific information to decision makers and managers to make informed decisions regarding biodiversity. It also is not unlikely that a steward that has previously borne the major responsibility for managing a species may, through such analyses, identify a more equitable distribution of that responsibility. We emphasize, however, that GAP only identifies private land as a homogeneous category and does not differentiate individual tracts or owners, unless the information was provided voluntarily to recognize a long-term commitment to biodiversity maintenance.

After comparison to stewardship, it is also necessary to compare biotic occurrence to categories of management status. The purpose of this comparison is to identify the need for change in management status for the distribution of individual elements or areas containing high degrees of diversity. Such changes can be accomplished in many ways that do not affect the stewardship status. While it will eventually be desirable to identify specific management practices for each tract, and whether they are beneficial or harmful to each element, GAP currently uses a scale of 1 to 4 to denote relative degree of maintenance of biodiversity for each tract. A status of "1" denotes the highest, most permanent level of maintenance, and "4" represents the lowest level of biodiversity management, or unknown status. This is a highly subjective area, and we recognize a variety of limitations in our approach, although we maintain certain principles in assigning the status level. Our first principle is that land ownership is not the primary determinant in assigning status. The second principle is that while data are imperfect, and all land is subject to changes in ownership and management, we can use the intent of a land steward as evidenced by legal and institutional factors to assign status. In other words, if a land steward institutes a program backed by legal and institutional arrangements that are intended for permanent biodiversity maintenance, we use that as the guide for assigning status.

The characteristics used to determine status are as follows:

- Permanence of protection from conversion of natural land cover to unnatural (human-induced barren, exotic-dominated, arrested succession).
- Relative amount of the tract managed for natural cover.

- Inclusiveness of the management, i.e., single feature or species versus all biota.
- Type of management and degree that it is mandated through legal and institutional arrangements.

The four status categories can generally be defined as follows (after Scott et al. 1993, Edwards et al. 1995, Crist et al. 1995):

Status 1: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events (of natural type, frequency, and intensity) are allowed to proceed without interference or are mimicked through management.

Status 2: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but which may receive use or management practices that degrade the quality of existing natural communities.

Status 3: An area having permanent protection from conversion of natural land cover for the majority of the area, but subject to extractive uses of either a broad, low-intensity type or localized intense type. It also confers protection to federally listed endangered and threatened species throughout the area.

Status 4: Lack of irrevocable easement or mandate to prevent conversion of natural habitat types to anthropogenic habitat types. Allows for intensive use throughout the tract. Also includes those tracts for which the existence of such restrictions or sufficient information to establish a higher status is unknown.

Mapping Standards and Methods
National GAP standards have a minimum mapping unit (MMU) of 40 acres/16 ha (quarter-quarter Township section) or smaller. Digital spatial data for NE-GAP meet these standards. The data also meet the USGS accuracy standards for 1:100,000 scale products, although some of the data for the stewardship layer was provided at a 1:24,000 scale.

Land Stewardship Mapping:
In Nebraska there is no single entity that is responsible for maintaining a comprehensive inventory of all public lands. This NE-GAP land stewardship map represents the first effort to accurately map all the public lands and private conservation lands. Federal and state agencies controlling land in the state were contacted, as well as private non-governmental conservation organizations such as The Nature Conservancy, the Audubon Society and the Platte River Whooping Crane Maintenance trust.

Stewardship data were received in many forms and were of varying quality (Table 4.1). Boundaries for stewardship units were compiled from a variety of sources differing in scale, projection, and quality of base materials. Some unit boundaries were available as existing GIS layers digitized by their administrative agency, while other units required digitizing by NE-GAP from source maps provided by the agencies. In a number of cases, the source maps could not be directly digitized because they either did not contain registration points or their boundaries had to be interpreted from legal descriptions. In these cases, the boundaries were manually transcribed into digital line graphs. Metadata for the source maps were frequently unavailable.

The Nebraska Game and Parks Commission provided maps for their properties and properties of several other agencies at a scale of 1:24,000. Bureau of Land Management properties were identified using 1:100,000-section maps and splitting sections based upon legal descriptions they provided. Army Corps of Engineers (ACOE) property ownership maps at various scales with legal descriptions (Township, Range, Section) were provided by ACOE-Omaha District in 1998; current personnel, however, would not verify that data. The United States Forest Service provided updated coverages, while the U.S. Fish and

Wildlife Service was in the process of reviewing their property boundaries in Nebraska and could not verify boundaries.

Digitizing was completed in 1999 and the current stewardship map is shown in Figure 4.1. Disclaimers are provided throughout to indicate data sources that could not be verified from 1998 to 2001 or where source data are subject to question.

Table 4.1. Sources for data used to create the NE-GAP Stewardship Layer

Land Steward	*Agency*	*Source of Data*
Federal	Army Corps of Engineers (ACOE)	Digitized by NE-GAP using maps provided by Omaha District ACOE
	Bureau of Land Management	Digitized by NE-GAP using maps provided by regional BLM office
	Department of Defense	Digitized by NE-GAP using maps provided by the Department of Defense.
	National Park Service	Digitized by NE-GAP from maps provided by NGPC
	U.S. Fish & Wildlife Service	Digitized by NE-GAP from maps provided by NGPC
	U.S. Forest Service	Digital products provided by U.S. Forest Service, Nebraska NF
Native	Bureau of Indian Affairs	Digitized by NE-GAP using maps provided by Bureau of Indian Affairs.
State	Nebraska Game & Parks Commission (NGPC)	Digitized by NE-GAP from maps provided by NGPC, some digital products provided by NGPC
	University of Nebraska	Digital products provided by Institute of Agriculture and Natural Resources, University of Nebraska and digitized by NE-GAP from maps provided by NGPC
	Nebraska Natural Resource Districts (NRDs)	Digitized by NE-GAP from maps provided by NGPC and individual NRDs, some digital products provided by NRDs.
Private	Nebraska Audubon Society	Digital products provided by Audubon state office and digitized by NE-GAP
	Fontenelle Forest Association	Digitized by NE-GAP from maps provided by NGPC
	Platte River Whooping Crane Maintenance Trust, Inc.	Digital products provided by Platte River Whooping Crane Maintenance Trust, Inc.
	Prairie Plains Resource Institute	Digital products provided by Prairie Plains Resource Institute
	The Nature Conservancy (TNC)	Digital products provided by TNC state and regional offices
	City of Lincoln	Digital products provided by Lincoln-Lancaster Co. Planning Dept.
	City of Omaha	Digital products provided by Omaha Parks & Rec. Dept.
	Other Cities/Counties	Digitized by NE-GAP from maps provided by NGPC

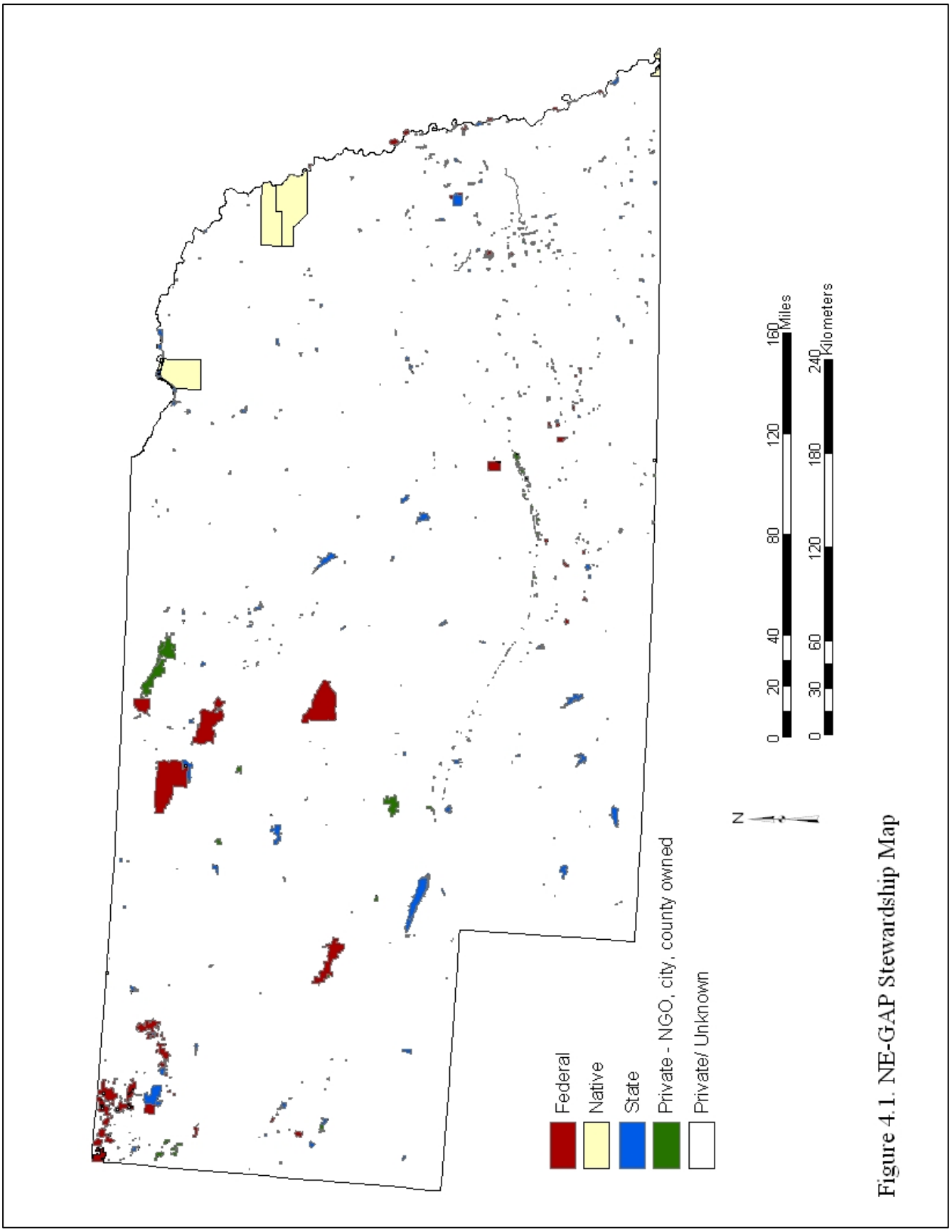


Figure 4.1. NE-GAP Stewardship Map

Overlaps in ownership boundaries could be ascribed to informal agreements between various agencies or to errors in maps provided by the agencies. It was not within the scope of NE-GAP to resolve these conflicts and dual ownership has been noted where these overlaps occur.

Management Status Categorization:
Using the definitions and dichotomous key provided in the GAP Handbook, status designations were assigned to each land unit (Figure 4.2). When possible, land managers were consulted to review the status designations and efforts were made to obtain land management plans for status 1 and status 2 lands (Appendix H). When status was in question due to an overlap of ownership boundaries of varying status, status was conservatively assigned as the higher of the two. In assigning management status to water features, the same management status of the surrounding land was assigned to the water. In the case where earlier data could not be verified (as with the ACOE), status designations of "4" were assigned.

Results
The following tables present summary statistics of stewardship and management categories in the state. Table 4.2 gives an overview of the management status categories and the primary land stewards within those categories in Nebraska. Most federal land management agencies (ACOE, DOD, BLM, BIA, NPS, USFWS, USFS) administer properties in the state, as do a number of national and state non-profit organizations, such as The Nature Conservancy, National Audubon Society, Platte River Whooping Crane Maintenance Trust, and Prairie Plains Resource Institute. State agencies, such as the Nebraska Game and Parks Commission and a network of Natural Resource Districts, are also responsible for the management of a variety of properties.

The proportional makeup of management status and corresponding land stewards are shown in Table 4.3. Privately owned lands comprise the majority of Nebraska's land area, (approximately 97.4%) and >98% of land in Nebraska can be classified as belonging to land management Status class 4. Status 4 is characterized by the lack of irrevocable easements or mandates to prevent conversion of natural habitat types to anthropogenic habitat types. Only 0.61% of Nebraska's land area can be designated as Status 1 or Status 2 lands, those having permanent protection from conversion of natural cover and a mandated management plan. The largest property-owners of these lands are The Nature Conservancy, which manages a number of preserves, and the U.S. Fish and Wildlife Service, which manages three National Wildlife Refuges in the state. Status 3 lands, those having permanent protection from conversion of natural land cover for the majority of the area, but subject to extractive uses, comprise 1.25% of the land area of Nebraska. Primary stewards of these lands include the U.S. Fish and Wildlife Service, which manages numerous waterfowl production areas and the Nebraska Game and Parks Commission, which manages state parks and other recreational areas.

Limitations and Discussion
The land stewardship map (Figure 4.1) is a compilation of ownership maps provided by a variety of sources that are individually responsible for their accuracy. It was created solely for the purpose of conducting the analyses described in this report and is not suitable for locating boundaries on the ground or determining precise area measurements of individual tracts.

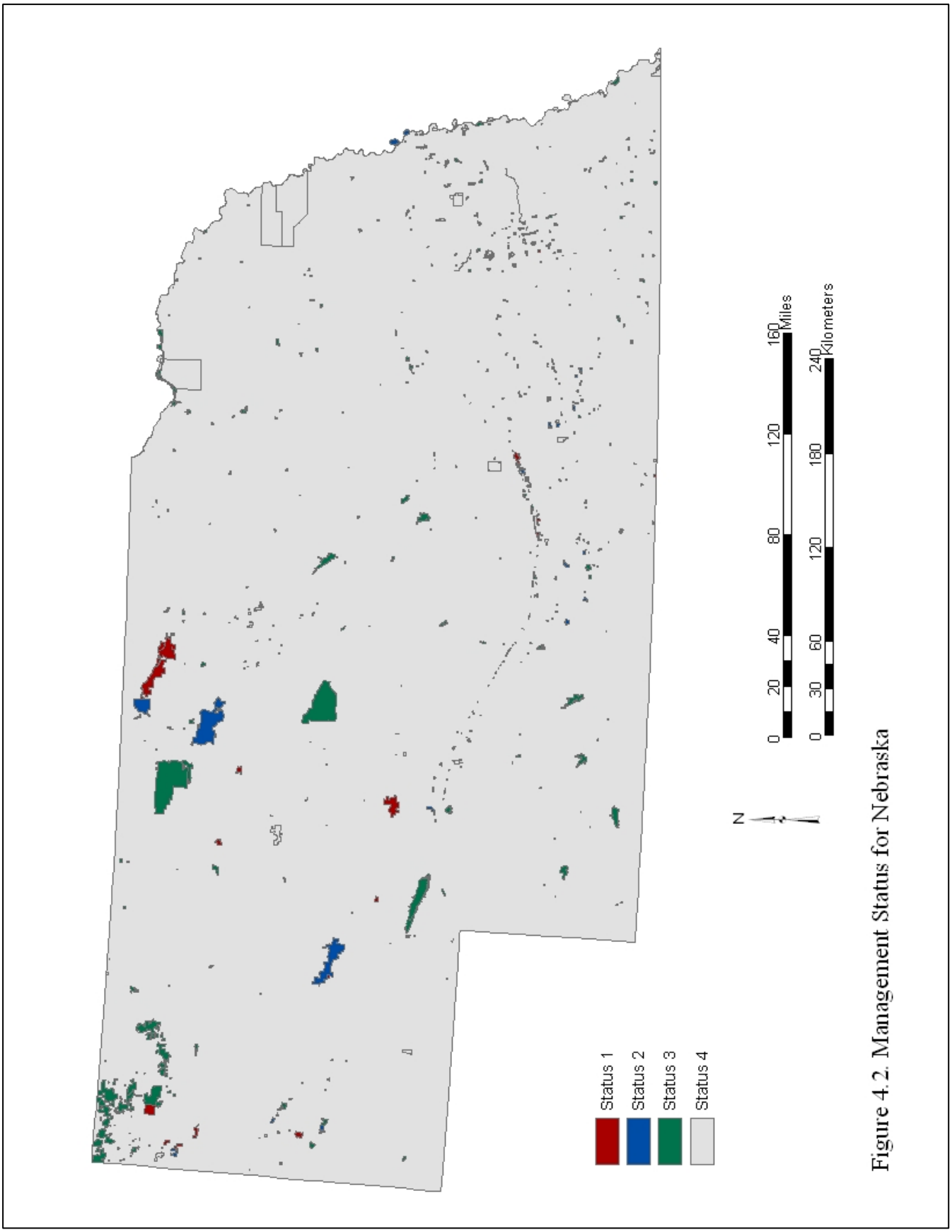


Figure 4.2. Management Status for Nebraska

Table 4.2. Management status assigned to land stewardship categories in Nebraska

Status 1	*Status 2*	*Status 3*	*Status 4*
National Audubon Society –preserves	NE Natural Resources Districts – wildlife management areas, conservation easements	NE Natural Resources Districts – dam projects, wildlife management areas, recreational areas	U.S. Army Corps of Engineers lands / Department of Defense lands
National Park Service – national monuments	The Nature Conservancy – working ranches	National Park Service – national historic site	Bureau of Indian Affairs – native lands
Platte River Whooping Crane Maintenance Trust – preserves	U.S. Fish and Wildlife Service – waterfowl production areas, national wildlife refuges	city or county Parks	Bureau of Land Management lands
Prairie Plains Institute – preserves	University of Nebraska – prairie preserves	Private parks	City/County parks
The Nature Conservancy – preserves and easements		Nebraska Game and Parks Commission – wildlife management areas, state recreation areas, state parks, state historic parks, fish hatcheries	Platte River Whooping Crane Maintenance Trust – working farm
U.S. Forest Service – wilderness area		U.S. Forest Service – national grasslands, national forests	Prairie Plains Institute – working ranch
NE Natural Resources Districts – preserves and easements		University of Nebraska– research areas, biological station, state forests	University of Nebraska – agricultural research sites
		NE State Historical Society – historic sites	Unknown/Private Lands

Changes in NE-GAP personnel, as well as turnover of agency and organization personnel during the course of this project resulted in difficulties verifying information and obtaining accurate metadata. As a consequence, these results should be treated as only preliminary. Follow-up to this initial effort should include better communication and establishment of collaborative mapping efforts with major federal, state and non-profit landowners in the state. An attempt also needs to be made to reconcile occurrences of overlapping ownership boundaries.

The assignment of management status could also be refined. Status classification was based on a 'generalization' for an entire unit. In a number of instances, management plans indicated that a large area is managed as smaller units of potentially varying status. Since these smaller units were either not shown on the maps provided or delineated within the digital data, they could not be classified individually.

These data represent a snapshot in time. To accurately reflect land stewardship and management in Nebraska, an ongoing effort of periodic revision will be required. The National Park Service has been working on defining boundaries and writing a management plan for the Niobrara Scenic River. Additional area could range from 22,586 acres to 24,329 acres, depending on the alternative selected. Land may be designated as status 2 or 3, depending on use. This information needs to be added to the next update.

Table 4.3. Area (ha) and percent (%) of Nebraska's total land area by management status and land stewardship categories

Land Stewardship Category	Area (ha)	%	Status 1 ha	Status 1 %	Status 2 ha	Status 2 %	Status 3 ha	Status 3 %	Status 4 ha	Status 4 %
Army Corps of Engineers/DOD	15,030	6.5	0.0	0.0	0.0	0.0	0.0	0.0	15,060	6.5
Bureau of Land Management	1,980	0.9	0.0	0.0	0.0	0.0	0.0	0.0	1,980	0.9
National Park Service	2,660	1.2	2,620	1.1	0.0	0.0	40	0.0	0.0	0.0
U.S. Fish & Wildlife Service	69,160	30.0	0.0	0.0	69,160	30.0	0.0	0.0	0.0	0.0
U.S. Forest Service	141,820	61.5	3,910	1.7	0.0	0.0	137,910	59.8	0.0	0.0
Total Federal Lands	**230,650**	**100.0**	**6,530**	**2.8**	**69,160**	**30.0**	**137,950**	**59.8**	**17,040**	**7.4**
Total Native Lands	**159,110**	**100.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**159,110**	**100.0**
NE State Historical Society	80	0.1	0.0	0.0	0.0	0.0	80	0.1	0.0	0.0
Nebraska Game & Parks Commission	105,840	85.2	0.0	0.0	0.0	0.0	105,840	85.2	0.0	0.0
Natural Resource Districts	3,800	3.1	150	0.1	90	0.1	2,880	2.3	690	0.6
University of Nebraska	14,560	11.7	0.0	0.0	200	0.2	520	0.4	13,840	11.1
Total State Lands	**124,280**	**100.0**	**150**	**0.1**	**290**	**0.2**	**109,320**	**88.0**	**14,530**	**11.7**
Total City/County Park Land	**3,560**	**100.0**	**0.0**	**0.0**	**0.0**	**0.0**	**700**	**19.7**	**2,860**	**80.3**
Nebraska Audubon	780	0.0	780	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fontenelle Forest Association	580	0.0	0.0	0.0	0.0	0.0	580	0.0	0.0	0.0
Platte River Whooping Crane Maintenance Trust	4,640	0.0	1,940	0.0	1,030	0.0	1,550	0.0	120	0.0
Prairie Plains Institute	1,710	0.0	120	0.0	0.0	0.0	0.0	0.0	1,590	0.0
The Nature Conservancy	42,510	0.2	39,510	0.2	3,000	0.0	0.0	0.0	0.0	0.0
Other Private Lands	19,466,310	99.7	0.0	0.0	0.0	0.0	0.0	0.0	19,466,120	99.7
Total Private Lands	**19,516,520**	**100.0**	**42,350**	**0.2**	**4,030**	**0.0**	**2,800**	**0.0**	**19,467,710**	**99.8**
Nebraska Totals	**20,034,120**	**100.0**	**49,030**	**0.2**	**73,480**	**0.4**	**250,770**	**1.3**	**19,661,250**	**98.1**

CHAPTER 5

ANALYSIS BASED ON STEWARDSHIP AND MANAGEMENT STATUS

Introduction

This chapter describes the method and results of the gap analysis as used by the Gap Analysis Program. As described in the general introduction to this report, the primary objective of GAP is to provide information on the distribution and status of several elements of biological diversity. Although GAP "seeks to identify habitat types and species not adequately represented in the current network of biodiversity management areas" (GAP Handbook, Preface, Version 1, p. I), it is unrealistic to create a standard definition of "adequate representation" for either land cover types or individual species (Noss et al. 1995).

A practical solution to this problem is to report both percentages and absolute area of each element in biodiversity management areas and allow the user to determine which types are adequately represented in natural areas. There are many other factors that should be considered in such determinations such as:

- historic loss or gain in distribution,
- nature of the spatial distribution,
- immediate versus long term risk, and
- degree of local adaptation among populations of the biotic elements that are worthy of individual conservation consideration.

Such analyses are beyond the scope of this project, but we encourage their application coupled with field confirmation of the mapped distributions.

Currently, land cover types and terrestrial vertebrates are the primary focus of GAP's mapping efforts, however, other components of biodiversity, such as aquatic organisms or selected groups of invertebrates may be incorporated into GAP distributional data sets. Where appropriate, GAP data may also be analyzed to identify the location of a set of areas in which most or all land cover types or species are predicted to be represented. The use of "complementarity" analysis, that is, an approach that additively identifies a selection of locations that may represent biodiversity rather than "hot spots of species richness" may prove most effective for guiding biodiversity maintenance efforts. Several quantitative techniques have been developed recently that facilitate this process (see Pressey et al. 1993, Williams et al. 1996, Csuti et al. 1997, for details). These areas become candidates for field validation and may be incorporated into a system of areas managed for the long-term maintenance of biological diversity.

The network of Conservation Data Centers (CDCs) and Natural Heritage Programs (NHPs) established cooperatively by The Nature Conservancy and various state agencies maintain detailed databases on the locations of rare elements of biodiversity. GAP cooperatively uses these data to develop predicted distributions of potentially suitable habitat for these elements, which may be valuable for identifying research needs and preliminary considerations for restoration or reintroduction. Conservation of such elements, however, is best accomplished through the fine-filter approach of the above organizations as described in the introduction. It is not the role of GAP to duplicate or disseminate Heritage Program or CDC Element Occurrence Records. Users interested in more specific information about the location, status, and ecology of populations of such species are directed to their state Heritage Program or CDC.

Methods
The gap analysis is accomplished by first producing: maps of land cover (see Figure 2.4), predicted distributions for selected animal species (see Figure 3.6), and land stewardship and management status (see Figure 4.2). Intersecting the land stewardship and management map with the distribution of the elements results in tables that summarize the area and percent of total mapped distribution of each element in different land stewardship and management categories.

Results
The data are provided in a format that allows users to carry out inquires about the representation of each element in different land stewardship and management categories as appropriate to their own management objectives. This forms the basis of GAP's mission to provide land owners and managers with the information necessary to conduct informed policy development, planning, and management for biodiversity maintenance.

As a coarse indicator of the status of the elements, we provide a breakdown along five levels of representation (0-<1%, 1-<10%, 10-<20%, and 20-<50%; >=50%). The <1% level indicates those elements with essentially none of their distribution in a protected status while levels of 10%, 20%, and 50% have been recommended in the literature as necessary amounts of conservation (Noss and Cooperrider 1994; Noss 1991; Odum 1972; Specht et al. 1974; Ride 1975; Miller 1994). Given the paucity of protected lands in Nebraska, our analysis is restricted only to the first two levels (0-<1% and 1-<10%).

Land Cover Analysis
The protection status for each land cover classification was derived from a digital overlay of the land cover map with the stewardship map in a GIS. This process created an intersection between each land cover type and its representation in a management status. The largest amount of land area for the state is in active or fallow agricultural fields (39.38%), followed by Sandhills upland prairie (22.74%), then Little Bluestem-Gramma Mixedgrass Prairie cover type (15.13%). Land ownership in Nebraska is predominately private (97.2%) and the most lands are classified as Status 4.

Distribution of protected areas (Status 1 & 2) include four University of Nebraska prairie sites, one USFS wilderness area, 64 USFWS waterfowl protection areas, six USFWS wildlife refuges, 49 NGO-owned units, seven state Natural Resource District managed areas, and three NPS managed national monument sites.

Summary of the land cover and stewardship analysis according to the thresholds described above is shown in Table 5.1. Table 5.2 provides the area in square kilometers (multiply by 100 for hectares, 247 for acres) and percentage of each types' mapped distribution by land steward. Table 5.3 provides this information by management status. For example, the first entry in Table 5.2 indicates that Ponderosa Pine Forests and Woodland land cover type has 1070.56 km^2 total land in the state with 30.3 km^2 in lands ranked Status 1 and 2, which represents 2.83% of its total distribution.

As explained above, we provide results according to thresholds of representation advocated in the literature to conserve biodiversity. The values in the table will allow users to set any desirable threshold to identify elements requiring more protection according to their criteria. The following summaries highlight potential gaps and conservation needs. Appendices I, J, and K provide figures of stewardship representation for all land cover types by land steward and management status.

Table 5.1. Area (km^2) and percent (%) of NE-GAP land cover types within Status 1& 2 categories.

Land Cover Type	Status 1 &2 km^2	%	Total in all GAP classes km^2	%
<1%				
Deciduous Forest/Woodland	24.0	0.69	3484.1	1.74
Juniper Woodland	0.7	0.07	1022.0	0.51
Sandsage Shrubland	0.0	0.00	677.2	0.34
Lowland Tallgrass Prairie	64.1	0.88	7301.1	3.64
Upland Tallgrass Prairie	7.0	0.09	7884.9	3.94
Little Bluestem-Gramma Mixedgrass Prairie	140.2	0.46	30319.5	15.13
Western Wheatgrass Mixedgrass Prairie	1.3	0.61	207.5	0.10
Western Shortgrass Prairie	100.9	0.60	16748.3	8.36
Barren/Sand/Outcrop	7.1	0.76	926.7	0.46
Agricultural Fields	62.3	0.08	73611.3	36.74
Fallow Agricultural Fields	0.6	0.01	5298.3	2.64
Low Intensity Residential	0.7	0.08	877.4	0.44
Commercial/Industrial/Transportation	1.0	0.14	686.2	0.34
1-<10%				
Ponderosa Pine Forests and Woodland	30.3	2.83	1070.6	0.53
Sandhills Upland Prairie	633.1	1.39	45569.9	22.75
Open Water	18.1	1.40	1289.6	0.64
Aquatic Bed Wetland	33.7	8.33	404.1	0.20
Emergent Wetland	91.0	3.82	2384.3	1.19
Riparian Shrubland	4.9	2.22	219.5	0.11
Riparian Woodland	4.1	1.16	357.5	0.18
Total	1224.8	0.61	200339.9	100.00

Limitations and Discussion for Land Cover Analysis

Assessing the conservation status of natural land cover is limited by several confounding factors: GAP has typically found the accuracy of the mapped distributions of natural communities at the floristic (e.g., alliance) level to be substantially lower and more variable than that of animal distributions; any aggregation of biotic units (e.g., above species) is a surrogate for species or lower levels of biotic organization and will under-represent conservation need (Pressey and Logan 1995); and for the most part we cannot distinguish the degree of natural condition or value of the mapped units due to management manipulation, exotic invasion, or spatial configuration. Considering an aggregation of species such as we have mapped to be sufficiently represented in existing conservation areas cannot be determined solely by the percentage of the community represented because the aggregation has unmapped variation in species composition that we could not measure. Until individual plant species distributions can be mapped, it is not possible to assure that the full range of vegetation biodiversity is represented, and surrogates must be used.

Predicted Animal Species Distributions Analysis

A summary table is not provided due to the large number of species analyzed, but some generalizations and examples of species results by the various thresholds are provided below. The Animal Species Distributions Analysis Tables (found in Appendix I for Birds, Appendix J for Reptiles and Amphibians, and Appendix K for Mammals) provide the area in square kilometers (multiply by 100 for hectares, 247 for acres) of the species' mapped distribution by management status and land steward, and the percent of the species' total distribution in each category. For example in Appendix J, the widely distributed Fence

Lizard has 95,364.5 km^2 (9536450 ha) of potential habitat in managed lands that are ranked with status 1 or 2 and this represents 1.1 % of that species' total modeled distribution.

Table 5.4. Number (N) and percent (%) of species with 0%, 0-1%, 1-2%, 2-10%, 10-50% and 50-100% of habitat contained in stewardship status 1 and 2.

	0%		0-1%		1-2%		2-10%		10-50%		50-100%		Total
	N	%	N	%	N	%	N	%	N	%	N	%	
Birds	2	1.04	138	71.9	32	16.7	20	10.4	0	0.0	0	0.0	192
Mammals	4	5.1	68	87.2	6	1.3	0	0.0	0	0.0	0	0.0	78
Amphibians and Reptiles	2	3.2	55	88.7	5	8.1	0	0.0	0	0.0	0	0.0	62

Table 5.5. Predicted habitat in Status 1 or 2 for vertebrate species and rankings by state, federal agencies (as footnotes), and The Nature Conservancy (TNC). Percent represents proportion of predicted distribution for each vertebrate species that was classified as Status 1 or 2.

	Rankings		Modeled Habitat Area (km^2)		
Common Name	**TNC**	**State**	**Total**	**Status 1&2**	**Percent (%) of modeled area in status 1&2**
REPTILES AND AMPHIBIANS					
<1%					
Coachwhip	G5	S3	9,366.2	0.0	0.0
Eastern Glossy Snake	G5	S2	5,190.0	0.0	0.0
Plains Blackhead Snake	G5	S1	9,933.9	4.2	0.0
Smallmouth Salamander	G5	S1	4,095.2	2.6	0.1
Great Plains Narrowmouth Toad	G5	S2	4,784.5	2.8	0.1
Copperhead	G5	S1	4,095.2	2.6	0.1
Massasauga	G4	S1	4,379.0	3.1	0.1
Western Fox Snake	G5	.	42,938.2	34.7	0.1
Slider	G5	.	1,946.2	1.8	0.1
Graham's Crayfish Snake	G5	S2	32,193.7	40.2	0.1
Prairie Kingsnake	G5	S3	32,193.7	40.2	0.1
Western Rat Snake	G5	S4	32,193.7	40.2	0.1
Five-Lined Skink	G5	S1	1,459.7	1.8	0.1
Great Plains Skink	G5	S3	15,326.6	18.1	0.1
False Map Turtle	G5	S3	23,962.7	29.0	0.1
Plains Leopard Frog	G5	S5	115,191.9	193.8	0.2
Great Plains Rat Snake	G5	.	18,327.0	32.8	0.2
Ringneck Snake	G5	S5	82,957.7	165.6	0.2
Western Ribbon Snake	G5	S2	11,555.7	26.0	0.2
Smooth Softshell	G5	S5	81,173.4	192.1	0.2
American Toad	G5	S1	11,271.9	28.1	0.3
Common Kingsnake	G5	S2	43,141.5	120.0	0.3
Lined Snake	G5	S5	50,399.3	143.3	0.3
Eastern Hognose Snake	G5	.	85,674.1	259.2	0.3
Eastern Worm Snake	G5	S2	5,960.3	17.6	0.3
Western Worm Snake	G5	S2	5,960.3	17.6	0.3
Timber Rattlesnake	G5	S1	5,960.3	17.6	0.3
Northern Prairie Skink	G5	.	77,848.7	244.4	0.3
Smooth Green Snake	G5	S1	22,219.3	76.1	0.3
Cope's Gray Treefrog	G5	S5	38,721.7	137.2	0.4
Gray Treefrog	G5	.	38,721.7	137.2	0.4
Brown Snake	G5	S3	48,777.2	176.8	0.4
Short-Horned Lizard	G5	S3	19,340.5	78.9	0.4

Northern Cricket Frog	G5	S5	94,310.6	392.3	0.4
Bullfrog	G5	S5	125,368.8	660.7	0.5
Common Garter Snake	G5	S5	125,368.8	660.7	0.5
Spiny Softshell	G5	S5	107,934.0	628.5	0.6
Great Plains Toad	G5	S5	206,420.6	1,223.7	0.6
Bullsnake	G5	S5	206,420.6	1,223.7	0.6
Milk Snake	G5	S5	206,420.6	1,223.7	0.6
Six-Lined Racerunner	G5	S5	190,729.2	1,145.9	0.6
Eastern Racer	G5	.	172,767.3	1,046.4	0.6
Ornate Box Turtle	G5	.	164,982.6	1,040.8	0.6
Northern Water Snake	G5	S5	172,159.3	1,109.8	0.6
Common Snapping Turtle	G5	S5	178,078.8	1,154.7	0.7
Painted Turtle	G5	S5	178,078.8	1,154.7	0.7
Northern Leopard Frog	G5	S5	176,375.6	1,183.3	0.7
Redbelly Snake	G5	S1	13,096.4	87.3	0.7
Eastern Tiger Salamander	G5	S5	148,196.3	1,037.3	0.7
Woodhouse's Toad	G5	S5	148,196.3	1,037.3	0.7
Western Chorus Frog	G5	S5	148,196.3	1,037.3	0.7
Plains Spadefoot	G5	S5	148,196.3	1,037.3	0.7
Plains Garter Snake	G5	S5	144,587.6	1,079.0	0.8
Western Hognose Snake	G5	S5	143,979.4	1,109.5	0.8
Sagebrush Lizard	G5	S1	1,743.5	14.2	0.8
Prairie Rattlesnake	G5	S4	123,341.3	1,038.1	0.8
Blanding's Turtle	G4	S4	124,760.6	1,087.4	0.9
1-<10%					
Many-Lined Skink	G5	S5	83,281.7	860.1	1.0
Fence Lizard	G5	.	95,364.5	1,055.3	1.1
Western Terrestrial Garter Snake	G5	S4	4,541.2	58.9	1.3
Lesser Earless Lizard	G5	S5	71,401.8	932.7	1.3
Yellow Mud Turtle	G5	S3	24,043.9	415.6	1.7
Above 1.7%					
None					
BIRDS					
<1%					
Mountain Plover (1)	G2	S1	2,189.5	0.0	0.0
Prothonotary Warbler	G5	S2	1,094.7	0.0	0.0
Yellow-Throated Warbler	G5	S?N	243.3	0.0	0.0
Gray Partridge	G5	SE	25,422.2	5.5	0.0
Acadian Flycatcher	G5	S4	4,135.7	2.7	0.1
Sedge Wren	G5	S2	32,396.3	25.0	0.1
Barn Owl	G5	S3	28,503.9	25.6	0.1
Barred Owl	G5	S2	44,438.5	40.2	0.1
Cassin's Sparrow	G5	S4	27,895.7	27.3	0.1
Indigo Bunting	G5	S4	112,637.3	126.0	0.1
Northern Parula	G5	.	1,581.3	1.8	0.1
Tufted Titmouse	G5	S3	26,801.0	33.7	0.1
Chuck-Will's-Widow	G5	S1	10,379.8	16.7	0.2
Carolina Wren	G5	S2	34,585.9	55.3	0.2
Purple Martin	G5	S4	90,945.3	166.1	0.2
Red-Bellied Woodpecker	G5	S4	123,219.9	222.1	0.2
Northern Cardinal	G5	S5	135,099.9	256.0	0.2
White-Breasted Nuthatch	G5	S3	122,003.5	236.9	0.2
Rose-Breasted Grosbeak	G5	S4	92,202.0	182.2	0.2

Eastern Towhee	G5	.	37,707.9	74.1	0.2
Song Sparrow	G5	S4	57,616.1	124.9	0.2
Ruby-Throated Hummingbird	G5	S3	12,123.3	28.1	0.2
Whip-Poor-Will	G5	S2	8,474.1	20.4	0.2
Northern Bobwhite	G5	S4	139,884.3	384.1	0.3
Cattle Egret	G5	S?N	70,510.0	194.2	0.3
Wood Thrush	G5	S4	20,719.1	58.2	0.3
Rock Wren	G5	S4	32,355.6	97.4	0.3
House Finch	G5	S3	116,124.2	365.5	0.3
Least Bittern	G5	S2	19,989.2	64.2	0.3
Greater Prairie-Chicken	G4	.	119,327.4	377.8	0.3
Blue-Gray Gnatcatcher	G5	S3	7,055.1	23.1	0.3
Scarlet Tanager	G5	S4	23,841.2	79.3	0.3
Green Heron	G5	S4	27,774.2	96.8	0.4
Eastern Wood-Pewee	G5	S4	76,429.5	280.2	0.4
Clark's Grebe	G5	SR	1,905.7	7.1	0.4
Chimney Swift	G5	S5	143,168.7	598.9	0.4
Western Wood-Pewee	G5	S4	20,070.4	84.1	0.4
Black-Headed Grosbeak	G5	S5	94,837.5	403.2	0.4
Brown Creeper	G5	S3	5,473.7	23.4	0.4
Chestnut-Collared Longspur	G5	S2	40,059.6	173.0	0.4
Gray Catbird	G5	S5	131,288.7	563.6	0.4
Eastern Phoebe	G5	S4	117,178.6	519.7	0.4
Mccown's Longspur	G5	S3	20,556.9	91.6	0.5
Yellow-Billed Cuckoo	G5	S5	150,061.6	686.2	0.5
Brewer's Sparrow	G5	S4	9,285.1	42.5	0.5
Great Crested Flycatcher	G5	S4	101,203.3	469.6	0.5
Turkey Vulture	G5	S3	142,398.1	667.0	0.5
Eastern Screech-Owl	G5	S4	80,403.2	379.6	0.5
White-Throated Swift	G5	S4	22,786.7	114.4	0.5
Cedar Waxwing	G5	S?N	87,620.4	437.5	0.5
Spotted Towhee	G5	S?	83,241.4	424.5	0.5
Eastern Meadowlark	G5	S5	139,154.5	710.0	0.5
Wild Turkey	G5	S4	125,368.8	660.7	0.5
Bell's Vireo	G5	S4	125,368.8	660.7	0.5
Bald Eagle (2)	G4	S1	28,868.9	155.0	0.5
Great-Tailed Grackle	G5	S?N	53,318.4	288.8	0.5
Red-Shouldered Hawk	G5	S1	2,757.1	15.7	0.6
Prairie Falcon	G5	S3	9,650.0	56.3	0.6
Bullock's Oriole	G5	S?	61,711.1	356.7	0.6
Mallard	G5	S5	206,420.6	1,223.7	0.6
Common Nighthawk	G5	S5	206,420.6	1,223.7	0.6
Killdeer	G5	S5	206,420.6	1,223.7	0.6
Mourning Dove	G5	S5	206,420.6	1,223.7	0.6
Rock Dove	G5	SE	206,420.6	1,223.7	0.6
Cooper's Hawk	G5	S1	111,299.4	658.1	0.6
Northern Harrier	G5	S3	206,420.6	1,223.7	0.6
Ring-Necked Pheasant	G5	SE	206,420.6	1,223.7	0.6
Horned Lark	G5	S5	206,420.6	1,223.7	0.6
Blue Grosbeak	G5	S5	206,420.6	1,223.7	0.6
Dickcissel	G5	S5	206,420.6	1,223.7	0.6
American Crow	G5	S5	206,420.6	1,223.7	0.6
Blue Jay	G5	S5	206,420.6	1,223.7	0.6
Field Sparrow	G5	S5	206,420.6	1,223.7	0.6
Grasshopper Sparrow	G5	S4	206,420.6	1,223.7	0.6
Lark Sparrow	G5	S4	206,420.6	1,223.7	0.6

American Goldfinch	G5	S5	206,420.6	1,223.7	0.6
Barn Swallow	G5	S5	206,420.6	1,223.7	0.6
Cliff Swallow	G5	S5	206,420.6	1,223.7	0.6
Northern Rough-Winged Swallow	G5	S?	206,420.6	1,223.7	0.6
Brown-Headed Cowbird	G5	S5	206,420.6	1,223.7	0.6
Orchard Oriole	G5	S5	206,420.6	1,223.7	0.6
Red-Winged Blackbird	G5	S5	206,420.6	1,223.7	0.6
Western Meadowlark	G5	S5	206,420.6	1,223.7	0.6
Loggerhead Shrike	G4	S?	206,420.6	1,223.7	0.6
Brown Thrasher	G5	S5	206,420.6	1,223.7	0.6
Northern Mockingbird	G5	S4	206,420.6	1,223.7	0.6
Black-Capped Chickadee	G5	S5	206,420.6	1,223.7	0.6
Common Yellowthroat	G5	S5	206,420.6	1,223.7	0.6
Yellow Warbler	G5	S5	206,420.6	1,223.7	0.6
House Sparrow	G5	SE	206,420.6	1,223.7	0.6
European Starling	G5	SE	206,420.6	1,223.7	0.6
House Wren	G5	S5	206,420.6	1,223.7	0.6
American Robin	G5	S5	206,420.6	1,223.7	0.6
Eastern Kingbird	G5	S5	206,420.6	1,223.7	0.6
Western Kingbird	G5	S5	206,420.6	1,223.7	0.6
Northern Flicker	G5	S5	206,420.6	1,223.7	0.6
Great Horned Owl	G5	S5	206,420.6	1,223.7	0.6
Baltimore Oriole	G5	S5	105,298.6	626.8	0.6
Downy Woodpecker	G5	S4	163,522.8	1,002.6	0.6
Black-Billed Cuckoo	G5	S5	133,680.8	833.4	0.6
Red-Tailed Hawk	G5	S4	142,844.3	890.6	0.6
Vesper Sparrow	G5	S5	120,178.7	747.4	0.6
Louisiana Waterthrush	G5	S1	2,554.4	15.7	0.6
American Wigeon	G5	S2	108,055.7	680.3	0.6
American Kestrel	G5	S5	157,116.5	996.4	0.6
Bobolink	G5	S4	191,012.8	1,211.3	0.6
Common Grackle	G5	S5	157,116.5	996.4	0.6
Warbling Vireo	G5	S5	157,116.5	996.4	0.6
Hairy Woodpecker	G5	S4	157,197.6	996.4	0.6
Red-Headed Woodpecker	G5	S5	157,116.5	996.4	0.6
Yellow-Headed Blackbird	G5	S4	109,677.4	705.8	0.6
Eastern Bluebird	G5	S3	129,058.6	825.9	0.6
Blue-Winged Teal	G5	S5	149,818.1	988.5	0.7
Bank Swallow	G5	S5	167,617.9	1,109.8	0.7
Say's Phoebe	G5	S4	162,022.4	1,073.2	0.7
Black-Billed Magpie	G5	S4	171,429.1	1,155.4	0.7
Great Blue Heron	G5	S4	120,503.3	822.0	0.7
Upland Sandpiper	G5	S5	172,807.5	1,183.8	0.7
Burrowing Owl	G4	S3	162,184.7	1,141.2	0.7
Canada Goose	G5	S?N	118,638.3	843.6	0.7
Chipping Sparrow	G5	S5	99,257.1	724.5	0.7
Lark Bunting	G5	S5	157,238.2	1,151.1	0.7
Kentucky Warbler	G5	S3	1,216.4	9.0	0.7
Northern Pintail	G5	S5	127,193.3	959.3	0.8
Northern Shoveler	G5	S4	127,193.3	959.3	0.8
Swainson's Hawk	G5	S3	152,777.8	1,142.4	0.8
King Rail	G4	S1	63,211.7	473.5	0.8
Wood Duck	G5	S3	104,284.7	788.1	0.8
Yellow-Throated Vireo	G5	S2	2,513.9	19.0	0.8
American Coot	G5	S?N	125,571.4	966.5	0.8
Ferruginous Hawk	G4	S2	94,431.9	742.8	0.8

Willow Flycatcher	G5	S4	95,608.0	790.7	0.8
Red-Eyed Vireo	G5	S4	67,428.3	564.8	0.8
Double-Crested Cormorant	G5	S3	130,315.1	1,097.0	0.8
Belted Kingfisher	G5	S4	92,648.2	809.0	0.9
Pygmy Nuthatch	G5	S3	6,852.3	59.6	0.9
Spotted Sandpiper	G5	S5	26,719.9	241.0	0.9
Brewer's Blackbird	G5	S4	20,597.3	185.7	0.9
Sharp-Tailed Grouse	G4	S4	110,163.8	1,038.2	0.9
1-<10%					
Golden Eagle	G5	S3	28,463.1	278.8	1.0
Tree Swallow	G5	S?N	91,026.2	912.9	1.0
Long-Eared Owl	G5	S4	69,252.9	692.1	1.0
Virginia Rail	G5	S4	75,415.9	771.7	1.0
Eared Grebe	G5	S4	43,222.2	447.7	1.0
Green-Winged Teal	G5	S3	60,859.6	636.7	1.1
Black Tern	G5	S3	48,290.6	525.2	1.1
American Bittern	G4	S3	48,331.1	525.2	1.1
Merlin	G5	S1	3,770.9	41.6	1.1
Piping Plover (3)	G3	S2	13,947.8	155.6	1.1
Least Tern (4)	G4	S2	13,947.8	155.6	1.1
Sora	G5	S4	36,532.0	421.6	1.2
Western Grebe	G5	S4	9,528.3	111.0	1.2
Ruddy Duck	G5	S4	49,385.3	594.7	1.2
Common Snipe	G5	S2	86,768.7	1,038.5	1.2
Redhead	G5	S4	50,277.3	638.7	1.3
Pied-Billed Grebe	G5	S5	50,277.3	638.7	1.3
Red Crossbill	G5	S4	32,599.2	426.6	1.3
Trumpeter Swan	G4	S2	34,383.3	455.2	1.3
American Avocet	G5	S4	17,394.2	233.3	1.3
Long-Billed Curlew	G5	S3	73,429.1	1,009.3	1.4
Gadwall	G5	S3	66,860.7	926.1	1.4
Black-Crowned Night-Heron	G5	S2	44,033.1	612.3	1.4
Swamp Sparrow	G5	S3	36,288.8	504.7	1.4
Lesser Scaup	G5	S3	4,257.4	59.7	1.4
Wilson's Phalarope	G5	S4	64,468.5	902.5	1.4
Townsend's Solitaire	G5	S2	1,905.7	27.1	1.4
Cinnamon Teal	G5	S?N	11,271.8	161.6	1.4
American Redstart	G5	S4	17,597.1	256.1	1.5
Willet	G5	S3	43,506.1	733.5	1.7
Yellow-Rumped Warbler	G5	S4	608.2	11.0	1.8
American White Pelican	G5	S3	49,020.4	951.8	1.9
Black-Necked Stilt	G5	S1	6,122.5	120.6	2.0
Yellow-Breasted Chat	G5	S5	15,731.9	317.8	2.0
Savannah Sparrow	G5	S3	10,663.5	220.3	2.1
Dark-Eyed Junco	G5	S4	1,216.4	25.5	2.1
Plumbeous Vireo	G5	S2	1,216.4	27.1	2.2
Ovenbird	G5	S4	10,623.1	239.7	2.3
White-Faced Ibis	G5	S1	12,853.2	304.6	2.4
Pinyon Jay	G5	S3	2,432.8	70.3	2.9
Western Tanager	G5	S4	2,432.8	70.3	2.9
Common Poorwill	G5	S2	3,446.5	110.5	3.2
Cassin's Kingbird	G5	S3	9,568.9	317.2	3.3
Red-Breasted Nuthatch	G5	S4	6,852.4	233.5	3.4
Lazuli Bunting	G5	S4	5,068.3	179.9	3.6
Black-And-White Warbler	G5	.	5,068.3	179.9	3.6

Mountain Bluebird	G5	S4	5,068.3	179.9	3.6
Violet-Green Swallow	G5	S3	3,365.4	124.8	3.7
Sharp-Shinned Hawk	G5	S1	6,244.2	233.2	3.7
Pine Siskin	G5	S5	5,271.0	201.7	3.8
Marsh Wren	G5	S4	7,298.3	370.1	5.1
Forster's Tern	G5	S3	6,163.0	370.1	6.0
Canvasback	G5	S3	4,743.9	370.1	7.8
Above 7.8%					
None					
MAMMALS					
<1%					
Southern Flying Squirrel	G5	S1	1,703.0	0.0	0.00
Wyoming Ground Squirrel	G5	SH	1,621.8	0.0	0.00
Northern Pocket Gopher	G5	S4	4,703.4	0.0	0.00
Townsend's Big-Eared Bat	G4	S1	932.6	0.0	0.00
Gray Squirrel	G5	S4	10,501.5	2.6	0.02
Eastern Chipmunk	G5	S1	7,744.4	2.6	0.03
Evening Bat	G5	S3	6,163.0	2.7	0.04
Eastern Pipistrelle	G5	S1	3,365.4	1.8	0.05
Hispid Cotton Rat	G5	S3	17,435.0	9.3	0.05
Elliot's Short-Tailed Shrew	G5	S3	40,465.4	64.8	0.16
Least Chipmunk	G5	S3	2,838.3	6.1	0.21
Franklin's Ground Squirrel	G5	S5	124,963.5	297.9	0.24
Northern Long-Eared Myotis	G4	S3	50,439.4	121.9	0.24
Woodchuck	G5	S4	34,910.3	96.0	0.28
Pine Vole/Woodland Vole	G5	S3	8,474.2	23.5	0.28
Gray Fox	G5	S4	144,303.9	469.0	0.33
Nine-Banded Armadillo	G5	.	41,073.6	152.3	0.37
Black-Tailed Prairie Dog	G4	S4	131,856.3	513.4	0.39
Silky Pocket Mouse	G5	S4	44,316.7	193.6	0.44
Eastern Woodrat	G5T3	S2	38,316.4	169.7	0.44
Little Brown Bat	G5	S4	50,845.0	237.5	0.47
Olive-Backed Pocket Mouse	G5	S3	26,152.1	130.0	0.50
Virginia Opossum	G5	S5	150,183.1	760.7	0.51
Southern Bog Lemming	G5T?	S1	47,641.9	249.4	0.52
Red Bat	G5	S5	187,120.5	995.9	0.53
Coyote	G5	S5	206,420.6	1,223.7	0.59
Hispid Pocket Mouse	G5	S5	206,420.6	1,223.7	0.59
Big Brown Bat	G5	S5	206,420.6	1,223.7	0.59
Porcupine	G5	S4	206,420.6	1,223.7	0.59
Hoary Bat	G5	S5	206,420.6	1,223.7	0.59
Silver-Haired Bat	G5	S5	206,420.6	1,223.7	0.59
Black-Tailed Jackrabbit	G5	S5	206,420.6	1,223.7	0.59
Bobcat	G5	S5	206,420.6	1,223.7	0.59
Striped Skunk	G5	S5	206,420.6	1,223.7	0.59
Prairie Vole	G5	S5	206,420.6	1,223.7	0.59
Meadow Vole	G5	S5	206,420.6	1,223.7	0.59
Long-Tailed Weasel	G5	S4	206,420.6	1,223.7	0.59
House Mouse	G5	SE	206,420.6	1,223.7	0.59
Mink	G5	S5	206,420.6	1,223.7	0.59
White-Tailed Deer	G5	S5	206,420.6	1,223.7	0.59
Northern Grasshopper Mouse	G5	S5	206,420.6	1,223.7	0.59
Muskrat	G5	S5	206,420.6	1,223.7	0.59
White-Footed Mouse	G5	S5	206,420.6	1,223.7	0.59

Deer Mouse	G5	S5	206,420.6	1,223.7	0.59
Raccoon	G5	S5	206,420.6	1,223.7	0.59
Norway Rat	G5	SE	206,420.6	1,223.7	0.59
Western Harvest Mouse	G5	S5	206,420.6	1,223.7	0.59
Plains Harvest Mouse	G5	S4	206,420.6	1,223.7	0.59
Eastern Mole	G5	S5	206,420.6	1,223.7	0.59
Eastern Spotted Skunk	G5	S3	206,420.6	1,223.7	0.59
Thirteen-Lined Ground Squirrel	G5	S5	206,420.6	1,223.7	0.59
Eastern Cottontail	G5	S5	206,420.6	1,223.7	0.59
Badger	G5	S5	206,420.6	1,223.7	0.59
Fox Squirrel	G5	S5	141,790.0	842.3	0.59
Desert Cottontail	G5	S4	65,238.5	393.8	0.60
Red Fox	G5	S5	164,090.5	1,001.8	0.61
Long-Legged Myotis	G5	S2	6,649.7	41.6	0.62
White-Tailed Jackrabbit	G5	S4	185,660.9	1,165.5	0.63
Mule Deer	G5	S5	183,552.6	1,157.6	0.63
Meadow Jumping Mouse	G5	S5	160,076.5	1,021.5	0.64
Swift Fox	G3	S2	39,288.9	256.3	0.65
Northern Short-Tailed Shrew	G5	S3	72,902.0	475.9	0.65
Plains Pocket Gopher	G5	S5	170,618.4	1,155.3	0.68
Masked Shrew	G5	.	161,617.0	1,110.1	0.69
Least Weasel	G5	S5	108,744.8	755.4	0.69
Beaver	G5	S5	116,327.2	822.2	0.71
Bushy-Tailed Woodrat	G5	S3	10,339.3	75.8	0.73
Least Shrew	G5	S4	159,833.2	1,183.1	0.74
Plains Pocket Mouse	G5	S5	148,682.6	1,135.8	0.76
River Otter	G5	S2	32,599.1	259.7	0.80
Fringe-Tailed Myotis	G4G5	S1	5,717.0	48.1	0.84
Ord's Kangaroo Rat	G5	S5	111,177.5	1,092.7	0.98
1-<10%					
Western Small-Footed Myotis	G5	S4	67,833.8	688.8	1.02
Pronghorn	G5	S3	32,842.5	337.9	1.03
Merriam's Shrew	G5	S1	3,892.5	41.6	1.07
Spotted Ground Squirrel	G5	S4	84,660.3	1,025.6	1.21
Mountain Lion	G5	S1	6,244.1	75.8	1.21
Elk	G5	S2	3,405.9	41.6	1.22
Above 1.22%					
None					

TNC Rank: Global rank of G1-G5, with G1 most threatened
State Rank: S1-S5, with S1 most threatened, SE = exotic, S? = unranked (not yet assessed), SR = reported, N = nonbreeding
(1) Candidate for ESA listing.
(2) Listed as threatened, endangered and non-breeding under the Endangered Species Act of 1973.
(3) Listed as threatened and endangered under the Endangered Species Act of 1973.

Discussion

This species-centric analysis clearly shows how only tiny fractions of the land area of Nebraska are within management units with some degree of conservation stewardship. A slightly different approach to this analysis, pursued in the next section, focuses on functional landscape connectivity as a broader context within which to manage biodiversity.

Special Features Analysis

Introduction

Nebraska is a leading agricultural state. According to the 2002 Census of Agriculture (USDA 2004), the total value of agricultural products sold in Nebraska was $9.7 billion (national ranking= 4th) of which $6.3 billion came from animal products and $3.4 billion from plant products. The extent of irrigated harvested cropland is vast: 7,508,900 ac (30,388 km^2) covers more than 15% of the land area of Nebraska and accounts for almost 15% of the national total (rank=2nd). Land holdings in Nebraska are overwhelmingly in private hands (>97%). Thus, biodiversity planning faces special challenges in the State of Nebraska, especially the issue of landscape connectivity in fragmented habitats.

Methods

Given the large human impact on the landscapes of Nebraska, we ask the question: "What is the coincidence of human activities with the statewide patterns of biodiversity?" We analyzed land cover pervasiveness within the modeling hexagons as follows. If the proportion of a land cover category at 30m resolution within the 40 km^2 hexagon exceeded 40.725%, then that land cover category was considered ***pervasive***. The motivation for this decision rule is the percolation threshold for the emergence of a spanning cluster in the case of eight nearest-neighbors (King's case) on 2-D random maps: p_{crit}= 0.40725 (Turner et al. 2001). We aggregated the land cover classes into four categories to assess functional landscape connectivity: Woodlands, Grasslands, Wetlands, and Anthropolands (Table 5.6). Note that the categorization allows land cover classes to be in multiple categories (e.g., riparian woodlands appear in both Wetlands and Woodlands categories); thus, proportional areas total across categories to more than 100%.

Applying the pervasiveness test to the modeling hexagons yielded four land cover masks. Within the highlighted hexagons the particular land cover category is pervasive and thus is likely to be well-connected. There is no guarantee of connectivity, because percolation theory applies strictly to random binary maps on an infinite lattice. However, the approach provides a first-pass filter to identify areas with potentially high degrees of functional landscape connectivity.

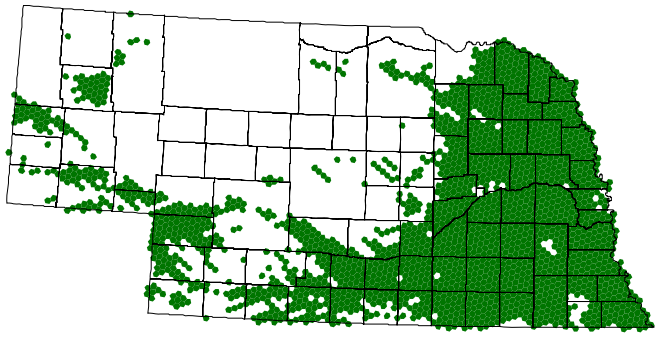


Figure 5.1 Anthropolands pervasiveness mask

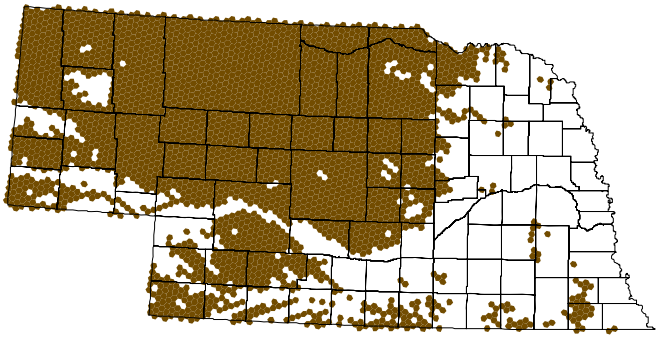


Figure 5.2 Grasslands pervasiveness mask

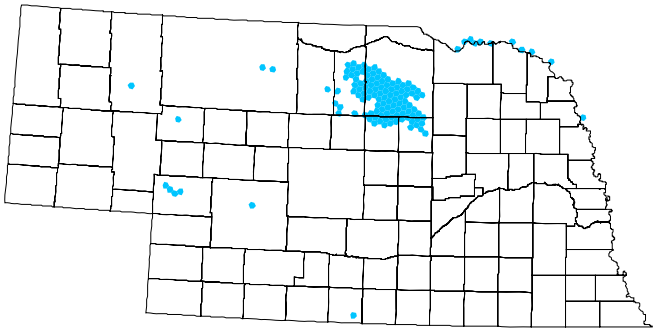


Figure 5.3 Wetlands pervasiveness mask

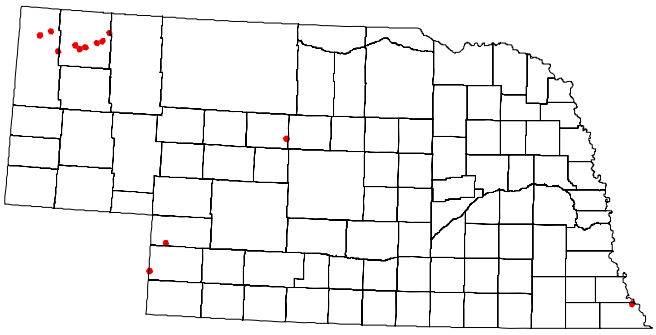


Figure 5.4 Woodlands pervasiveness mask

Table 5.6. GAP land cover assignment to aggregated categories for pervasiveness analysis

Aggregated Category	GAP land cover classes	proportion of State
Grasslands	5 (Sandhills Upland Prairie), 6 (Lowland Tallgrass Prairie), 7 (Upland Tallgrass Prairie), 8 (Little Bluestem-Gramma Mixedgrass Prairie), 9 (Western Wheatgrass Mixedgrass Prairie), 10 (Western Shortgrass Prairie)	60%
Anthropolands	12 (Agricultural Fields), 14 (Fallow Agricultural Fields), 19 (Low Intensity Residential), 20 (High Intensity Residential/ Commercial/ Industrial/ Transportation)	48%
Wetlands	6 (Lowland Tallgrass Prairie), 13 (Open Water), 15 (Aquatic Bed Wetland), 16 (Emergent Wetland), 17 (Riparian Shrubland), 18 (Riparian Woodland)	2.5%
Woodlands	1 (Ponderosa Pine Forests and Woodlands), 2 (Deciduous Forests and Woodlands), 3 (Juniper Woodlands), 4 (Sandsage Shrubland), 17 (Riparian Shrubland), 18 (Riparian Woodland)	0.3%

Results & Discussion

Not surprisingly, the pervasiveness analysis showed that Nebraska landscapes are predominately grasslands (60%) but that intensive human uses of the landscapes are nearly as pervasive (48%; Table 5.6). Even generously considered through the inclusion of open water into the wetlands category, only a small fraction (2.5%) of Nebraska has pervasive wetlands. And despite the National Arbor Day Foundation being located in Nebraska, the state has just a tiny proportion (0.3%) of land as pervasive woodlands.

Table 5.7 takes the pervasiveness analysis to the next level by focusing on the context of the most species rich hexagons in the higher conservation status lands (Figure 5.5). The key finding from this table is that there are no status 1 or 2 lands within hexagons that are pervasive wetlands. Additional results can be found in Appendix L.

It is important to note that the results of the pervasiveness analysis are highly dependent on the size of the grid. A finer grid size would likely yield more hexagons that met the pervasiveness criterion. Tuning the grid size to home range size could facilitate habitat analysis of larger mammals. This is an area that needs additional research

Figure 5.5. Anthropolands pervasiveness mask intersected with status 1&2 and 4th quartile richness of terrestrial vertebrates. Red dots indicate hexagons meeting the criteria.

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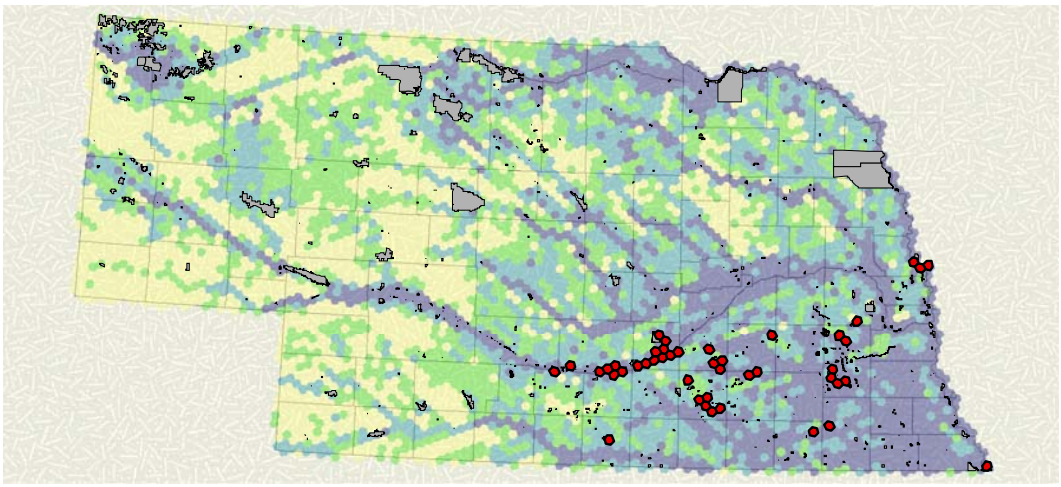

Table 5.7a-e. Amount (km^2) and percentage (%) of Status 1 and 2 area for the top quartile of species richness for terrestrial vertebrates generally and across taxa considered statewide (a) and within each of the pervasiveness masks (b-e).

a. statewide	Total (km^2)	Status 1&2 (km^2)	Percent (%) of modeled area in Status 1&2
Birds	42,086.9	456.7	1.1
Mammals	33,166.8	194.6	0.6
Amphibians & Reptiles	40,627.3	61.2	0.2
Total	48,858.1	333.1	0.7

b. anthropolands	Total (km^2)	Status 1&2 (km^2)	Percent (%) of modeled area in Status 1&2
Birds	22,868.0	82.6	0.4
Mammals	18,732.4	65.5	0.3
Amphibians & Reptiles	34,180.5	103.6	0.3
Total	31,585.5	91.5	0.3

c. grasslands	Total (km^2)	Status 1&2 (km^2)	Percent (%) of modeled area in Status 1&2
Birds	19,097.2	357.5	1.9
Mammals	15,002.1	122.4	0.8
Amphibians & Reptiles	7,298.3	4.5	0.1
Total	17,799.8	228.2	1.3

d. wetlands	Total (km^2)	Status 1&2 (km^2)	Percent (%) of modeled area in Status 1&2
Birds	1,540.8	0	0.0
Mammals	162.2	0	0.0
Amphibians & Reptiles	446.0	0	0.0
Total	1,054.2	0	0.0

e. woodlands	Total (km^2)	Status 1&2 (km^2)	Percent (%) of modeled area in Status 1&2
Birds	243.3	2.5	1.0
Mammals	283.8	2.5	0.9
Amphibians & Reptiles	40.6	0	0.0
Total	162.2	0	0.0

Analysis of Important Statewide Species Assemblages:

According to the Nebraska Game and Parks Commission, there are several endangered vertebrate species in the state (Table 5.8).

Table 5.8. Nebraska threatened and endangered vertebrate species

Common Name	Scientific Name	State Status	Federal Status	Modeled Habitat (km2)	% modeled area in status 1& 2
Birds					
Eskimo Curlew	Numenius borealis	Endangered	Endangered	na	na
Whooping Crane	Grus americana	Endangered	Endangered	na	na
Interior Least Tern	Sterna antillarum athalassos	Endangered	Endangered	13,947.8	1.1
Bald Eagle	Haliaeetus leucophalus	Threatened	Threatened	28,868.9	0.5
Piping Plover	Charadrius melodus	Threatened	Threatened	13,947.8	1.1
Mountain Plover	Charadrius montanus	Threatened	Candidate	2,189.5	0
Mammals					
Black-footed Ferret	Mustela nigripes	Endangered	Endangered	na	na
Swift Fox	Vulpes velox	Endangered		39,288.9	0.65
River Otter	Lutra canadensis	Threatened		4,379.0	0.80
Southern Flying Squirrel	Glaucomys volans	Threatened		na	na
Reptiles & Amphibians					
Massasauga	Sistrurs catenatus	Threatened	Threatened	4,379.0	0.1

Limitations and Discussion

When applying the results of our analyses, it is critical that the following limitations are considered: 1) the limitations described for each of the component parts (land cover mapping, animal species mapping, stewardship mapping) of the analyses, 2) the spatial and thematic map accuracy of the components, and 3) the suitability of the results for the intended application (see Appropriate and Inappropriate Use below).

However the data are sliced, the point remains: the paucity of status 1 & 2 and even status 3 lands within Nebraska —0.2%, 0.4%, and 1.3%, respectively—means that there is very little maneuvering room for conservation opportunities on public lands. Conservation of Nebraska's biodiversity will require more public participation in conservation planning and programs for biodiversity protection, enhancement, and management.

Table 5.2. Area (km^2) and percent (%) of NE-GAP land cover types within major land stewardship categories

	Federal		Native		State		Private		Total	
Land Cover Type	**km^2**	**%**	**km^2**	**%**	**km^2**	**%**	**km^2**	**%**	**km^2**	**%**
Ponderosa Pine Forests and Woodland	151.06	14.11	0.04	0.00	47.84	4.47	871.62	81.42	1070.56	0.53
Deciduous Forest/Woodland	26.60	0.76	98.97	2.84	91.38	2.62	3267.09	93.77	3484.05	1.74
Juniper Woodland	3.31	0.32	16.40	1.60	19.72	1.93	982.60	96.14	1022.04	0.51
Sandsage Shrubland	0.00	0.00	0.00	0.00	0.93	0.14	676.27	99.86	677.20	0.34
Sandhills Upland Prairie	1115.49	2.45	8.88	0.02	119.04	0.26	44326.49	97.27	45569.90	22.75
Lowland Tallgrass Prairie	72.85	1.00	19.99	0.27	54.53	0.75	7153.73	97.98	7301.09	3.64
Upland Tallgrass Prairie	15.30	0.19	415.91	5.27	71.52	0.91	7382.19	93.62	7884.92	3.94
Little Bluestem-Gramma Mixedgrass Prairie	127.36	0.42	53.21	0.18	160.45	0.53	29978.49	98.88	30319.50	15.13
Western Wheatgrass Mixedgrass Prairie	18.52	8.92	0.00	0.00	2.15	1.04	186.81	90.04	207.47	0.10
Western Shortgrass Prairie	462.07	2.76	1.43	0.01	126.66	0.76	16158.16	96.48	16748.31	8.36
Barren/Sand/Outcrop	41.35	4.46	1.29	0.14	2.30	0.25	881.77	95.15	926.71	0.46
Agricultural Fields	112.67	0.15	933.50	1.27	175.39	0.24	72389.76	98.34	73611.32	36.74
Open Water	28.73	2.23	15.09	1.17	292.62	22.69	953.11	73.91	1289.55	0.64
Fallow Agricultural Fields	0.55	0.01	0.00	0.00	4.16	0.08	5293.59	99.91	5298.30	2.64
Aquatic Bed Wetland	35.70	8.83	1.76	0.44	14.83	3.67	351.80	87.06	404.09	0.20
Emergent Wetland	80.01	3.36	11.81	0.50	62.75	2.63	2229.72	93.52	2384.29	1.19
Riparian Shrubland	2.32	1.06	1.93	0.88	10.09	4.60	205.14	93.47	219.48	0.11
Riparian Woodland	3.17	0.89	1.64	0.46	12.04	3.37	340.62	95.28	357.48	0.18
Low Intensity Residential	4.02	0.46	5.92	0.68	6.59	0.75	860.88	98.12	877.41	0.44
Commercial/Industrial/Transportation	4.94	0.72	3.29	0.48	5.54	0.81	672.49	98.00	686.24	0.34
Total	**2306.01**	**1.15**	**1591.06**	**0.79**	**1280.52**	**0.64**	**195162.33**	**97.42**	**200339.92**	**100**

Table 5.3. Area (km^2) and percent (%) of NE-GAP land cover types within management status categories

	Status 1		Status 2		Status 3		Status 4		Total
Land Cover Type	**km^2**	**%**	**km^2**	**%**	**km^2**	**%**	**km^2**	**%**	**km^2**
Ponderosa Pine Forests and Woodland	26.60	2.48	3.72	0.35	188.76	17.63	851.47	79.54	1070.56
Deciduous Forest/Woodland	10.11	0.29	13.91	0.40	89.49	2.57	3370.54	96.74	3484.05
Juniper Woodland	0.34	0.03	0.34	0.03	19.56	1.91	1001.80	98.02	1022.04
Sandsage Shrubland	0.00	0.00	0.00	0.00	0.93	0.14	676.27	99.86	677.20
Sandhills Upland Prairie	259.67	0.57	373.42	0.82	796.06	1.75	44140.75	96.86	45569.90
Lowland Tallgrass Prairie	16.90	0.23	47.17	0.65	63.22	0.87	7173.80	98.26	7301.09
Upland Tallgrass Prairie	3.29	0.04	3.63	0.05	46.62	0.59	7831.38	99.32	7884.92
Little Bluestem-Gramma Mixedgrass Prairie	65.30	0.22	74.87	0.25	191.08	0.63	29988.24	98.91	30319.50
Western Wheatgrass Mixedgrass Prairie	1.25	0.60	0.01	0.00	19.24	9.28	186.97	90.12	207.47
Western Shortgrass Prairie	60.98	0.36	39.91	0.24	506.09	3.02	16141.34	96.38	16748.31
Barren/Sand/Outcrop	3.80	0.41	3.27	0.35	37.16	4.01	882.48	95.23	926.71
Agricultural Fields	17.45	0.02	44.85	0.06	141.24	0.19	73407.79	99.72	73611.32
Open Water	5.19	0.40	12.88	1.00	291.02	22.57	980.46	76.03	1289.55
Fallow Agricultural Fields	0.38	0.01	0.22	0.00	3.02	0.06	5294.68	99.93	5298.30
Aquatic Bed Wetland	0.02	0.01	33.65	8.33	16.41	4.06	354.01	87.61	404.09
Emergent Wetland	13.74	0.58	77.25	3.24	59.71	2.50	2233.59	93.68	2384.29
Riparian Shrubland	2.44	1.11	2.43	1.11	10.73	4.89	203.88	92.89	219.48
Riparian Woodland	2.02	0.57	2.11	0.59	14.47	4.05	338.88	94.80	357.48
Low Intensity Residential	0.24	0.03	0.50	0.06	3.27	0.37	873.41	99.54	877.41
Commercial/Industrial/Transportation	0.49	0.07	0.46	0.07	4.45	0.65	680.84	99.21	686.24

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

As a leading agricultural state, Nebraska's landscapes have been transformed since European settlement and are now dominated by human activities more or less intensively. Plowing and cultivation of the prairies, suppression of periodic wildfire, drainage of wetlands, channelization of rivers and streams, emplacement of reservoirs and ponds, planting of shelterbelts, extirpation of large carnivores, displacement of large herbivores and replacement by cattle, introduction of exotic and invasive species, intensive use of fertilizers and pesticides, expansion of irrigation, growth and development of human settlements, transportation corridors, and commercial and industrial activities—all these anthropogenic impacts on the Nebraska landscapes and wildlife have led to the current situation. The species richness maps produced through the wildlife-habitat relationship modeling show not the current state of biodiversity in Nebraska. Rather, they portray a potential biodiversity across the State.

The NE-GAP project has revealed profound gaps in the network of stewardship needed to cover a representative selection of Nebraska's biodiversity. Yet, this conclusion could be gleaned from a glance at an atlas. However, it would be imprudent to infer that a lack of formal protective status indicates poor management of the lands in private hands. The appropriate conclusion is, rather, that stewardship of Nebraska's biodiversity depends on public-private partnerships.

A significant result of the NE-GAP project has been a demonstration in the gaps in our knowledge base about the common species that inhabit Nebraska. Periodic biodiversity surveys are a necessary complement to the kind of predictive modeling attempted here. That animal distributions are changing is clear (Benedict et al. 2000) and this is not necessarily surprising given the central location of Nebraska in the Great Plains and its predominantly west-to-east riparian corridors. What are the implications of these movements? What are the potential connections between shifting animal distributions, habitat quality, and climate change? Are there linkages between disease occurrence and habitat and climate change? How can this species habitat model be improved? These are a few of the questions that can be addressed using the information produced by the Nebraska Gap Analysis Project.

PRODUCT USE AND AVAILABILITY

How to Obtain the Products
It is the goal of the Gap Analysis Program and the USGS Biological Resources Division (BRD) to make the data and associated information as widely available as possible. Use of the data requires specialized software called geographic information systems (GIS) and substantial computing power. Additional information on how to use the data or obtain GIS services is provided below and on the GAP home page (URL below). While a CD-ROM of the data will be the most convenient way to obtain the data, it may also be downloaded via the Internet from the national GAP home page at:

http://gapanalysis.nbii.gov/

The home page will also provide, over the long term, the status of our state's project, future updates, data availability, and contacts. Within a few months of this project's completion, CD-ROMs of the final report and data should be available at a nominal cost--the above home page will provide ordering information. To find information on this state GAP project's status and data, follow the links to "project information" and then to the particular state of interest. The Nebraska GAP data are available from the Center for Advanced Land Management Information Technologies (CALMIT) at the University of Nebraska-Lincoln:

http://www.calmit.unl.edu/gap/

Disclaimer
Following is the official Biological Resources Division (BRD) disclaimer as of 29 January 1996, followed by additional disclaimers from GAP. Prior to using the data, you should consult the GAP home page (see How to Obtain the Data, above) for the current disclaimer.

Although these data have been processed successfully on a computer system at the BRD, no warranty expressed or implied is made regarding the accuracy or utility of the data on any other system or for general or scientific purposes, nor shall the act of distribution constitute any such warranty. This disclaimer applies both to individual use of the data and aggregate use with other data. It is strongly recommended that these data are directly acquired from a BRD server [see above for approved data providers] and not indirectly through other sources which may have changed the data in some way. It is also strongly recommended that careful attention be paid to the content of the metadata file associated with these data. The Biological Resources Division shall not be held liable for improper or incorrect use of the data described and/or contained herein.

These data were compiled with regard to the following standards. Please be aware of the limitations of the data. These data are meant to be used at a scale of 1:100,000 or smaller (such as 1:250,000 or 1:500,000) for the purpose of assessing the conservation status of animals and vegetation types over large geographic regions. The data may or may not have been assessed for statistical accuracy. Data evaluation and improvement may be ongoing. The Biological Resources Division makes no claim as to the data's suitability for other purposes. This is writable data which may have been altered from the original product if not obtained from a designated data distributor identified above.

Appropriate and Inappropriate Use of These Data
All information is created with a specific end use or uses in mind. This is especially true for GIS data, which is expensive to produce and must be directed to meet the immediate program needs. For GAP, minimum standards were set (see A Handbook for Gap Analysis, Scott et al. 1993) to meet program objectives.

Recognizing, however, that GAP would be the first, and for many years likely the only, source of statewide biological GIS maps, the data were created with the expectation that they would be used for other applications. Therefore, we list below both appropriate and inappropriate uses. This list is in no way exhaustive but should serve as a guide to assess whether a proposed use can or cannot be supported by GAP data. For most uses, it is unlikely that GAP will provide the only data needed, and for uses with a regulatory outcome, field surveys should verify the result. In the end, it will be the responsibility of each data user to determine if GAP data can answer the question being asked, and if they are the best tool to answer that question.

Scale: First we must address the issue of appropriate scale to which these data may be applied. The data were produced with an intended application at the ecoregion level, that is, geographic areas from several hundred thousand to millions of hectares in size. The data provide a coarse-filter approach to analysis, meaning that not every occurrence of every plant community or animal species habitat is mapped, only larger, more generalized distributions. The data are also based on the USGS 1:100,000 scale of mapping in both detail and precision. When determining whether to apply GAP data to a particular use, there are two primary questions: do you want to use the data as a map for the particular geographic area, or do you wish to use the data to provide context for a particular area? The distinction can be made with the following example: You could use GAP land cover to determine the approximate amount of oak woodland occurring in a county, or you could map oak woodland with aerial photography to determine the exact amount. You then could use GAP data to determine the approximate percentage of all oak woodland in the region or state that occurs in the county, and thus gain a sense of how important the county's distribution is to maintaining that plant community.

Appropriate Uses: The above example illustrates two appropriate uses of the data: as a coarse map for a large area such as a county, and to provide context for finer-level maps. No specific case-study examples are provided here, but following is a general list of applications:

- Statewide biodiversity planning
- Regional (Councils of Government) planning
- Regional habitat conservation planning
- County comprehensive planning
- Large-area resource management planning
- Coarse-filter evaluation of potential impacts or benefits of major projects or plan initiatives on biodiversity, such as utility or transportation corridors, wilderness proposals, regional open space and recreation proposals, etc.
- Determining relative amounts of management responsibility for specific biological resources among land stewards to facilitate cooperative management and planning.
- Basic research on regional distributions of plants and animals and to help target both specific species and geographic areas for needed research.
- Environmental impact assessment for large projects or military activities.
- Estimation of potential economic impacts from loss of biological resource-based activities.
- Education at all levels and for both students and citizens.

Inappropriate Uses: It is far easier to identify appropriate uses than inappropriate ones, however, there is a "fuzzy line" that is eventually crossed when the differences in resolution of the data, size of geographic area being analyzed, and precision of the answer required for the question are no longer compatible. Examples include:

- Using the data to map small areas (less than thousands of hectares), typically requiring mapping resolution at 1:24,000 scale and using aerial photographs or ground surveys.
- Combining GAP data with other data finer than 1:100,000 scale to produce new hybrid maps or answer queries.
- Generating specific areal measurements from the data finer than the nearest thousand hectares (minimum mapping unit size and accuracy affect this precision).

- Establishing exact boundaries for regulation or acquisition.
- Establishing definite occurrence or non-occurrence of any feature for an exact geographic area (for land cover, the percent accuracy will provide a measure of probability).
- Determining abundance, health, or condition of any feature.
- Establishing a measure of accuracy of any other data by comparison with GAP data.
- Altering the data in any way and redistributing them as a GAP data product.
- Using the data without acquiring and reviewing the metadata and this report.

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Appendix A:
NVCS Alliance List for Nebraska

1. Ponderosa Pine Forests and Woodlands

***I.A.8.N.b.10 Pinus ponderosa* forest alliance**

Forests dominated by *Pinus ponderosa* occur in mountainous regions of the western United States, from the Cascades and Black Hills, throughout the Rocky Mountains, southeast to the mountains of Arizona, New Mexico, and western Texas. This alliance may range into southern British Columbia, and although *Pinus ponderosa* is found in Mexico, it is uncertain whether this alliance ranges into that country. This alliance can be found on slopes of a variety of aspects and pitches, but is most often on gentle to moderate, northeast- to northwest-facing slopes. It can be on slopes of other aspects where the soil is heavier and retains more moisture or if other conditions make the site relatively mesic. Periodic ground fires are important in maintaining *Pinus ponderosa* forests. In the prolonged absence of fires, some stands will succeed to other communities. Throughout its range, *Pinus ponderosa* is found at elevations from sea level to 3050 m (10,000 feet). Within the central Rocky Mountains, *Pinus ponderosa* grows at elevations between 1800-2600 m (6000-8500 feet). In the Black Hills and northeastern Wyoming, it can be found from 1080-2100 m (3600-7000 feet). In the southeastern United States, these forests are restricted to the high elevations (over 1800 m, 6000 feet) of the Guadalupe, Davis, and Chisos mountains in western Texas, where associations are dominated by *Pinus ponderosa var. scopulorum*. Associated species vary with elevation and geography, but consistently include *Quercus gambelii, Pinus strobiformis, Juniperus deppeana, Quercus grisea, Quercus muehlenbergii, Pinus arizonica var. stormiae, Cupressus arizonica, Juniperus flaccida, Festuca arizonica, Schizachyrium scoparium var. scoparium (= Schizachyrium scoparium ssp. neomexicanum), Panicum bulbosum,* and *Piptochaetium pringlei (= Stipa pringlei)*.

***II.A.4.N.a.32 Pinus ponderosa* woodland alliance**

This alliance is one of the most widespread wooded alliances in the western United States; there are currently over 50 plant associations in this alliance. The alliance is found throughout the western half of the U.S. and southwestern Canada, as well as the Trans-Pecos of Texas and the western portions of the Great Plains, such as in western Oklahoma and the Dakotas. Sites are dry/dry-mesic to xeric, and soils are generally well-drained and coarse-textured. *Pinus ponderosa* often dominates these woodlands, but codominant species may include *Pseudotsuga menziesii*, other *Pinus* species, and species of *Juniperus, Abies*, or *Picea*. The understory ranges from dense shrub or graminoid layers to barren rock. The associated plant species vary with changes in geography and environmental conditions. Associated trees include species of *Pinus, Quercus, Juniperus, Abies, Pseudotsuga, Populus*, and *Picea*. Shrubs can include species of *Arctostaphylos, Artemisia, Cercocarpus, Ceanothus, Symphoricarpos, Physocarpus, Rosa, Purshia*, and others. Important graminoids include species of *Carex, Elymus, Poa, Festuca, Muhlenbergia, Piptochaetium*, and many others.

2. Deciduous Forests and Woodlands

***I.B.2.N.a.8 Acer saccharum - Tilia Americana - (Quercus rubra)* forest alliance**

This alliance, found in the midwestern United States, forms the westernmost portion of the mesic deciduous forests that occupy much of the eastern United States. Stands in this alliance have a moderately dense to dense tree canopy dominated by some combination of *Acer saccharum, Quercus rubra,* and *Tilia americana*. The latter two species become more prominent constituents of the forest along the drier western edge of the alliance's range. Other common canopy species include *Acer rubrum, Carya* spp., *Celtis occidentalis, Fraxinus pennsylvanica, Quercus alba,* and *Ulmus* spp. *Carpinus caroliniana* (in the southern half of this alliance's range) and *Ostrya virginiana* are characteristic subcanopy trees. The dense canopy tends to inhibit the formation of a significant shrub layer. Scattered shrubs of *Acer spicatum* (in the north), *Corylus americana, Hamamelis virginiana, Ribes* spp., *Sambucus* spp., *Viburnum acerifolium* (in the north), and *Zanthoxylum americanum* may be found in stands of this alliance. Spring ephemerals are a distinctive part of the herbaceous layer, especially in the southern part of this alliance's range. Common herbaceous species include *Anemone quinquefolia, Eurybia macrophylla (= Aster macrophyllus)* (in the north), *Carex pensylvanica, Claytonia* spp., *Dicentra cucullaria, Erythronium spp., Hepatica nobilis var. acuta (= Hepatica triloba), Laportea canadensis, Polygonatum pubescens, Sanicula odorata (= Sanicula gregaria), Trillium grandiflorum, and Uvularia grandiflora.*

Stands of this alliance are found on well-drained, nutrient-rich, loamy soils. In the southern part of the alliance's range, stands are often found on ravine slopes where the microclimate is more mesic than the surrounding uplands. This alliance is very intolerant of fire. Thus, along the western edge of its range, stands are found on sites protected from fire, such as the lee side of waterbodies or where topographic features inhibit the spread of fire.

I.B.2.N.a.27 Quercus alba - (Quercus rubra, Carya spp.) forest alliance

This alliance is widely distributed in the eastern United States and portions of adjacent Canada and includes dry mesic to mesic upland oak forests dominated by *Quercus alba* and/or *Quercus rubra*, with or without *Carya* species. Stands are 15-25 m tall, with a closed, deciduous canopy. The shrub and herbaceous strata are typically well-developed. *Quercus alba* usually dominates the stands, either alone or in combination with *Quercus rubra* (especially on moister sites) and sometimes *Quercus velutina* (especially on drier sites). Some associations in this alliance are dominated by *Quercus rubra,* although *Quercus alba* is usually also a canopy component. *Carya* species (particularly *Carya alba, Carya glabra* or *Carya ovata*) are typically common either in the canopy or subcanopy. In the southeastern United States, this alliance covers dry-mesic forests of the Piedmont, low Appalachian Mountains, and the Cumberland and Interior Low Plateau, and mesic oak-hickory forests of the Blue Ridge and the interior highlands of the Ozarks and Ouachita Mountains. Associated species in the southeastern United States include *Carya glabra, Carya ovata, Carya alba, Fraxinus americana, Acer rubrum, Acer leucoderme, Cornus florida, Nyssa sylvatica, Ostrya virginiana, Calycanthus floridus, Pyrularia pubera, Tilia americana var. caroliniana, Oxydendrum arboreum,* and others. This alliance is found throughout the midwestern United States on moderately rich,

upland sites. Typical associates include *Fraxinus americana, Ulmus americana, Tilia americana, Acer saccharum, Acer rubrum,* and more locally, *Quercus macrocarpa* and *Quercus ellipsoidalis*.

Stands are found on gentle to moderately steep slopes on uplands and on steep valley sides. The soils are moderately deep to deep and vary from silts to clays and loams. The parent material ranges from glaciated till to limestone, shale, sandstone and other bedrock types. In the midwestern United States, many stands are succeeding to types dominated by *Acer saccharum, Tilia americana, Acer rubrum,* and other mesic tree associates. This succession may be delayed by fire and grazing. In the eastern and southeastern United States, *Liriodendron tulipifera, Fraxinus americana, Acer rubrum,* and other mesic associates often increase after disturbances, such as clearcutting or windstorms, especially in the absence of fire.

I.B.2.N.a.33 Quercus macrocarpa forest alliance

This alliance is restricted to the northern Great Plains and the Black Hills. The canopy can be moderately closed to closed but is often relatively open for a forest alliance. The overstory of this alliance is usually dominated by *Quercus macrocarpa,* although in some elements *Tilia americana* is a codominant. Associated trees include *Ulmus americana, Fraxinus pennsylvanica,* and *Betula papyrifera* throughout its range, and *Pinus ponderosa* in the Black Hills. There is a subcanopy of *Ostrya virginiana, Juniperus virginiana,* and small overstory species. In the eastern portion of its range, *Juglans nigra, Populus tremuloides,* and *Celtis* spp. are often found in the canopy and subcanopy. A shrub layer may be present. It is usually made up of species 0.5-2 m tall, such as *Symphoricarpos occidentalis, Prunus virginiana, Ribes* spp., *Amelanchier alnifolia, Corylus cornuta,* and *Corylus americana*. Smaller shrubs like *Mahonia repens* and *Rosa* spp. are also commonly found in this alliance. The herbaceous layer typically contains *Aralia nudicaulis, Caulophyllum thalictroides, Elymus virginicus, Carex* spp., *Maianthemum stellatum,* and *Viola* spp.

Quercus macrocarpa Forest Alliance (A.245) is found on rolling hills, mountain slopes (in the Black Hills), and along watercourses. These topographic positions provided some protection from the fires that regularly occurred in the surrounding grasslands. In the drier parts of its range, this alliance is predominantly found on north-facing slopes or along watercourses where the microclimate is more mesic. The soils of this alliance tend to be deep, loamy, and moderately well-drained to well-drained.

I.B.2.N.b.3 Betula papyrifera forest alliance

This alliance is found in the Black Hills, Great Lakes area, and northern New England. The canopy is moderately closed to closed and tree density can be high. The dominant tree, *Betula papyrifera*, does not cast dense shade and thus there is usually a prominent subcanopy or shrub layer. The subcanopy, and most other tree reproduction, is composed largely of more shade-tolerant tree species such as *Abies balsamea* (near the western Great Lakes), *Acer rubrum, Acer saccharum, Betula alleghaniensis, Picea glauca* (near

the western Great Lakes), *Pinus banksiana* (in northwestern Ontario), *Pinus ponderosa* (in the western Great Plains), and *Quercus rubra*. These trees may be found in small amounts in the canopy, especially in older stands of this alliance. *Populus tremuloides* and *Populus grandidentata* are common canopy associates, as well, although in the range of *Populus tremuloides* this alliance is restricted to stands where *Betula papyrifera* comprises >90% of the deciduous canopy. *Amelanchier* spp. and *Corylus cornuta* are common shrubs across the range of this alliance. In the western Great Lakes area, *Acer spicatum, Diervilla lonicera, Rosa acicularis*, and *Vaccinium* spp. are typical shrubs. The herbaceous layer contains species such as *Actaea rubra, Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Clintonia borealis* (in the western Great Lakes area), *Maianthemum canadense*, *Schizachne purpurascens* (in the Great Plains), and *Trientalis borealis* (in the western Great Lakes area).

This alliance is an early successional forest and occurs on a variety of sites. It is most often found on well-drained or rapidly drained, fresh to moist soil. Stands can be found on flat to moderately sloping areas, generally, although they may occur on steep slopes in the Great Plains. The soil texture is usually loam.

II.B.2.N.a.20 Quercus macrocarpa woodland alliance

This alliance is widespread in the northern and central Great Plains. All of its associations are found exclusively or primarily in the midwestern United States west of the Mississippi River. The canopy is open to moderately closed and usually dominated by *Quercus macrocarpa*. Common associates in the canopy are *Quercus muehlenbergii* in the southeast portion, *Fraxinus pennsylvanica, Tilia americana*, and *Populus tremuloides* in the northern half, and *Carya* spp. and *Ulmus* spp. in the eastern part of the alliance's range. *Pinus ponderosa* can occur in some stands at the extreme western limit of this alliance's range. A shrub layer 1-2 m tall is often present, especially in the northern half of the range of this alliance. Dominant shrubs include *Amelanchier alnifolia, Corylus americana, Corylus cornuta, Prunus virginiana*, and *Symphoricarpos occidentalis*. The herbaceous layer is dominated by graminoids. These can range from tall grasses, such as *Andropogon gerardii, Panicum virgatum*, and *Sorghastrum nutans*, to mid grasses, such as *Schizachyrium scoparium* and *Hesperostipa spartea (= Stipa spartea)*, to short graminoids, such as *Carex inops ssp. heliophila*. This alliance is found in a landscape dominated by prairie communities. The woodland is typically found on rolling hills, lower mountain slopes (in the Black Hills), or along ravines. These topographic positions provided some protection from the fires that regularly occurred on the surrounding prairies in pre-European times. However, some fire was necessary to prevent the woodland physiognomy from closing and becoming a forest. This was especially important in the more mesic eastern portions of this alliance's range. In Nebraska, the soils are fertile, moderately well-drained to well-drained, and deep.

3. Juniper Woodlands

II.A.4.N.a.8 Juniperus scopulorum woodland alliance

This alliance includes woodlands dominated by *Juniperus scopulorum*, occurring in seven states from the northern and central Rocky Mountains, east to the Great Plains. Many associations in this alliance occur in the landscape above dry prairies and below communities dominated by *Pinus ponderosa* or *Pseudotsuga menziesii*. In southwestern North Dakota and western South Dakota, *Juniperus scopulorum* dominates low-stature woodlands, where associated species can include *Pinus ponderosa, Pseudotsuga menziesii, Artemisia* spp., *Cercocarpus montanus, Purshia tridentata, Rhus trilobata, Bouteloua gracilis, Festuca idahoensis, Piptatherum micranthum (= Oryzopsis micrantha), Pseudoroegneria spicata,* and *Hesperostipa comata (= Stipa comata).* This alliance is extremely limited in the southeastern United States, occurring in northwestern Texas in the escarpment area between the High Plains and Rolling Plains, where *Juniperus scopulorum* forms nearly pure stands on mesic slopes and in canyons. *Juniperus scopulorum* woodlands are typically found on gentle to steep, north-facing slopes, rock outcrops, and bluffs, and are best developed on calcareous soils. Soils are typically thin, stony, clay or clay loam, commonly with exposed bedrock. The soil parent material varies with community association but may be limestone, gneiss, sandstone, scoria, or shale.

4. Sandsage Shrubland

***III.A.4.N.a.4 Artemisia filifolia* shrubland alliance**

This alliance includes *Artemisia filifolia*-dominated shrublands occurring mostly in the southern Great Plains, but associations are distributed as far north as the Black Hills, south to the Trans-Pecos of western Texas, as well as on the Colorado Plateau. These shrublands typically occur on flat, hummocky, or rolling terrain, as well as on partially stabilized dunes and sand sheets. Soils supporting these communities have low water retention and nutrient availability, and are typically sand or loamy sand, primarily of aeolian origin, but include sand deposits derived from sandstone residuum and cinder deposits. Less xeric sites tend to be more grass-dominated. In western Kansas and eastern Colorado, this alliance is found downwind of major waterways where alluvial sand is blown. In Texas these shrublands occur over sandy soils in the Rolling and High Plains and on gypsum dunes in the Trans-Pecos. On the Colorado Plateau, stands occur on a variety of sites including pockets of sand below sandstone cliffs, dunes and sheets of sand or cinder, floodplain terraces and alluvial fans. Vegetation cover is sparse to moderately dense, with a shrub stratum approximately 1 m tall, dominated by *Artemisia filifolia*, interspersed with areas of bare substrate and scattered tall or mid grasses. Species composition will vary with geography, precipitation, disturbance, and soil texture. Associated species may include *Andropogon hallii, Artemisia frigida, Bouteloua curtipendula, Bouteloua gracilis, Carex duriuscula (= Carex eleocharis), Calamovilfa gigantea, Calamovilfa longifolia, Calylophus serrulatus, Carex inops ssp. heliophila, Helianthus petiolaris, Hesperostipa comata (= Stipa comata), Heterotheca villosa var. villosa, Ipomoea leptophylla, Lathyrus polymorphus, Lygodesmia juncea, Opuntia* spp., *Penstemon buckleyi, Prosopis glandulosa, Prunus angustifolia, Psoralidium lanceolatum, Schizachyrium scoparium, Sporobolus giganteus, Sporobolus cryptandrus,* and *Yucca glauca*. Communities associated with gypsum dunes have many gypsophiles

or gypsum endemics. Colorado Plateau shrub associates include *Ericameria nauseosa, Ephedra torreyana, Ephedra viridis, Gutierrezia sarothrae, Atriplex canescens*, and the graminoids *Muhlenbergia pungens, Sporobolus cryptandrus, Bouteloua eriopoda*, and *Achnatherum hymenoides*.

5. Sandhills Upland Prairie

***V.A.5.N.a.3 Andropogon hallii* herbaceous alliance**

This alliance includes herbaceous vegetation with *Andropogon hallii*, occurring in the Great Plains from the United States-Canada border south to Texas. It is dominated by tall and midgrass species, with shortgrass species becoming important in the western portion of its range. *Andropogon hallii* is usually dominant or codominant. *Calamovilfa longifolia* is present to codominant in most stands south of the South Dakota-Nebraska border. *Hesperostipa comata (= Stipa comata), Koeleria macrantha, Schizachyrium scoparium, Bouteloua gracilis, Bouteloua hirsuta, Eragrostis trichodes, Pascopyrum smithii*, and *Sporobolus cryptandrus* are typical grasses in stands of this alliance. Upland sedges are also very common, especially *Carex filifolia*, *Carex inops ssp. heliophila*, and *Carex duriuscula (= Carex eleocharis).* Although graminoids are overwhelmingly dominant, several species of forbs can be found in many stands of this alliance. Some of the more common forbs are *Ambrosia psilostachya*, *Psoralidium* spp., *Ipomoea leptophylla, Liatris punctata*, and *Tradescantia occidentalis*. There may be widely scattered low shrubs, including *Rosa woodsii, Prunus pumila var. besseyi*, and *Yucca glauca*. In west Texas common associates on deep sands include *Panicum havardii, Sporobolus giganteus*, and *Calamovilfa gigantea*. Stands of this alliance occur on sand deposits, usually on gentle to steep slopes but sometimes on flat ground. The soils are sand, loamy sand, or sandy loam. They can be poorly to moderately well-developed. There is little runoff or evaporation because moisture quickly sinks into the coarse soil. Soil near the surface is consequently dry throughout much of the year, but moisture is present further down, favoring deep-rooting species such as *Andropogon hallii* and *Calamovilfa longifolia*. Wind sometimes scours sand and vegetation from small areas, creating blowouts. These bare spots are initially colonized by species that are uncommon in this alliance, such as *Muhlenbergia pungens* and *Redfieldia flexuosa*. Eventually, these blowouts succeed to one of the communities in the V.A.5.N.a *Andropogon hallii Herbaceous Alliance (A.1193).* These grasslands occur on semi-stabilized quartz sand dunes in eastern Trans-Pecos Texas, where they form landscape mosaics with *Quercus havardii* shrublands, wetland dune swales, and sparsely vegetated dunes. The rare plant, *Penstemon haydenii*, an endemic to dune blowouts in the sandhills of Nebraska, may be endangered by the decline in habitat because of fire suppression and low to moderate stocking rates (Harrison 1980).

6. Lowland Tallgrass Prairie

***V.A.5.N.a.1 Andropogon gerardii - (Calamagrostis canadensis, Panicum virgatum)* herbaceous alliance**

This alliance, found in central North America, is made up of mesic to wet-mesic tall grasslands. The dominant lifeforms in stands of this alliance are tall grasses, although forbs can be abundant as well. Trees and shrubs can occur as scattered individuals or clumps. Vegetation tends to be dense and between 1.5 and 2 m tall. The dominant species across the range of this alliance is *Andropogon gerardii*. Other species that are common to abundant throughout the alliance's range are *Calamagrostis canadensis, Carex* spp., *Panicum virgatum, Sorghastrum nutans*, and *Spartina pectinata*. *Muhlenbergia*

richardsonis may be diagnostic of this alliance in the northeastern Great Plains, and *Pascopyrum smithii* is common in the western portion of this alliance's range. *Elymus canadensis* is abundant in Wisconsin. *Schizachyrium scoparium* can be found on sites subject to seasonal drought. Forbs are abundant, especially farther east in this alliance's range. Among these forbs are Asteraceae spp., *Helianthus grosseserratus, Lysimachia quadrifolia, Pycnanthemum virginianum, Ratibida columnifera, Ratibida pinnata, Thalictrum dasycarpum*, and *Zizia aurea*.

Stands of this widespread alliance occur most frequently on sand to silt loam soils. Some are found on clay loams or silty clays. The sites are typically level to gently sloping, and those with heavier soils often have standing water present in the spring or after heavy rains. Most stands are in the glaciated Midwest and occur on glacial till, outwash, or drift, or on glacial lakeplains. Fires were a common occurrence in stands of this alliance before effective fire suppression activities. In the prolonged absence of fire, woody species usually invade and can become abundant.

V.A.5.N.j.11 Spartina pectinata temporarily flooded herbaceous alliance

This alliance is found primarily in central North America. This description is based on this alliance as it occurs in the Midwest. The vegetation of this alliance is characterized by dense stands of graminoids 1-2 m tall with scattered to very infrequent woody plants. The most abundant species are *Calamagrostis canadensis, Carex aquatilis, Carex atherodes, Carex pellita (= Carex lanuginosa), Carex sartwellii*, and *Spartina pectinata*. In some stands, *Spartina pectinata* can form virtual monocultures. Other common graminoids include *Andropogon gerardii*, *Muhlenbergia richardsonis, Panicum virgatum, Poa palustris* (in the western part of this alliance's range), and *Sorghastrum nutans*. Forbs are abundant and include *Symphyotrichum ericoides (= Aster ericoides), Symphyotrichum novae-angliae (= Aster novae-angliae), Helianthus grosseserratus, Lythrum alatum, Pycnanthemum virginianum*, and *Thalictrum dasycarpum*. Shrubs and small trees are infrequent in the south and west but are often present in the north and east. Among these *Cornus* spp., *Fraxinus pennsylvanica*, and *Salix* spp. are typical.

This alliance occurs in the Southeast only as small disjunct occurrences in Oklahoma, the Upper West Gulf Coastal Plain of Kentucky, and possibly extending a short distance into adjacent Tennessee. Associates in Kentucky and Tennessee occurrences may include *Helianthus angustifolius, Viola sagittata, Cephalanthus occidentalis, Andropogon gerardii, Dichanthelium scoparium, Schizachyrium scoparium, Sorghastrum nutans, Tripsacum dactyloides, Asclepias tuberosa, Baptisia alba var. macrophylla (= Baptisia leucantha), Crotalaria sagittalis, Dichanthelium clandestinum, Agalinis fasciculata, Helianthus grosseserratus, Helianthus mollis, Heterotheca villosa (= Chrysopsis villosa), Spiranthes cernua, Rhexia mariana, Rudbeckia hirta, Rudbeckia subtomentosa*, and *Viola sagittata*. In Kentucky, this vegetation is at present probably seasonally saturated; it was presumably formerly seasonally flooded. In Oklahoma, this alliance contains *Spartina pectinata* with *Eleocharis montevidensis* and *Carex* spp.

Stands of this wide-ranging alliance are found on level to gently sloping sites with sand, loam, or clay soils. They occur near lakes or rivers or in depressions. All sites are typically flooded for part of the winter and spring. In the east, stands can experience droughty conditions in the summer and fall (Comer et al. 1995) while in the south and central portion of this alliance's range they can remain saturated for much of the growing season.

7. Upland Tallgrass Prairie

***V.A.5.N.a.2 Andropogon gerardii - (Sorghastrum nutans)* herbaceous alliance**

This alliance is a very widespread mesic tallgrass prairie, which occurs in central North America. Most communities have moderately dense to dense vegetation dominated by graminoids 1-2 m tall. *Andropogon gerardii* is dominant across this alliance's range. Other abundant species include *Bouteloua curtipendula, Pascopyrum smithii* (in the western portions of this alliance's range), *Schizachyrium scoparium, Sorghastrum nutans* (in the center and east), *Sporobolus heterolepis* (in the Great Plains), and *Hesperostipa spartea (= Stipa spartea)* (in the northern Great Plains). In Montana, *Festuca idahoensis* (at its eastern range limits) is codominant in an association in this alliance. Forbs are abundant in stands of this alliance, especially in the more humid East. Among these are *Aletris farinosa* (in the East), Asteraceae spp., *Echinacea pallida, Helianthus grosseserratus, Liatris pycnostachya, Phlox pilosa, Ratibida pinnata, Silphium laciniatum* (in the center), and *Solidago* spp. *Galium boreale* and *Oxalis* sp. are more common in northern tallgrass prairies than in southern. Trees and tall shrubs are infrequent in high-quality stands, especially in the Great Plains. Among those that may be found are scattered *Symphoricarpos occidentalis* (in the northern Great Plains), *Rhus* spp., and *Quercus macrocarpa* (in the central and eastern portions of this alliance's range).

Stands of this alliance occur on flat to rolling topography. In the West and South, stands are found on lower slopes and valleys that receive extra moisture. On the western plains, the alliance can be found in areas with gravelly soil where water infiltrates below the surface but is held by an impermeable subsurface layer. Floodplain and toe-slope soils are deep and fine-textured, whereas the foothills soils are coarse-textured, often with cobble-sized rocks. In the northwestern plains, this alliance in found on lower slopes of hills, creeks and creek terraces. Soils are generally finer-textured (clay loams). In other parts of this alliance's range, stands can be found on many topographic positions. Soils are generally fertile, deep, slightly acidic, and moderately to well-drained. In glacial lakeplains near the Great Lakes, soils tend to be more poorly drained. Soils moisture is generally mesic, although it can vary from dry-mesic to wet-mesic. Soil texture can range from clay loams to sands.

In the far western extent, vegetation in this alliance is a relict true prairie found along the eastern foothills and floodplains of the Front Range of the Rocky Mountains.

Andropogon gerardii is the major diagnostic species, as well as *Sorghastrum nutans, Panicum virgatum, Schizachyrium scoparium, Sporobolus heterolepis*, the other common tallgrass prairie species. *Bouteloua curtipendula* and *Pascopyrum smithii* are also common grasses. The alliance is found in mesic areas along the Colorado Front Range. Landform position and soil texture dictate potential sites, as precipitation is generally not adequate to support stands of this alliance. In localized areas, hydrological processes of the site enhance the soil moisture. Along the Front Range, 'relict' true prairie is found along the foothills in parks and on slopes below *Pinus ponderosa* woodlands. Soils are coarse-textured, and runoff and seeps enhance soil moisture. The alliance is also found in floodplains adjacent to streams where the water table is within reach for plant roots.

8. Little Bluestem-Gramma Mixedgrass Prairie

***V.A.5.N.c.20 Schizachyrium scoparium - Bouteloua curtipendula* herbaceous alliance**

This alliance is mainly in the Great Plains but extends eastward to the Mississippi River and even beyond on dry sites. Across its range, the vegetation is dominated by mid grasses. The vegetation cover can be moderately sparse to dense. Tall grasses and short grasses contribute substantially to the vegetation cover in most communities. The proportions of these two lifeforms are typically negatively correlated with each other and vary with the specific community and site. The tall grasses are more prevalent on sandier soils and on moderate or gentle lower slopes. The short grasses tend to be more common on flat uplands or steep slopes with heavier soils. The dominant species are the nominal species, *Schizachyrium scoparium* and *Bouteloua curtipendula*. *Bouteloua gracilis* and *Bouteloua hirsuta* are common associates across this alliance's range. Other graminoids that are present to codominant are *Aristida purpurea, Andropogon gerardii, Andropogon hallii* (on sandier soils), *Buchloe dactyloides* (in the south and west of this alliance's range), *Calamovilfa longifolia* (on sandier soils), *Carex duriuscula (= Carex eleocharis), Carex inops ssp. heliophila*, and *Carex filifolia* (all three Carices in the north), *Koeleria macrantha, Muhlenbergia cuspidata, Pascopyrum smithii, Pseudoroegneria spicata* (in the northwest), *Sporobolus cryptandrus, Sporobolus compositus var. compositus* (in the south), *Sporobolus heterolepis* (in the east), *Hesperostipa spartea (= Stipa spartea)*, and *Hesperostipa comata (= Stipa comata)* (in the north). There are a great number of forbs that occur in communities of this alliance, although they do not make up a large part of the herbaceous canopy. *Amorpha canescens, Symphyotrichum oblongifolium (= Aster oblongifolius), Symphyotrichum ericoides (= Aster ericoides), Ambrosia psilostachya, Dalea purpurea, Echinacea angustifolia, Gaura coccinea, Liatris punctata, Lygodesmia juncea, Ratibida columnifera*, and *Sphaeralcea coccinea* are found in many communities in this alliance. Shrubs are not abundant, but *Symphoricarpos occidentalis, Yucca glauca, Artemisia frigida*, and *Rosa* spp. may be scattered among the herbaceous species.

Communities within this alliance are most commonly found on slopes but can occur on level ground. Loam and silt soils appear to be the most common; however, in the southwest of this alliance's range, some communities are predominantly on sandy soils. Communities in the central and western portions of this alliance's range usually occur on

medium to deep soils. Communities in the eastern portion of this alliance's range are found almost exclusively on steep south- or west-facing slopes. These slopes have thinner soils, greater insolation, and greater runoff than surrounding areas. These factors inhibit the growth of taller grasses and woody species and allow the midgrass communities to be maintained. Most of these sites are small.

***V.A.5.N.c.29 Hesperostipa comata - Bouteloua gracilis* herbaceous alliance**

This alliance is widespread across upland sites in the northern Great Plains. Its communities tend to be the climax communities on fertile dry-mesic sites across much of its range. It is dominated by mid and short grass species; woody species do not regularly achieve prominence. Few of the species exceed 1 m while many, including *Bouteloua gracilis*, do not exceed 50 cm. The most abundant species are *Hesperostipa comata (= Stipa comata)* and *Bouteloua gracilis*. On more mesic sites *Hesperostipa comata* is predominant, while on areas that are drier or subject to light grazing *Bouteloua gracilis* takes precedence. Other graminoid species that are commonly found in communities of this alliance are *Aristida purpurea var. longiseta (= Aristida longiseta), Carex duriuscula (= Carex eleocharis), Carex filifolia, Koeleria macrantha, Nassella viridula*, and *Pascopyrum smithii*. Sites in the southern half of the range of this alliance may have significant amounts of *Bouteloua curtipendula*. Forbs are common but not usually abundant. Forb species that are regularly found are *Artemisia frigida, Gaura coccinea, Gutierrezia sarothrae (= Gutierrezia diversifolia), Liatris punctata, Sphaeralcea coccinea (= Malvastrum coccineum), Phlox hoodii*, and *Sphaeralcea coccinea*. The clubmoss *Selaginella densa* is present in many stands in this alliance. Scattered shrubs are sometimes present. These include *Prunus virginiana, Rhus aromatica*, and *Symphoricarpos occidentalis*. In the western and southwestern portions of its range, *Cercocarpus montanus* may be found where this alliance occurs on slopes.

Communities in this alliance are found on flat to moderately steep topography. The soils are sandy loam, loam, or sometimes clay loam. They are often well-developed and derived from either glacial deposits or sometimes limestone or sandstone (Hanson and Whitman 1938, Coupland 1950, Hanson 1955).

9. Western Wheatgrass Mixedgrass Prairie

***V.A.5.N.c.27 Pascopyrum smithii* herbaceous alliance**

This alliance is common and widespread in the Great Plains, especially the northern portions, and parts of the intermountain western U.S. and possibly Canada. The communities in it range from dry or dry-mesic to wet-mesic. Mid grasses are the dominant vegetation in most communities, although short grasses and sedges can be codominant. The vegetation tends to be denser where the mid grasses are predominant and more open where shorter graminoids are abundant. The mid grasses grow to 0.5-1.0 m on favorable sites, while the short grasses and sedges are less than 0.5 m tall. The most abundant midgrass is *Pascopyrum smithii*. Common associates include *Hesperostipa comata (= Stipa comata), Nassella viridula, Koeleria macrantha, Schizachyrium scoparium, Hesperostipa spartea (= Stipa spartea)*, and *Poa* spp. In the drier

communities of this alliance *Bouteloua gracilis* is the most common shortgrass. Other short graminoids typically found in the drier communities include *Carex inops ssp. heliophila, Carex duriuscula (= Carex eleocharis), Carex filifolia*, and *Bouteloua curtipendula* (in the northern portion of this alliance's range), *Aristida purpurea*, and *Buchloe dactyloides* (in the southern half of this alliance's range). In the wetter communities within this alliance, *Distichlis spicata, Hordeum jubatum, Elymus trachycaulus*, and *Iva annua* are common. Forbs and shrubs are generally minor components of communities within this alliance. If shrubs are present they are rarely taller than 1 m. Some forbs that are usually scattered about are *Gaura coccinea, Sphaeralcea coccinea, Amorpha canescens, Astragalus* spp., and *Tragopogon dubius*. Shrubs include *Symphoricarpos occidentalis, Artemisia cana, Artemisia frigida*, and *Opuntia* spp.

Communities within this alliance occur on several different soil types. The soil is most often clay or clay loam, however. it can be loam or sandy loam. In the east and central part of this alliance's range, these communities can be found on flat or rolling uplands, hillslopes, or along streams or depressions. In the western part of this alliance's range, its communities are found where local conditions are wetter than the average. This includes such areas as the base of slopes or along rivers or streams.

10. Western Shortgrass Prairie

***V.A.5.N.e.9 Bouteloua gracilis* herbaceous alliance**

This widespread alliance includes grasslands dominated or codominated by *Bouteloua gracilis*, and is found across the Great Plains from near the United States-Mexico border to southern Canada. The bulk of this alliance occurs in the western Great Plains and southwestern United States, but one extensive and one restricted community occur in the midwestern United States. Stands are found on flat to rolling uplands such as plains, plateaus, foothills, valley bottoms, and sand sheets and dunes with a variety of soil types. Surface soils can range from sandy loam to loamy clay. Subsoils are often finer than the surface soils and may be somewhat impermeable to water. The upland position and heavy soils often result in much of the precipitation running off, and drought conditions prevail for much of the year. This trend is more pronounced in the northern part of this alliance. In the southern portions of its range, the greater temperatures and lack of precipitation allow this shortgrass alliance to occur on coarser soils.

Vegetation within this alliance is dominated by short grasses with mid grasses present to codominant. Mid grasses are more abundant in the eastern portions of this alliance. Coverage by short grasses is moderate to almost complete. The foliage is typically 7-19 cm tall with flowering stalks reaching 45 cm. Midgrass species are usually dwarfed because of dry conditions and may not exceed 0.7 m except in especially wet years. Shrubs are very rare except in the southern parts of this alliance's range where scattered desert shrubs may occur (<10% cover). Typical codominant species are *Buchloe dactyloides* or *Pleuraphis jamesii (= Hilaria jamesii)*. Other common to codominant graminoids may include *Aristida purpurea, Bouteloua curtipendula, Bouteloua hirsuta,*

Carex filifolia, Carex inops ssp. heliophila, Carex duriuscula (= Carex eleocharis), Elymus elymoides, Hesperostipa neomexicana (= Stipa neomexicana), Pascopyrum smithii, Sporobolus cryptandrus, or *Sporobolus airoides*. There are a variety of forbs found in stands of this alliance, although they do not contribute greatly to the total vegetation cover. Common forbs include *Astragalus* spp., *Gaura coccinea, Machaeranthera pinnatifida var. pinnatifida, Opuntia polyacantha, Plantago patagonica, Psoralidium tenuiflorum, Ratibida columnifera,* and *Sphaeralcea coccinea*.

11. Barren/Sand/Outcrop

VII.A.1.N.a.6 **Open cliff sparse vegetation alliance**

This is technically not an alliance. It is a placeholder for a group of sparsely vegetated associations that do not have adequate vegetation descriptions, but do share certain substrate characteristics.

VII.A.1.N.a.8 **Rock outcrop sparse vegetation alliance**

This is technically not an alliance. It is a placeholder for a group of sparsely vegetated associations that do not have adequate vegetation descriptions, but do share certain substrate characteristics.

VII.C.3.N.b.7 **Large eroding bluffs sparse vegetation alliance**

This is technically not an alliance. It is a placeholder for a group of sparsely vegetated associations that do not have adequate vegetation descriptions, but do share certain substrate characteristics.

12. Agricultural Field

13. Open Water

14. Fallow Agricultural Field

15. Aquatic Bed Wetland

V.A.5.N.c.27 Pascopyrum smithii **- intermittently flooded herbaceous alliance**

This alliance, found in the southern Great Plains, occurs on the edges of playa lakebeds. This description is strongly based on the part of the alliance found in the Midwest. Perennial graminoids and forbs under 1 m tall dominate this alliance. *Pascopyrum smithii* is the most abundant and consistent throughout the range of this alliance, though in some places *Agrostis hyemalis, Elymus virginicus*, and *Hordeum jubatum* may be abundant. *Buchloe dactyloides* is often common in grazed sites. Early-season ephemeral annuals, such as *Alopecurus carolinianus, Elatine rubella*, *Myosurus minimus*, and *Veronica peregrina*, are ubiquitous, and *Limosella aquatica* and *Plagiobothrys scouleri* may be common. Perennial forbs are conspicuous in some places, including *Ambrosia* spp., *Phyla cuneifolia (= Lippia cuneifolia), Oenothera canescens*, and *Vernonia fasciculata*. Stands of this alliance often occur at the margin of playa and pond marsh communities and grade into upland tallgrass and mixedgrass prairie. The extent and species

composition of stands vary with water levels from year to year. Species diversity is low to moderate.

Stands of this alliance occur on nearly level ground and in very shallow depression in uplands. Soils are somewhat poorly drained, silty clay loams underlain by a clay pan. They are usually formed from loess. These areas may be temporarily flooded in winter and early spring but are usually dry by early summer.

V.A.5.N.j.5 Distichlis spicata - (Hordeum jubatum) temporarily flooded herbaceous alliance

This alliance occurs in the Great Plains and western United States. This description is based on those communities found in the Great Plains. Dominant vegetation is a mixture of short and mid grasses and can have moderately sparse to dense cover. Vegetation height and cover and species diversity tend to vary inversely with salinity. *Distichlis spicata* is the most abundant species in stands across the range of this alliance. Other species found in the Great Plains include *Grindelia squarrosa* (in the northern portion of this alliance's range), *Hordeum jubatum, Iva annua, Bassia scoparia (= Kochia scoparia), Pascopyrum smithii* (on less saline stands), *Poa arida, Puccinellia nuttalliana* (in the north), *Salicornia rubra* (on more saline stands), *Schoenoplectus maritimus (= Scirpus maritimus), Sporobolus airoides,* and *Suaeda calceoliformis* (on more saline stands). Widely scattered low shrubs, especially *Atriplex patula* and *Sarcobatus vermiculatus,* can be found on sites in the western and central Great Plains. Trees are not found on stands of this alliance.

Stands of this alliance are found in depressions and along the margins of saline lakes and ponds. Most of the stands are flooded or saturated for a few weeks in the spring and after heavy rains; some have water present for most of the growing season. The soils range from sand to clay and from moderately well-drained to poorly drained. Most are deep and moderately to strongly saline. Stands that have good drainage in the surface soils usually have a deeper impermeable or slowly permeable layer that allows retention of water. Fires which spread from upland prairies may have moved through the more dense stands, but many stands did not have sufficient vegetation to support fires.

V.A.5.N.j.12 Polygonum spp. - Echinochloa spp. temporarily flooded herbaceous alliance

This alliance, found in the southern Great Plains, occurs in temporarily flooded playa lakebeds. Annual herbaceous graminoids and forbs mostly less than 1 m tall dominate the exposed mud flats of this alliance. Species composition and extent of stands vary from year to year. *Coreopsis tinctoria, Echinochloa* spp., *Eleocharis engelmannii, Lindernia dubia, Polygonum* spp., and *Rumex stenophyllus* are typical species of this alliance. In sites which have been modified to hold water longer, i.e., drainage ditches and re-use pits, perennials such as *Eleocharis palustris* and *Marsilea vestita* may dominate. The frequent water fluctuations and thick clay pan prevent establishment of most perennial hydrophytes typical of pond marshes.

Stands of this alliance occur in shallow depressions in nearly level ground. Soils are silty clay loam underlain by a clay pan. These areas are temporarily or sometimes seasonally flooded by ponded rainwater and surface runoff. Sites dry out by mid to late summer in all but the wettest years.

***V.C.2.N.a.14 Potamogeton spp. - Ceratophyllum spp. - Elodea spp.* permanently flooded herbaceous alliance**

This broadly defined alliance is found throughout the southeastern and midwestern United States, as well as several Great Plains states and Canadian provinces. The vegetation is generally found in open water less than 2 m deep with emergent cover of floating-leaved aquatics up to 25% and submerged aquatics at least 25%. Individual stands may be dominated by a single species, leading to any number of dominance types, and until the patterns are better understood, these are all grouped together in one alliance. In northern parts of the range, stands may be dominated by *Potamogeton* spp., including *Potamogeton natans, Stuckenia pectinata (= Potamogeton pectinatus), Potamogeton zosteriformis*, and *Potamogeton richardsonii*; *Ceratophyllum* spp., including *Ceratophyllum demersum*; *Elodea* spp., including *Elodea canadensis*; and *Myriophyllum* spp., including *Myriophyllum verticillatum*. Other associated species include emergents such as *Zizania palustris, Utricularia macrorhiza, Nuphar* spp., *Ranunculus longirostris, Chara* spp., *Lemna* spp., *Spirodela polyrrhiza*, and *Vallisneria americana*. *Potamogeton nodosus* and *Ceratophyllum demersum* are reported from stands in Oklahoma. Other associated species in the southern part of the range may include *Potamogeton diversifolius, Potamogeton nodosus, Ceratophyllum demersum, Stuckenia pectinata, Elodea canadensis, Elodea nuttallii, Cabomba caroliniana, Heteranthera dubia, Hottonia inflata, Myriophyllum pinnatum*, and *Proserpinaca* spp. The exotic *Egeria densa* may also be present and may crowd out native components.

Stands are often found in sheltered bays of lakes and streams. Water hardness may play an important role in species patterns within this group.

16. Emergent Wetland

***V.A.5.N.j.5 Distichlis spicata - (Hordeum jubatum)* temporarily flooded herbaceous alliance**

This alliance occurs in the Great Plains and western United States. This description is based on those communities found in the Great Plains. Dominant vegetation is a mixture of short and mid grasses and can have moderately sparse to dense cover. Vegetation height and cover and species diversity tend to vary inversely with salinity. *Distichlis spicata* is the most abundant species in stands across the range of this alliance. Other species found in the Great Plains include *Grindelia squarrosa* (in the northern portion of this alliance's range), *Hordeum jubatum, Iva annua, Bassia scoparia (= Kochia scoparia), Pascopyrum smithii* (on less saline stands), *Poa arida, Puccinellia nuttalliana* (in the north), *Salicornia rubra* (on more saline stands), *Schoenoplectus maritimus (= Scirpus maritimus), Sporobolus airoides*, and *Suaeda calceoliformis* (on more saline stands). Widely scattered low shrubs, especially *Atriplex patula* and *Sarcobatus*

vermiculatus, can be found on sites in the western and central Great Plains. Trees are not found on stands of this alliance.

Stands of this alliance are found in depressions and along the margins of saline lakes and ponds. Most of the stands are flooded or saturated for a few weeks in the spring and after heavy rains; some have water present for most of the growing season. The soils range from sand to clay and from moderately well-drained to poorly drained. Most are deep and moderately to strongly saline. Stands that have good drainage in the surface soils usually have a deeper impermeable or slowly permeable layer that allows retention of water. Fires which spread from upland prairies may have moved through the more dense stands, but many stands did not have sufficient vegetation to support fires.

V.A.5.N.k.33 Typha spp. - (Schoenoplectus spp., Juncus spp.) seasonally flooded herbaceous alliance

This alliance, found in the midwestern United States and the central provinces of Canada, is characterized by emergent graminoids and forbs in shallow marshes. Shallow aquatics like *Sparganium eurycarpum* or *Sagittaria latifolia* may be more diagnostic than *Typha* spp. or *Schoenoplectus* spp. (= *Scirpus* spp.). Other species present include *Carex comosa, Lemna minor,* and *Rumex orbiculatus*. Further work is needed to characterize this alliance.

Shallow marshes have soils that are saturated to inundated by standing water up to 15 cm in depth throughout much of the growing season.

V.A.5.N.k.53 Carex pellita seasonally flooded herbaceous alliance

Vegetation types within this seasonally flooded grassland alliance occur in wet meadows, basins, and sometimes shallow standing water. They are found from the plains (<300 m) and lowlands (1050 m) to moderate (2700 m) elevations in the mountains in low-gradient, trough-shaped, moderately wide valleys with gentle to moderately steep sideslopes. Stands occur in depressions and swales at the saturated edge of stream channels or in standing water. Sites are poorly drained, often flooded during spring runoff, and water levels normally remain in the rooting zone throughout the growing season. Soils are variable, but most commonly mineral with large amounts of organic matter or, more rarely, with thick accumulations of partially decomposed sedges. Streambanks have alluvial soils composed of sand, silt, and clay deposits. This alliance is often characterized by a nearly monotypic cover of 40-90% *Carex pellita (= Carex lanuginosa).* Other graminoid cover is minor, but includes *Carex microptera, Phalaris arundinacea, Calamagrostis stricta, Carex nebrascensis, Juncus balticus, Scirpus microcarpus, Schoenoplectus acutus (= Scirpus acutus),* and *Schoenoplectus pungens (= Scirpus pungens).* Scattered forbs include *Geum macrophyllum, Mentha arvensis, Prunella vulgaris,* and *Potentilla gracilis*.

V.A.5.N.l.6 Schoenoplectus pungens semipermanently flooded herbaceous alliance

This alliance, found in the northern Great Plains, Utah, and Nevada, is made up of graminoid-dominated communities found in saline wetlands. Medium-tall and short graminoids predominate. Woody species are very uncommon. *Schoenoplectus pungens (= Scirpus pungens), Suaeda calceoliformis, Distichlis spicata* (on drier margins), and *Ruppia maritima* are all common species. *Chenopodium incanum, Monolepis nuttalliana*, and *Picradeniopsis oppositifolia* are sometimes abundant on less saline portions of the alliance.

This alliance occurs in depressions and river valleys. The loam to sandy loam soils are deep, poorly drained and formed in alluvium (Steinauer 1989). These soils are slightly to strongly affected by soluble salt. Standing water is at or near the surface for most of the year.

V.A.5.N.l.9 Typha (angustifolia, latifolia) - (Schoenoplectus spp.) **semipermanently flooded herbaceous alliance**

This alliance, found in virtually every state in the United States and probably most Canadian provinces, contains stands dominated by *Typha angustifolia* and/or *Typha latifolia*, either alone or in combination with other tall emergent marsh species. Associated species vary widely; in the Midwest they include many sedges such as *Carex aquatilis, Carex rostrata, Carex pellita (= Carex lanuginosa),* bulrushes such as *Schoenoplectus americanus (= Scirpus americanus), Schoenoplectus acutus (= Scirpus acutus),* and *Schoenoplectus heterochaetus (= Scirpus heterochaetus),* and broad-leaved herbs such as *Thelypteris palustris, Asclepias incarnata, Impatiens capensis, Sagittaria latifolia, Scutellaria lateriflora, Sparganium eurycarpum, Hibiscus moscheutos*, and *Verbena hastata*. Floating aquatics such as *Lemna minor* may predominate in deeper zones.

This alliance is found most commonly along lake margins and in shallow basins, and occasionally in river backwaters. Lacustrine cattail marshes typically have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and a floating mat zone, where the roots grow suspended in a buoyant peaty mat. *Typha angustifolia* can grow in deeper water compared to *Typha latifolia*, although both species reach maximum growth at a water depth of 50 cm. *Typha* often occurs in pure stands, and can colonize areas recently exposed by either natural or human causes. *Lythrum salicaria*, an exotic species from Europe, has become a common associate of many eastern *Typha* marshes. In the Southeast, this alliance is widespread and currently representative of a wide variety of mixed marshes with no clear dominants. Vegetation in this alliance may be natural or semi-natural and includes mixed stands of the nominal species, as well as essentially monospecific stands of *Typha latifolia*. These monospecific stands occur especially in artificial wetlands, such as borrow pits or ponds. This alliance occurs on hydric soils in wetlands, ditches, ponds, lakes, and rivers, as well as on shorelines and streambanks. Inundation is commonly 3-6 dm (1-2 feet) in depth. These marshes have hydric soils and are flooded with water levels ranging from several centimeters to more than 1 m for a significant part of the growing season. Occurrences may display areas of

open water, but emergent vegetation dominates (80% cover). Seasonal flooding during winter and spring or flooding during heavy rains help maintain these marshes by causing water exchange which replenishes freshwater and circulates nutrients and organic debris. Soils which support this community can be mineral or organic but are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. Vegetative diversity and density is highly variable in response to water depth, water chemistry, and natural forces.

V.A.5.N.m.19 Carex spp. - Typha spp. **saturated herbaceous alliance**

This alliance is dominated by hydrophytic graminoids and found in the central United States near acid or neutral seeps. Vegetation cover is moderate to high and 1 m or less tall. Diagnostic species of this alliance are not well understood. *Typha latifolia* is the most common of the taller species. Among the shorter species, *Carex* spp., *Equisetum hyemale, Climacium americanum, Eupatorium perfoliatum,* and *Scirpus* spp. are abundant. Shrubs and small trees, such as *Populus deltoides, Salix* spp., and *Lindera benzoin* (in the southeast of this alliance's range), are sometimes present.

This alliance forms on the slopes and at the bases of hills, valleys, and bluffs. Soils are shallow to deep and formed from sandstone, glacial till, loess, and colluvium. Moderately minerotrophic groundwater saturates stands for much of the year.

17. Riparian Shrubland

III.B.2.N.d.20 Symphoricarpos occidentalis **temporarily flooded shrubland alliance**

This alliance is found in the northern Great Plains in mesic swales, depressions, ravines and floodplains. Some sites experience intermittent and brief flooding. The soils are fertile and well-drained to imperfectly drained silts and loams. The upper soil horizon is usually deep, although a thin layer of sand may be present if the site has been recently flooded This alliance is dominated by shrubs approximately 1 m tall. Shrub cover is typically greater than 50%, and in places it can approach 100%. These shrubs form dense clumps that exclude most other species. *Symphoricarpos occidentalis* is the most common shrub. *Rhus aromatica* and *Prunus virginiana* can be locally abundant, and both can grow to 2-3 m in places . Rarely, scattered small trees are present. These are most often *Fraxinus americana* or *Populus deltoides*. Herbaceous species and smaller shrubs are most abundant at the edge of stands of this alliance and in gaps between the taller shrubs where the shading is less complete. *Rosa woodsii* is a typical smaller shrub. *Achillea millefolium, Artemisia ludoviciana, Galium boreale,* and *Pascopyrum smithii* are common herbaceous species. Woody vines sometimes occur, most commonly *Parthenocissus vitacea*. *Symphoricarpos occidentalis* shrublands often have a significant component of exotic species, especially where grazing has been intense *Bromus inermis, Cirsium arvense,* and *Poa pratensis* are the most abundant of these exotics. Overgrazing of prairies can lead to the expansion of degraded forms of this alliance.

***V.A.5.N.m.20 Carex pellita - (Carex nebrascensis) - Schoenoplectus spp.* saturated herbaceous alliance**

This alliance, found in the central Great Plains, occurs where groundwater seeps to the surface. The vegetation of these seepage fens is predominantly hydrophytic graminoids which typically forms dense cover. Common herbaceous species include *Carex hystericina, Carex pellita (= Carex lanuginosa), Carex nebrascensis, Eleocharis* spp., *Eupatorium maculatum, Leersia oryzoides, Scirpus* spp., *Thelypteris palustris,* and *Typha latifolia*. Shrubs, primarily *Salix* spp., may occasionally occur. Ferns may be locally common. Species composition is variable between sites and is probably related to factors such as depth and composition of organic soils, water chemistry, and level of disturbance. Vegetation zonation is often conspicuous and related to hydrologic regime.

Stands of this alliance are found on mid to lower slopes of hillsides and terraces in canyons and stream valleys. In eastern Nebraska, stands are associated with sandstone outcrops or loess and glacial till slopes. Soils are deep and consist of peat or muck, often mixed with sands. Peat layers range from 0.5-1.5 m deep. Fens are constantly saturated by groundwater. Mounded groundwater discharge zones are common features of these fens. Groundwater pH typically ranges from 6.0-7.5 and is not calcium-rich. The water table is usually near the soil surface.

***VII.C.2.N.c.1* Sand flats temporarily flooded sparse vegetation alliance**

This is technically not an alliance. It is a placeholder for a group of sparsely vegetated associations that do not have adequate vegetation descriptions, but do share certain substrate characteristics.

18. Riparian Woodland

***I.B.2.N.d.15 Populus deltoides* temporarily flooded forest alliance**

This alliance, found throughout the central midwestern and southeastern United States, contains riverfront floodplain forests. The tree canopy is tall (to 30 m) and dominated by *Populus deltoides* and *Salix nigra*, although *Fraxinus pennsylvanica, Acer negundo, Acer rubrum, Acer saccharinum, Platanus occidentalis,* and *Ulmus americana* are also commonly encountered in various parts of this alliance's range. Tree diversity is limited due to the dynamics of flooding and deposition/scouring of sediments. The shrub layer is often sparse, but species such as *Salix exigua, Carpinus caroliniana, Lindera benzoin, Cornus drummondii* and, in the Southeast, *Ilex vomitoria, Ilex opaca var. opaca,* and *Forestiera acuminata* can be found. Herbaceous growth can be thick and lush but is often patchy and sparse due to frequent inundation. Herbaceous species found throughout the range of this alliance are not well known, but in parts of the range, species can include *Carex* spp., *Leersia oryzoides, Bidens* spp., Asteraceae spp., *Eragrostis hypnoides, Lipocarpha micrantha, Rumex maritimus, Potentilla paradoxa,* and, more commonly in the Southeast, *Leptochloa panicea ssp. mucronata (= Leptochloa mucronata)* and *Mikania scandens*.

Stands are found primarily along riverfronts, where they develop on bare, moist soil on

newly made sand bars, front-land ridges, and well-drained flats. Soils are formed in alluvium, are deep, medium-textured, and with adequate or excessive moisture available for vegetation during the growing season. This alliance can also be found on abandoned fields and well-drained ridges in the first bottoms.

II.B.2.N.a.20 Quercus macrocarpa woodland alliance

This alliance is widespread in the northern and central Great Plains. All of its associations are found exclusively or primarily in the midwestern United States west of the Mississippi River. The canopy is open to moderately closed and usually dominated by *Quercus macrocarpa*. Common associates in the canopy are *Quercus muehlenbergii* in the southeast portion, *Fraxinus pennsylvanica, Tilia americana,* and *Populus tremuloides* in the northern half, and *Carya* spp. and *Ulmus* spp. in the eastern part of the alliance's range. *Pinus ponderosa* can occur in some stands at the extreme western limit of this alliance's range. A shrub layer 1-2 m tall is often present, especially in the northern half of the range of this alliance. Dominant shrubs include *Amelanchier alnifolia, Corylus americana, Corylus cornuta, Prunus virginiana*, and *Symphoricarpos occidentalis*. The herbaceous layer is dominated by graminoids. These can range from tall grasses, such as *Andropogon gerardii, Panicum virgatum,* and *Sorghastrum nutans,* to mid grasses, such as *Schizachyrium scoparium* and *Hesperostipa spartea (= Stipa spartea),* to short graminoids, such as *Carex inops ssp. heliophila*. This alliance is found in a landscape dominated by prairie communities. The woodland is typically found on rolling hills, lower mountain slopes (in the Black Hills), or along ravines. These topographic positions provided some protection from the fires that regularly occurred on the surrounding prairies in pre-European times. However, some fire was necessary to prevent the woodland physiognomy from closing and becoming a forest. This was especially important in the more mesic eastern portions of this alliance's range. In Nebraska, the soils are fertile, moderately well-drained to well-drained, and deep.

II.B.2.N.a.29 Fraxinus pennsylvanica - (Ulmus Americana) woodland alliance

This alliance is found along streams and rivers and in draws and canyons across much of the northern Great Plains. Stands often have an overstory that is more dense than typical woodland physiognomy. The canopy can be moderately closed to closed. Most of the canopy trees are 6-10 m tall, and they allow significant light to penetrate to the understory. The shrub layer is usually well-developed while the herbaceous layer is moderately to well-developed. The canopy is dominated by *Fraxinus pennsylvanica* and sometimes *Ulmus americana*. Individuals of *Populus deltoides* and *Acer negundo* are often scattered throughout. The shrub layer is typically dominated by *Prunus virginiana, Symphoricarpos occidentalis, Symphoricarpos albus,* and *Ribes* spp. The herbaceous layer often contains *Maianthemum stellatum, Galium aparine,* and *Elymus canadensis*.

Stands of this alliance are usually on flat to moderately steep slopes near permanent or ephemeral streams. Rarely, it can be found on steep north-facing escarpments. These sites create more mesic microclimates in which the woodland can develop in landscapes otherwise dominated by grasslands. The soils are typically deep and loamy, but in places

they can be rocky. Stands are common along riparian areas but are usually distant enough from larger streams that they do not flood or do so for very short periods.

II.B.2.N.b.4 Populus deltoides temporarily flooded woodland alliance

This alliance occurs throughout the Great Plains near rivers and large streams. It is dominated by *Populus deltoides* throughout its range. Secondary canopy species include *Acer negundo* throughout, *Salix nigra* (in the eastern part of its range), *Fraxinus pennsylvanica* and *Ulmus americana* (central and eastern), and *Salix amygdaloides* (central and western). *Fraxinus pennsylvanica* and *Ulmus americana* often increase in abundance and dominance as stands of this alliance age. *Populus deltoides* does not reproduce well in established stands. The understory composition and structure are variable. A shrub layer may be present, with species such as *Salix* spp., *Symphoricarpos occidentalis*, and *Prunus virginiana* predominating. Sites experience seasonal floods, which, after receding, leave areas available for colonization. This process often favors the establishment of aggressive native and exotic plants. Among the species that are common in this alliance are *Carex* spp., *Juncus* spp., *Spartina pectinata* (in the east), *Pascopyrum smithii* (in the west), *Elymus* spp., *Cenchrus longispinus, Melilotus officinalis*, and *Equisetum* spp. Typical exotics found in this alliance are *Poa pratensis* and *Bromus* spp.

Stands of this alliance are found on level to gently sloping topography near rivers, streams, lakes, and ponds. The areas may have been very recently deposited by water action, or they may have been deposited earlier and occupied by other communities. The water table fluctuates with the level of the adjacent water body. This can lead to periods of flooding and soil saturation in the spring and after heavy rains and also to periods of drought when the water level falls in the summer and fall. The soils are silts, loams, and sands, and are derived from alluvial material.

19. Low Intensity Residential

20. High Intensity Residential/Commercial/Industrial/Transportation

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Appendix B:
Aggregation of NWI codes to selected Nebraska GAP land cover classes

Nebraska GAP land cover class: Open Water

L1UBFH	L2UBG	PUBFd	PUSC	PUSCX
L1UBFh	L2UBGH	PUBFdx	PUSCd	PUSCx
L1UBFX	L2UBGh	PUBFH	PUSCH	PUSKAx
L1UBGH	L2UBGX	PUBFh	PUBKFh	PUSKx
L1UBGh	L2UBGx	PUBFHx	PUBKFhx	R2UBF
L1UBGX	L2UBH	PUBFhx	PUBKFx	R2UBFX
L1UBGx	L2UBHH	PUBFX	PUBKGh	R2UBFx
L1UBH	L2UBHh	PUBFx	PUBKGhx	R2UBG
L1UBHH	L2UBKGh	PUBG	PUBKGx	R2UBGx
L1UBHh	L2USA	PUBGd	PUBKh	R2UBH
L1UBHhx	L2USAH	PUBGh	PUBKHh	R2UBHX
L1UBHX	L2USAh	PUBGhx	PUBKhx	R2UBHx
L1UBHx	L2USAx	PUBGX	PUBKx	R2USA
L1UBKGx	L2USC	PUBGx	PUSA	R2USAx
L1UBKh	L2USCd	PUBH	PUSAD	R2USC
L1UBKhx	L2USCH	PUBHH	PUSAd	R2USCx
L2UBAH	L2USCh	PUBHh	PUSAH	R2USF
L2UBF	L2USCX	PUBHhx	PUSAh	R3UBH
L2UBFH	L2USCx	PUBHX	PUSAX	R3USA
L2UBFh	PUBF	PUBHx	PUSAx	R3USC
L2UBFX	PUBFb	PUBKAh	PUSCh	

Nebraska GAP land cover class: Aquatic Bed Wetland

L1ABGH	L2ABG	PABCx	PABFXD	PABHH
L1ABHX	L2ABGd	PABF	PABG	PABHh
L1ABHx	L2ABGH	PABFD	PABGb	PABHx
L2ABF	L2ABGh	PABFd	PABGH	PABKx
L2ABFD	L2ABGX	PABFh	PABGh	PAFBX
L2ABFH	L2ABGx	PABFHX	PABGX	PUB/ABFx
L2ABFh	L2ABH	PABFhx	PABGx	PUB/ABG
L2ABFX	PAB4Gh	PABFX	PABH	PUB/ABGh
L2ABFx	PABC	PABFx		

Nebraska GAP land cover class: Emergent Wetland

L2EM2F	PEM/UBF	PEM1Fhx	PEMCH	PEMKCh
L2EM2G	PEM/UBFd	PEM2Gh	PEMCh	PEMKFh
L2EM2KFh	PEM/UBFh	PEMA	PEMChx	PEMKh
L2EM2KGh	PEM/UBFx	PEMAD	PEMCX	PEMKhx

PAB/EMF	PEM/UBGx	PEMAd	PEMCx	PEMKx
PAB/EMFD	PEM/UBKFh	PEMAdx	PEMCXD	PEMU
PAB/EMFd	PEM/USA	PEMAH	PEME	PUB/EMF
PAB/EMFH	PEM/USAd	PEMAh	PEMF	PUB/EMFb
PAB/EMFh	PEM/USAh	PEMAX	PEMFb	PUB/EMFh
PAB/EMFX	PEM/USAx	PEMAx	PEMFd	PUB/EMFhx
PAB/EMFx	PEM/USC	PEMB	PEMFD	PUB/EMFx
PEM/ABF	PEM/USCd	PEMBd	PEMFH	PUB/EMKFh
PEM/ABFb	PEM/USCH	PEMBg	PEMFh	PUB/EMKh
PEM/ABFD	PEM/USCX	PEMC	PEMFhx	PUS/EMA
PEM/ABFH	PEM/USCx	PEMCD	PEMFX	PUS/EMAh
PEM/ABFh	PEM1AD	PEMCd	PEMFx	PUS/EMC
PEM/ABFX	PEM1Ah	PEMCdx	PEMKAh	PUS/EMCH
PEM/ABFx				

Nebraska GAP land cover class: Riparian Shrubland

PAB/SSFh	PEM/SSCD	PSS/EMF	PSS1/USAx	PSSAh
PEM/SS1A	PEM/SSCd	PSS/EMFD	PSS1A	PSSAx
PEM/SS1Ad	PEM/SSCH	PSS/EMFH	PSS1Ad	PSSB
PEM/SS1Ah	PEM/SSCh	PSS/UBF	PSS1Ah	PSSC
PEM/SS1Ax	PEM/SSCx	PSS/USA	PSS1Ax	PSSCD
PEM/SS1B	PEM/SSF	PSS/USAh	PSS1B	PSSCd
PEM/SS1Bd	PEM/SSFH	PSS/USC	PSS1Bd	PSSCH
PEM/SS1Bg	PEM1/SS1A	PSS/USCH	PSS1C	PSSCh
PEM/SS1C	PEM1/SS1C	PSS1/EMA	PSS1Cd	PSSCX
PEM/SS1Cd	PSS/EMA	PSS1/EMAh	PSS1Ch	PSSCx
PEM/SS1Ch	PSS/EMAD	PSS1/EMAx	PSS1Cx	PSSF
PEM/SS1Cx	PSS/EMAd	PSS1/EMB	PSS1E	PSSFH
PEM/SS1KCh	PSS/EMAH	PSS1/EMBd	PSS1KCh	PSSFh
PEM/SSA	PSS/EMC	PSS1/EMC	PSS1Kh	PUB/SS5Gh
PEM/SSAD	PSS/EMCD	PSS1/EMCd	PSSA	PUS/SS1A
PEM/SSAd	PSS/EMCd	PSS1/EMCh	PSSAD	PUS/SSA
PEM/SSAh	PSS/EMCH	PSS1/EMCx	PSSAd	PUS/SSC
PEM/SSC	PSS/EMCh	PSS1/USA	PSSAH	PUS/SSCH

Nebraska GAP land cover class: Riparian Woodland

PAB/FOFh	PFO/EMAd	PFO1/EMAd	PFO1Ax	PFOCh
PEM/FO1A	PFO/EMAH	PFO1/EMAh	PFO1B	PFOCX
PEM/FO1Ad	PFO/EMAh	PFO1/EMAx	PFO1C	PFOCx
PEM/FO1Ah	PFO/EMC	PFO1/EMB	PFO1Cd	PFOFH
PEM/FO1Ax	PFO/EMCD	PFO1/EMBd	PFO1Ch	PFOFh

PEM/FO1B	PFO/EMCd	PFO1/EMC	PFO1Cx	PFOKh
PEM/FO1C	PFO/EMCH	PFO1/EMCd	PFO1Fh	PSS/FO1C
PEM/FO1Cd	PFO/EMCh	PFO1/EMCh	PFO1J	PSS/FO1Ch
PEM/FO1Ch	PFO/EMCX	PFO1/EMCx	PFO1KAh	PSS/FOA
PEM/FO1Cx	PFO/EMCx	PFO1/EMKh	PFO1KCh	PSS/FOAh
PEM/FO1KCh	PFO/EMF	PFO1/SS1A	PFO1Kh	PSS/FOC
PEM/FO1Kh	PFO/SS1A	PFO1/SS1Ad	PFO1Kx	PSS/FOCH
PEM/FOA	PFO/SS1C	PFO1/SS1Ah	PFOA	PSS/FOFH
PEM/FOAD	PFO/SSA	PFO1/SS1Ax	PFOAB	PSS1/FO1A
PEM/FOAd	PFO/SSAD	PFO1/SS1B	PFOAD	PSS1/FO1Ad
PEM/FOAH	PFO/SSAH	PFO1/SS1C	PFOAd	PSS1/FO1B
PEM/FOC	PFO/SSC	PFO1/SS1Cd	PFOAD	PSS1/FO1C
PEM/FOCD	PFO/SSCH	PFO1/SS1Ch	PFOAH	PSS1/FO1Cd
PEM/FOCd	PFO/SSCh	PFO1/SS1Cx	PFOAh	PSS1/FO1Ch
PEM/FOCH	PFO/SSCX	PFO1/SS1KAh	PFOAX	PSS1/FO1Cx
PEM/FOCh	PFO/SSFH	PFO1/SS1KCh	PFOAx	PSS1/FO1KCh
PEM/FOCX	PFO/USA	PFO1/USA	PFOB	PUB/FO5Fh
PEM/FOCx	PFO/USC	PFO1/USAx	PFOC	PUB/FO5Gh
PFO/ABFH	PFO/USCH	PFO1A	PFOCD	PUS/FOA
PFO/EMA	PFO/USCh	PFO1Ad	PFOCd	PUS/FOCH
PFO/EMAD	PFO1/EMA	PFO1Ah	PFOCH	

Appendix C:
List of Species Modeled for Nebraska

Scientific Name	Common Name	Element Code	TNC Rank	State Status	Federal Status	Model Type
Accipiter cooperii	Cooper's Hawk	ABNKC12040	G5	S1	-	L
Accipiter striatus	Sharp-shinned Hawk	ABNKC12020	G5	S1	-	L
Actitis macularia	Spotted Sandpiper	ABNNF04020	G5	S5	-	Q
Aechmophorus clarkii	Clark's Grebe	ABNCA04020	G5	-	-	Q
Aechmophorus occidentalis	Western Grebe	ABNCA04010	G5	S4	-	L
Aeronautes saxatalis	White-throated Swift	ABNUA06010	G5	S4	-	L
Agelaius phoeniceus	Red-winged Blackbird	ABPBXB0010	G5	S5	-	S
Aimophila cassinii	Cassin's Sparrow	ABPBX91070	G5	S4	-	Q
Aix sponsa	Wood Duck	ABNJB09010	G5	S3	-	Q
Ammodramus savannarum	Grasshopper Sparrow	ABPBXA0020	G5	S4	-	S
Anas acuta	Northern Pintail	ABNJB10110	G5	S5	-	L
Anas americana	American Wigeon	ABNJB10180	G5	S2	-	Q
Anas clypeata	Northern Shoveler	ABNJB10150	G5	S4	-	L
Anas crecca	Green-winged Teal	ABNJB10010	G5	S3S4	-	Q
Anas cyanoptera	Cinnamon Teal	ABNJB10140	G5	S?N	-	L
Anas discors	Blue-winged Teal	ABNJB10130	G5	S5	-	L
Anas platyrhynchos	Mallard	ABNJB10060	G5	S5	-	S
Anas strepera	Gadwall	ABNJB10160	G5	S3	-	Q
Aquila chrysaetos	Golden Eagle	ABNKC22010	G5	S3	-	Q
Archilochus colubris	Ruby-throated Hummingbird	ABNUC45010	G5	S3	-	L
Ardea herodias	Great Blue Heron	ABNGA04010	G5	S4	-	L
Asio flammeus	Short-eared Owl	ABNSB13040	G5	S2	-	S
Asio otus	Long-eared Owl	ABNSB13010	G5	S4	-	L
Athene cunicularia	Burrowing Owl	ABNSB10010	G4	S3	-	Q
Aythya affinis	Lesser Scaup	ABNJB11070	G5	S3	-	L
Aythya americana	Redhead	ABNJB11030	G5	S4	-	Q
Aythya valisineria	Canvasback	ABNJB11020	G5	S3	-	Q
Baeolophus bicolor	Tufted Titmouse	ABPAW01110	G5	S3	-	Q
Bartramia longicauda	Upland Sandpiper	ABNNF06010	G5	S5	-	L
Bombycilla cedrorum	Cedar waxwing	ABPBN01020	G5	S?N	-	Q
Botaurus lentiginosus	American Bittern	ABNGA01020	G4	S3	-	Q

Scientific Name	Common Name	Element Code	TNC Rank	State Status	Federal Status	Model Type
Branta canadensis	Canada Goose	ABNJB04020	G5	S?N	-	L
Bubo virginianus	Great Horned Owl	ABNSB05010	G5	S5	-	S
Bubulcus ibis	Cattle Egret	ABNGA07010	G5	S?N	-	Q
Buteo jamaicensis	Red-tailed Hawk	ABNKC19110	G5	S4	-	L
Buteo lineatus	Red-shouldered Hawk	ABNKC19030	G5	S1	-	L
Buteo regalis	Ferruginous Hawk	ABNKC19120	G4	S2	-	Q
Buteo swainsoni	Swainson's Hawk	ABNKC19070	G5	S3	-	L
Butorides virescens	Green Heron	ABNGA08010	G5	S4	-	L
Calamospiza melanocorys	Lark Bunting	ABPBX98010	G5	S5	-	L
Calcarius mccownii	McCown's Longspur	ABPBXA6010	G5	S3	-	Q
Calcarius ornatus	Chestnut-collared longspur	ABPBXA6040	G5	S2	-	Q
Caprimulgus carolinensis	Chuck-will's-widow	ABNTA07010	G5	S1	-	L
Caprimulgus vociferus	Whip-poor-will	ABNTA07070	G5	S2	-	L
Cardinalis cardinalis	Northern Cardinal	ABPBX60010	G5	S5	-	Q
Carduelis pinus	Pine Siskin	ABPBY03010	G5	S5	-	Q
Carduelis tristis	American Goldfinch	ABPBY06110	G5	S5	-	S
Carpodacus mexicanus	House Finch	ABPBY04040	G5	S3	-	L
Cathartes aura	Turkey Vulture	ABNKA02010	G5	S3	-	L
Catoptrophorus semipalmatus	Willet	ABNNF02010	G5	S3	-	Q
Certhia americana	Brown Creeper	ABPBA01010	G5	S3	-	L
Ceryle alcyon	Belted Kingfisher	ABNXD01020	G5	S4	-	L
Chaetura pelagica	Chimney Swift	ABNUA03010	G5	S5	-	Q
Charadrius melodus	Piping Plover	ABNNB03070	G3	S2	LT	L
Charadrius montanus	Mountain Plover	ABNNB03100	G2	S1B	-	L
Charadrius vociferus	Killdeer	ABNNB03090	G5	S5	-	S
Chlidonias niger	Black Tern	ABNNM10020	G5	S3	-	Q
Chondestes grammacus	Lark Sparrow	ABPBX96010	G5	S4	-	S
Chordeiles minor	Common Nighthawk	ABNTA02020	G5	S5	-	S
Circus cyaneus	Northern Harrier	ABNKC11010	G5	S3	-	L
Cistothorus palustris	Marsh Wren	ABPBG10020	G5	S4	-	Q
Cistothorus platensis	Sedge Wren	ABPBG10010	G5	S2	-	Q
Coccyzus americanus	Yellow-billed Cuckoo	ABNRB02020	G5	S5	-	Q

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Coccyzus erythropthalmus	Black-billed Cuckoo	ABNRB02010	G5	S5	-	Q
Colaptes auratus	Northern Flicker	ABNYF10020	G5	S5	-	S
Colinus virginianus	Northern Bobwhite	ABNLC21020	G5	S4	-	Q
Columba livia	Rock Dove	ABNPB01010	G5	SE	-	S
Contopus sordidulus	Western Wood-Pewee	ABPAE32050	G5	S4	-	Q
Contopus virens	Eastern Wood-Pewee	ABPAE32060	G5	S4	-	Q
Corvus brachyrhynchos	American Crow	ABPAV10010	G5	S5	-	S
Cyanocitta cristata	Blue Jay	ABPAV02020	G5	S5	-	S
Cygnus buccinator	Trumpeter Swan	ABNJB02030	G4	S2	-	Q
Dendroica coronata	Yellow-rumped Warbler	ABPBX03060	G5	S4	-	Q
Dendroica dominica	Yellow-throated Warbler	ABPBX03130	G5	S?N	-	L
Dendroica petechia	Yellow Warbler	ABPBX03010	G5	S5	-	S
Dolichonyx oryzivorus	Bobolink	ABPBXA9010	G5	S4	-	Q
Dumetella carolinensis	Gray Catbird	ABPBK01010	G5	S5	-	Q
Empidonax traillii	Willow Flycatcher	ABPAE33040	G5	S4	-	Q
Empidonax virescens	Acadian Flycatcher	ABPAE33020	G5	S4	-	L
Eremophila alpestris	Horned Lark	ABPAT02010	G5	S5	-	S
Euphaus caynocephalus	Brewer's Blackbird	ABPBXB5020	G5	S4	-	Q
Falco columbarius	Merlin	ABNKD06030	G5	S1	-	L
Falco mexicanus	Prairie Falcon	ABNKD06090	G5	S3	-	Q
Falco sparverius	American Kestrel	ABNKD06020	G5	S5	-	L
Fulica americana	American Coot	ABNME14020	G5	S?N	-	Q
Gallinago gallinago	Common Snipe	ABNNF18010	G5	S2	-	Q
Geothlypis trichas	Common Yellowthroat	ABPBX12010	G5	S5	-	S
Guiraca caerulea	Blue Grosbeak	ABPBX63010	G5	S5	-	S
Gymnorhinus cyanocephalus	Pinyon Jay	ABPAV07010	G5	S3	-	Q
Haliaeetus leucocephalus	Bald Eagle	ABNKC10010	G4	S1	LT	Q
Himantopus mexicanus	Black-necked Stilt	ABNND01010	G5	S1	-	L
Hirundo rustica	Barn Swallow	ABPAU09030	G5	S5	-	S
Hylocichla mustelina	Wood Thrush	ABPBJ19010	G5	S4	-	Q
Icteria virens	Yellow-breasted Chat	ABPBX24010	G5	S5	-	Q
Icterus bullockii	Bullock's Oriole	ABPBXB9220	G5	S?	-	Q

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Icterus galbula	Baltimore Oriole	ABPBXB9190	G5	S5	-	L
Icterus spurius	Orchard Oriole	ABPBXB9070	G5	S5	-	S
Ixobrychus exilis	Least Bittern	ABNGA02010	G5	S2	-	L
Junco hyemalis	Dark-eyed Junco	ABPBXA5020	G5	S4	-	L
Lanius ludovicianus	Loggerhead Shrike	ABPBR01030	G4	S?	-	S
Loxia curvirostra	Red Crossbill	ABPBY05010	G5	S4	-	Q
Melanerpes carolinus	Red-bellied Woodpecker	ABNYF04170	G5	S4	-	Q
Melanerpes erythrocephalus	Red-headed Woodpecker	ABNYF04040	G5	S5	-	L
Meleagris gallopavo	Wild Turkey	ABNLC14010	G5	S4	-	L
Melospiza georgiana	Swamp Sparrow	ABPBXA3030	G5	S3	-	L
Melospiza melodia	Song Sparrow	ABPBXA3010	G5	S4	-	Q
Mimus polyglottos	Northern Mockingbird	ABPBK03010	G5	S4	-	L
Mniotilta varia	Black-and-white Warbler	ABPBX05010	G5	S3	-	Q
Molothrus ater	Brown-headed Cowbird	ABPBXB7030	G5	S5	-	S
Myadestes townsendi	Townsend's Solitaire	ABPBJ16010	G5	S2	-	L
Myiarchus crinitus	Great Crested Flycatcher	ABPAE43070	G5	S4	-	Q
Numenius americanus	Long-billed Curlew	ABNNF07070	G5	S3	-	Q
Nycticorax nycticorax	Black-crowned Night-Heron	ABNGA11010	G5	S2	-	Q
Oporornis formosus	Kentucky Warbler	ABPBX11010	G5	S3	-	L
Otus asio	Eastern Screech-Owl	ABNSB01030	G5	S4	-	L
Oxyura jamaicensis	Ruddy Duck	ABNJB22010	G5	S4	-	Q
Parula americana	Northern Parula	ABPBX02010	G5	-	-	L
Passer domesticus	House Sparrow	ABPBZ01010	G5	SNA	-	S
Passerculus sandwichensis	Savannah Sparrow	ABPBX99010	G5	S3	-	L
Passerina amoena	Lazuli Bunting	ABPBX64020	G5	S4	-	Q
Passerina cyanea	Indigo Bunting	ABPBX64030	G5	S4	-	Q
Pelecanus erythrorhynchos	American White Pelican	ABNFC01010	G5	S3	-	Q
Perdix perdix	Gray Partridge	ABNLC01010	G5	SE	-	Q
Petrochelidon pyrrhonota	Cliff Swallow	ABPAU09010	G5	S5	-	S
Phalacrocorax auritus	Double-crested Cormorant	ABNFD01020	G5	S3	-	Q
Phalaenoptilus nuttallii	Common Poorwill	ABNTA04010	G5	S2	-	L
Phalaropus tricolor	Wilson's Phalarope	ABNNF20010	G5	S4	-	Q

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Phasianus colchicus	Ring-necked Pheasant	ABNLC07010	G5	SNA	-	S
Pheucticus ludovicianus	Rose-breasted Grosbeak	ABPBX61030	G5	S4	-	Q
Pheucticus melanocephalus	Black-headed Grosbeak	ABPBX61040	G5	S5	-	Q
Pica pica	Black-billed Magpie	ABPAV09010	G5	S4	-	Q
Picoides pubescens	Downy Woodpecker	ABNYF07030	G5	S4	-	L
Picoides villosus	Hairy Woodpecker	ABNYF07040	G5	S4	-	L
Pipilo erythrophthalmus	Eastern Towhee	ABPBX74030	G5	S4	-	L
Pipilo maculatus	Spotted Towhee	ABPBX74080	G5	S?	-	L
Piranga ludoviciana	Western Tanager	ABPBX45050	G5	S4	-	Q
Piranga olivacea	Scarlet Tanager	ABPBX45040	G5	S4	-	L
Plegadis chihi	White-faced Ibis	ABNGE02020	G5	S1	-	Q
Podiceps nigricollis	Eared Grebe	ABNCA03030	G5	S4	-	Q
Podilymbus podiceps	Pied-billed Grebe	ABNCA02010	G5	S5	-	Q
Poecile atricapillus	Black-capped Chickadee	ABPAW01010	G5	S5	-	S
Polioptila caerulea	Blue-gray Gnatcatcher	ABPBJ08010	G5	S3	-	L
Pooecetes gramineus	Vesper Sparrow	ABPBX95010	G5	S5	-	Q
Porzana carolina	Sora	ABNME08020	G5	S4	-	Q
Progne subis	Purple Martin	ABPAU01010	G5	S4	-	Q
Protonotaria citrea	Prothonotary Warbler	ABPBX07010	G5	S2	-	L
Quiscalus mexicanus	Great-tailed Grackle	ABPBXB6050	G5	S?N	-	L
Quiscalus quiscula	Common Grackle	ABPBXB6070	G5	S5	-	L
Rallus elegans	King Rail	ABNME05020	G4G5	S1	-	L
Rallus limicola	Virginia Rail	ABNME05030	G5	S4	-	L
Recurvirostra americana	American Avocet	ABNND02010	G5	S4	-	Q
Riparia riparia	Bank Swallow	ABPAU08010	G5	S5	-	Q
Salpinctes obsoletus	Rock Wren	ABPBG03010	G5	S4	-	Q
Sayornis phoebe	Eastern Phoebe	ABPAE35020	G5	S4	-	Q
Sayornis saya	Say's Phoebe	ABPAE35030	G5	S4	-	Q
Seiurus aurocapillus	Ovenbird	ABPBX10010	G5	S4	-	Q
Seiurus motacilla	Louisiana Waterthrush	ABPBX10030	G5	S1	-	L
Setophaga ruticilla	American Redstart	ABPBX06010	G5	S4	-	Q
Sialia currucoides	Mountain Bluebird	ABPBJ15030	G5	S4	-	Q

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Sialia sialis	Eastern Bluebird	ABPBJ15010	G5	S3/S4	-	L
Sitta canadensis	Red-breasted Nuthatch	ABPAZ01010	G5	S4	-	Q
Sitta carolinensis	White-breasted Nuthatch	ABPAZ01020	G5	S3	-	Q
Sitta pygmaea	Pygmy Nuthatch	ABPAZ01030	G5	S3	-	Q
Spiza americana	Dickcissel	ABPBX65010	G5	S5	-	S
Spizella breweri	Brewer's Sparrow	ABPBX94040	G5	S4	-	Q
Spizella passerina	Chipping Sparrow	ABPBX94020	G5	S5	-	Q
Spizella pusilla	Field Sparrow	ABPBX94050	G5	S5	-	S
Stelgidopteryx ruficollis	Northern Rough-winged Swallow	ABPAU07010	G5	S?	-	L
Sterna antillarum	Least Tern	ABNNM08100	G4T2	S2	LE	L
Sterna forsteri	Forster's Tern	ABNNM08090	G5	S3	-	Q
Strix varia	Barred Owl	ABNSB12020	G5	S2	-	Q
Sturnella magna	Eastern Meadowlark	ABPBXB2020	G5	S5	-	Q
Sturnella neglecta	Western Meadowlark	ABPBXB2030	G5	S5	-	S
Sturnus vulgaris	European Starling	ABPBT01010	G5	SE	-	S
Tachycineta bicolor	Tree Swallow	ABPAU03010	G5	SNRN	-	Q
Tachycineta thalassina	Violet-green Swallow	ABPAU03040	G5	S3	-	Q
Thryothorus ludovicianus	Carolina Wren	ABPBG06130	G5	S2	-	Q
Toxostoma rufum	Brown Thrasher	ABPBK06010	G5	S5	-	S
Troglodytes aedon	House Wren	ABPBG09010	G5	S5	-	S
Turdus migratorius	American Robin	ABPBJ20170	G5	S5	-	S
Tympanuchus cupido	Greater Prairie-Chicken	ABNLC13010	G4	S3S4	-	Q
Tympanuchus phasianellus	Sharp-tailed Grouse	ABNLC13030	G4	S4	-	Q
Tyrannus tyrannus	Eastern Kingbird	ABPAE52060	G5	S5	-	S
Tyrannus verticalis	Western Kingbird	ABPAE52050	G5	S5	-	S
Tyrannus vociferans	Cassin's Kingbird	ABPAE52030	G5	S3	-	L
Tyto alba	Barn Owl	ABNSA01010	G5	S3	-	L
Vireo bellii	Bell's Vireo	ABPBW01110	G5	S4	-	L
Vireo flavifrons	Yellow-throated Vireo	ABPBW01170	G5	S2	-	L
Vireo gilvus	Warbling Vireo	ABPBW01210	G5	S5	-	L
Vireo olivaceus	Red-eyed Vireo	ABPBW01240	G5	S4	-	Q
Vireo plumbeus	Plumbeous Vireo	ABPBW01280	G5	S2	-	L

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Xanthocephalus xanthocephalus	Yellow-headed Blackbird	ABPBXB3010	G5	S4	-	L
Zenaida macroura	Mourning Dove	ABNPB04040	G5	S5	-	S
Acris crepitans	Northern Cricket Frog	AAABC01010	G5	S5	-	Q
Ambystoma texanum	Smallmouth Salamander	AAAAA01130	G5	S1	-	L
Ambystoma tigrinum	Eastern Tiger Salamander	AAAAA01140	G5	S5	-	L
Bufo americanus	American Toad	AAABB01020	G5	S1	-	L
Bufo cognatus	Great Plains Toad	AAABB01050	G5	S5	-	S
Bufo woodhousii	Woodhouse's Toad	AAABB01180	G5	S5	-	L
Gastrophryne olivacea	Great Plains Narrowmouth Toad	AAABE01020	G5	S2	-	L
Hyla chrysoscelis	Cope's Gray Treefrog	AAABC02050	G5	S5	-	Q
Hyla versicolor	Gray Treefrog	AAABC02130	G5	-	-	Q
Pseudacris triseriata	Western Chorus Frog	AAABC05070	G5	S5	-	L
Rana blairi	Plains Leopard Frog	AAABH01040	G5	S5	-	Q
Rana catesbeiana	Bullfrog	AAABH01070	G5	S5	-	L
Rana pipiens	Northern Leopard Frog	AAABH01170	G5	S5	-	Q
Spea bombifrons	Plains Spadefoot	AAABF02010	G5	S5	-	L
Antilocapra americana	Pronghorn	AMALD01010	G5	S3	-	L
Blarina brevicauda	Northern Short-tailed Shrew	AMABA03010	G5	S3	-	L
Blarina hylophaga	Elliot's Short-tailed shrew	AMABA03030	G5	S3	-	L
Canis latrans	Coyote	AMAJA01010	G5	S5	-	L
Castor canadensis	Beaver	AMAFE01010	G5	S5	-	L
Cervus elaphus	Elk	AMALC01010	G5	S2	-	L
Chaetodipus hispidus	Hispid Pocket mouse	AMAFD05050	G5	S5	-	L
Corynorhinus townsendii	Townsend's Big-eared bat	AMACC08010	G4	S1	-	L
Cryptotis parva	Least shrew	AMABA04010	G5	S4	-	L
Cynomys ludovicianus	Black-tailed Prairie dog	AMAFB06010	G4	S4	-	L
Dasypus novemcinctus	Nine-banded armadillo	AMADA01010	G5	-	-	L
Didelphis virginiana	Virginia opossum	AMAAA01010	G5	S5	-	L
Dipodomys ordii	Ord's Kangaroo rat	AMAFD03010	G5	S5	-	L
Eptesicus fuscus	Big Brown bat	AMACC04010	G5	S5	-	L
Erethizon dorsatum	Porcupine	AMAFJ01010	G5	S4	-	L
Geomys bursarius	Plains Pocket gopher	AMAFC02010	G5	S5	-	L

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Glaucomys volans	Southern Flying squirrel	AMAFB09010	G5	S1	-	L
Lasionycteris noctivagans	Silver-haired bat	AMACC02010	G5	S5	-	L
Lasiurus borealis	Red bat	AMACC05010	G5	S5	-	L
Lasiurus cinereus	Hoary bat	AMACC05030	G5	S5	-	L
Lepus californicus	Black-tailed jackrabbit	AMAEB03050	G5	S5	-	L
Lepus townsendii	White-tailed jackrabbit	AMAEB03040	G5	S4	-	L
Lontra canadensis	River otter	AMAJF10010	G5	S2	-	L
Lynx rufus	Bobcat	AMAJH03020	G5	S5	-	L
Marmota monax	Woodchuck	AMAFB03010	G5	S4	-	L
Mephitis mephitis	Striped skunk	AMAJF06010	G5	S5	-	L
Microtus ochrogaster	Prairie vole	AMAFF11140	G5	S5	-	L
Microtus pennsylvanicus	Meadow vole	AMAFF11010	G5	S5	-	L
Microtus pinetorum	Pine vole/Woodland vole	AMAFF11150	G5	S3	-	L
Mus musculus	House mouse	AMAFF22010	G5	SNA	-	L
Mustela frenata	Long-tailed weasel	AMAJF02030	G5	S4	-	L
Mustela nivalis	Least weasel	AMAJF02020	G5	S5	-	L
Mustela vison	Mink	AMAJF02050	G5	S5	-	L
Myotis ciliolabrum	Western Small-footed myotis	AMACC01140	G5	S4	-	L
Myotis lucifugus	Little Brown bat	AMACC01010	G5	S4	-	L
Myotis septentrionalis	Northern Long-eared myotis	AMACC01150	G4	S3	-	L
Myotis thysanodes	Fringe-tailed myotis	AMACC01090	G4G5	S1	-	L
Myotis volans	Long-legged myotis	AMACC01110	G5	S2	-	L
Neotoma cinerea	Bushy-tailed woodrat	AMAFF08090	G5	S3	-	L
Neotoma floridana	Eastern woodrat	AMAFF08010	G5T3	S2	-	L
Nycticeius humeralis	Evening bat	AMACC06010	G5	S3	-	L
Odocoileus hemionus	Mule deer	AMALC02010	G5	S5	-	L
Odocoileus virginianus	White-tailed deer	AMALC02020	G5	S5	-	L
Ondatra zibethicus	Muskrat	AMAFF15010	G5	S5	-	L
Onychomys leucogaster	Northern Grasshopper mouse	AMAFF06010	G5	S5	-	L
Perognathus fasciatus	Olive-backed Pocket mouse	AMAFD01010	G5	S3	-	L
Perognathus flavescens	Plains Pocket mouse	AMAFD01020	G5	S5	-	L
Perognathus flavus	Silky Pocket mouse	AMAFD01030	G5	S4	-	L

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Peromyscus leucopus	White-footed mouse	AMAFF03070	G5	S5	-	L
Peromyscus maniculatus	Deer mouse	AMAFF03040	G5	S5	-	L
Pipistrellus subflavus	Eastern pipistrelle	AMACC03020	G5	S1	-	L
Procyon lotor	Raccoon	AMAJE02010	G5	S5	-	L
Puma concolor	Mountain lion	AMAJH04010	G5	S1	-	L
Rattus norvegicus	Norway rat	AMAFF21020	G5	SNA	-	L
Reithrodontomys megalotis	Western Harvest mouse	AMAFF02030	G5	S5	-	L
Reithrodontomys montanus	Plains Harvest mouse	AMAFF02010	G5	S4	-	L
Scalopus aquaticus	Eastern mole	AMABB04010	G5	S5	-	L
Sciurus carolinensis	Gray squirrel	AMAFB07010	G5	S4	-	L
Sciurus niger	Fox squirrel	AMAFB07040	G5	S5	-	L
Sigmodon hispidus	Hispid Cotton rat	AMAFF07010	G5	S3	-	L
Sorex cinereus	Masked shrew	AMABA01010	G5	-	-	L
Sorex merriami	Merriam's shrew	AMABA01230	G5	S1	-	L
Spermophilus elegans	Wyoming Ground squirrel	AMAFB05190	G5	SH	-	L
Spermophilus franklinii	Franklin's Ground squirrel	AMAFB05120	G5	S5	-	L
Spermophilus spilosoma	Spotted Ground squirrel	AMAFB05110	G5	S4	-	L
Spermophilus tridecemlineatus	Thirteen-lined Ground squirrel	AMAFB05090	G5	S5	-	L
Spilogale putorius	Eastern Spotted skunk	AMAJF05010	G5	S3	-	L
Sylvilagus audubonii	Desert cottontail	AMAEB01070	G5	S4	-	L
Sylvilagus floridanus	Eastern cottontail	AMACB01040	G5	S5	-	L
Synaptomys cooperi	Southern Bog lemming	AMAFF17010	G5T?	S1	-	L
Tamias minimus	Least chipmunk	AMAFB02020	G5	S3	-	L
Tamias striatus	Eastern chipmunk	AMAFB02230	G5	S1	-	L
Taxidea taxus	Badger	AMAJF04010	G5	S5	-	L
Thomomys talpoides	Northern Pocket gopher	AMAFC01040	G5	S4	-	L
Urocyon cinereoargenteus	Gray fox	AMAJA04010	G5	S4	-	L
Vulpes velox	Swift fox	AMAJA03030	G3	S2	-	L
Vulpes vulpes	Red fox	AMAJA03010	G5	S5	-	L
Zapus hudsonius	Meadow Jumping mouse	AMAFH01010	G5	S5	-	L
Agkistrodon contortrix	Copperhead	ARADE01010	G5	S1	-	L
Apalone mutica	Smooth Softshell	ARAAG01020	G5	S5	-	Q

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Apalone spinifera	Spiny Softshell	ARAAG01030	G5	S5	-	Q
Arizona elegans	Eastern Glossy Snake	ARADB01010	G5	S2	-	L
Carphophis vermis	Western Worm Snake	ARADB02010	G5	S2	-	L
Chelydra serpentina	Common Snapping Turtle	ARAAB01010	G5	S5	-	L
Chrysemys picta	Painted Turtle	ARAAD01010	G5	S5	-	L
Cnemidophorus sexlineatus	Six-lined Racerunner	ARACJ02110	G5	S5	-	Q
Coluber constrictor	Eastern racer	ARADB07010	G5	S5	-	L
Crotalus horridus	Timber Rattlesnake	ARADE02040	G5	S1	-	L
Crotalus viridus	Prairie Rattlesnake	ARADE02120	G5	S4	-	Q
Diadophis punctatus	Ringneck Snake	ARADB10010	G5	S5	-	Q
Elaphe emoryi	Great Plains Rat Snake	ARADB13020	G5	-	-	Q
Elaphe obsoleta	Western Rat Snake	ARADB13030	G5	S4	-	Q
Elaphe vulpina	Western Fox Snake	ARADB13060	G5	S5	-	Q
Emydoidea blandingii	Blanding's Turtle	ARAAD04010	G4	S4	-	Q
Eumeces fasciatus	Five-lined Skink	ARACH01050	G5	S1	-	L
Eumeces multivirgatus	Many-lined Skink	ARACH01090	G5	S5	-	Q
Eumeces obsoletus	Great Plains Skink	ARACH01130	G5	S3	-	Q
Eumeces septentrionalis	Northern Prairie Skink	ARACH01100	G5	S5	-	Q
Graptemys pseudogeographica	False Map Turtle	ARAAD05080	G5	S3	-	Q
Heterodon nasicus	Western Hognose Snake	ARADB17010	G5	S5	-	Q
Heterodon platirhinos	Eastern Hognose Snake	ARADB17020	G5	S4	-	Q
Holbrookia maculata	Lesser Earless Lizard	ARACF08020	G5	S5	-	Q
Kinosternon flavescens	Yellow Mud Turtle	ARAAE01020	G5	S3	-	Q
Lampropeltis calligaster	Prairie Kingsnake	ARADB19010	G5	S3	-	Q
Lampropeltis getula	Common Kingsnake	ARADB19020	G5	S2	-	L
Lampropeltis triangulum	Milk Snake	ARADB19050	G5	S5	-	S
Liochlorophis vernalis	Smooth Green Snake	ARADB47010	G5	S1	-	L
Masticophis flagellum	Coachwhip	ARADB21020	G5	S3	-	L
Nerodia sipedon	Northern Water Snake	ARADB22060	G5	S5	-	Q
Phrynosoma douglasii	Short-horned lizard	ARACF12080	G5	S3	-	Q
Pituophis catenifer	Bullsnake	ARADB26020	G5	S5	-	S
Regina grahamii	Graham's Crayfish Snake	ARADB27020	G5	S2	-	Q

Scientific Name	Common Name	Element Code	TNC Rank	State Status	Federal Status	Model Type
Sceloporus graciosus	Sagebrush Lizard	ARACF14030	G5	S1	-	L
Sceloporus undulatus	Fence Lizard	ARACF14130	G5	S5	-	Q
Sistrurus catenatus	Massasauga	ARADE03010	G4	S1	-	L
Storeria dekayi	Brown Snake	ARADB34010	G5	S3	-	Q
Storeria occipitomaculata	Redbelly Snake	ARADB34030	G5	S1	-	L
Tantilla nigriceps	Plains Blackhead Snake	ARADB35050	G5	S1	-	L
Terrapene ornata	Ornate Box Turtle	ARAAD08020	G5	S5	-	Q
Thamnophis elegans	Western Terrestrial Garter Snake	ARADB36050	G5	S4	-	Q
Thamnophis proximus	Western Ribbon Snake	ARADB36090	G5	S2	-	L
Thamnophis radix	Plains Garter Snake	ARADB36100	G5	S5	-	L
Thamnophis sirtalis	Common Garter Snake	ARADB36130	G5	S5	-	L
Trachemys scripta	Slider	ARAAD09010	G5	-	-	L
Tropidoclonion lineatum	Lined Snake	ARADB38010	G5	S5	-	Q

Center for Advanced Land Management Information Technologies

CALMIT

University of Nebraska

Species Models of Nebraska Birds

Nebraska Gap Analysis Project

2005

G A P

University of Nebraska Lincoln

Modeled Nebraska Birds

Common Name	Scientific Name	Order	Family	Page
Wood Duck	*Aix sponsa*	Anseriformes	Anatidae	1
Northern Pintail	*Anas acuta*	Anseriformes	Anatidae	2
American Wigeon	*Anas americana*	Anseriformes	Anatidae	3
Northern Shoveler	*Anas clypeata*	Anseriformes	Anatidae	4
Green-winged Teal	*Anas crecca*	Anseriformes	Anatidae	5
Cinnamon Teal	*Anas cyanoptera*	Anseriformes	Anatidae	6
Blue-winged Teal	*Anas discors*	Anseriformes	Anatidae	7
Mallard	*Anas platyrhynchos*	Anseriformes	Anatidae	8
Gadwall	*Anas strepera*	Anseriformes	Anatidae	9
Lesser Scaup	*Aythya affinis*	Anseriformes	Anatidae	10
Redhead	*Aythya americana*	Anseriformes	Anatidae	11
Canvasback	*Aythya valisineria*	Anseriformes	Anatidae	12
Canada Goose	*Branta canadensis*	Anseriformes	Anatidae	13
Trumpeter Swan	*Cygnus buccinator*	Anseriformes	Anatidae	14
Ruddy Duck	*Oxyura jamaicensis*	Anseriformes	Anatidae	15
White-throated Swift	*Aeronautes saxatalis*	Apodiformes	Caprimulgidae	16
Chimney Swift	*Chaetura pelagica*	Apodiformes	Caprimulgidae	17
Ruby-throated Hummingbird	*Archilochus colubris*	Apodiformes	Trochilidae	18
Chuck-will's-widow	*Caprimulgus carolinensis*	Caprimulgiformes	Caprimulgidae	19
Whip-poor-will	*Caprimulgus vociferus*	Caprimulgiformes	Caprimulgidae	20
Common Nighthawk	*Chordeiles minor*	Caprimulgiformes	Caprimulgidae	21
Common Poorwill	*Phalaenoptilus nuttallii*	Caprimulgiformes	Caprimulgidae	22
Piping Plover	*Charadrius melodus*	Charadriiformes	Charadriidae	23
Mountain Plover	*Charadrius montanus*	Charadriiformes	Charadriidae	24
Killdeer	*Charadrius vociferus*	Charadriiformes	Charadriidae	25
Black Tern	*Chlidonias niger*	Charadriiformes	Laridae	26
Least Tern	*Sterna antillarum*	Charadriiformes	Laridae	27
Forster's Tern	*Sterna forsteri*	Charadriiformes	Laridae	28
Black-necked Stilt	*Himantopus mexicanus*	Charadriiformes	Recurvirostridae	29
American Avocet	*Recurvirostra americana*	Charadriiformes	Recurvirostridae	30
Spotted Sandpiper	*Actitis macularia*	Charadriiformes	Scolopacidae	31
Upland Sandpiper	*Bartramia longicauda*	Charadriiformes	Scolopacidae	32
Willet	*Catoptrophorus semipalmatus*	Charadriiformes	Scolopacidae	33
Common Snipe	*Gallinago gallinago*	Charadriiformes	Scolopacidae	34
Long-billed Curlew	*Numenius americanus*	Charadriiformes	Scolopacidae	35
Wilson's Phalarope	*Phalaropus tricolor*	Charadriiformes	Scolopacidae	36

Nebraska GAP Analysis 2004
Bird Species Atlas

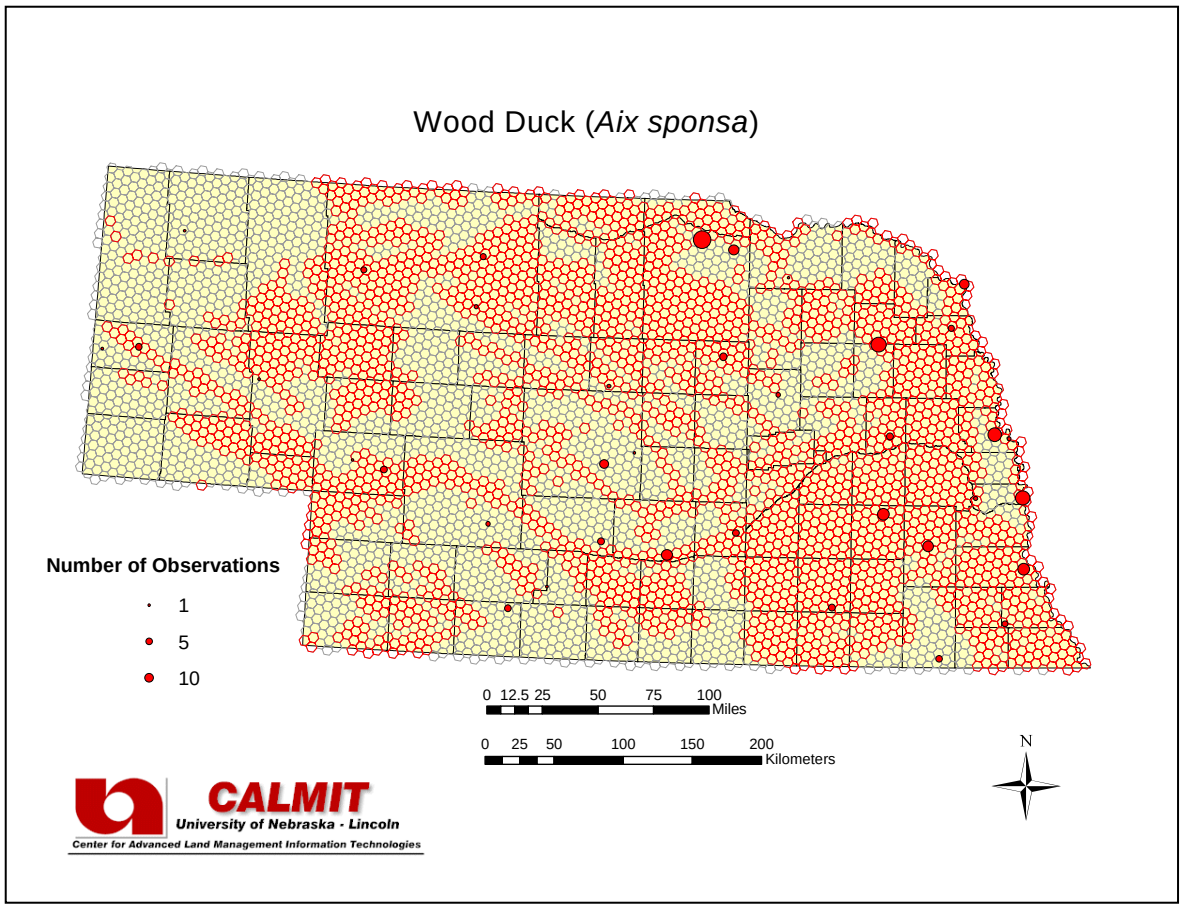
Common Name:	**Wood Duck**	TNC Global Status:	G5
Scientific Name:	***Aix sponsa***	Federal Status:	--
TNC Element Code:	ABNJB09010	State (NE) Status:	S3
AOU Code:	01440		

Habitat Description:
This species is found in riparian situations but also around wooded ponds, in towns, or in dry wooded ravines up to 1.5 km from water (Johnsgard 1997, Mollhoff 2001). Breeding populations are restricted by the absences of tree cavities for nesting, particularly in the Sandhills and the Panhandle. The addition of nest boxes has contributed to the expansion of the population. The species is most widespread and common in the east, more locally distributed in south-central Nebraska, and localized in the Sandhills and Panhandle (Mollhoff 2001, Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.04×10^7

Model Description:
Modeled distribution using the variable 'Percentage of Hydric Soils > 1%'.

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



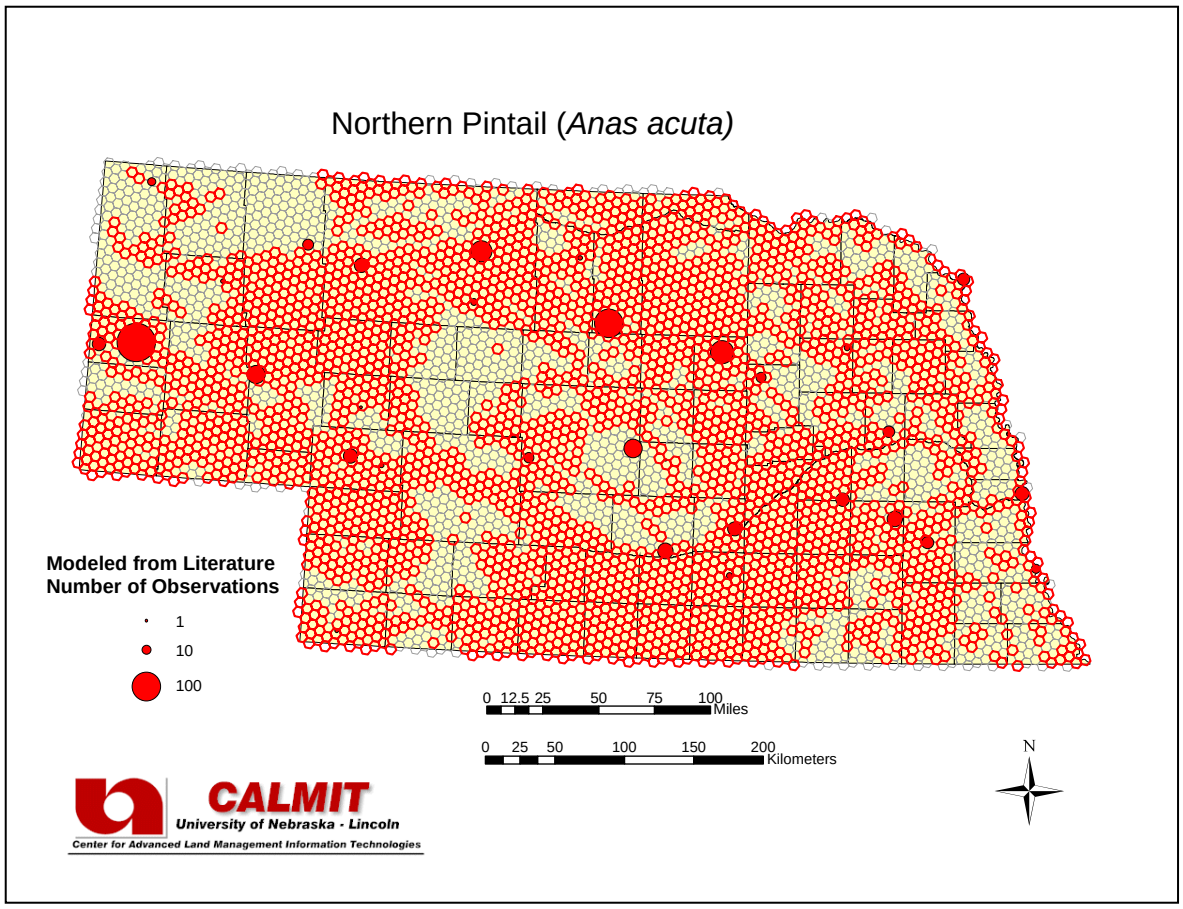
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Northern Pintail**	TNC Global Status:	G5
Scientific Name:	***Anas acuta***	Federal Status:	--
TNC Element Code:	ABNJB10110	State (NE) Status:	S5
AOU Code:	01430		

Habitat Description:
Breeding near water areas ranging from small ponds to permanent marshes, but usually where the surrounding lands is open and well drained (Johnsgard 1997). Found most frequently on pothole lakes and ponds surrounded by hay meadows or grassy hills; outside the Sandhills they are found on marshy ponds in agricultural lands (Mollhoff 2001). Breeding has been documented in suitable marsh habitat statewide, with the largest regularly occurring breeding populations found in the Sandhills lakes region of Cherry, Sheridan, and Garden Counties (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.27×10^7

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Emergent Wetland > 0.25%'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

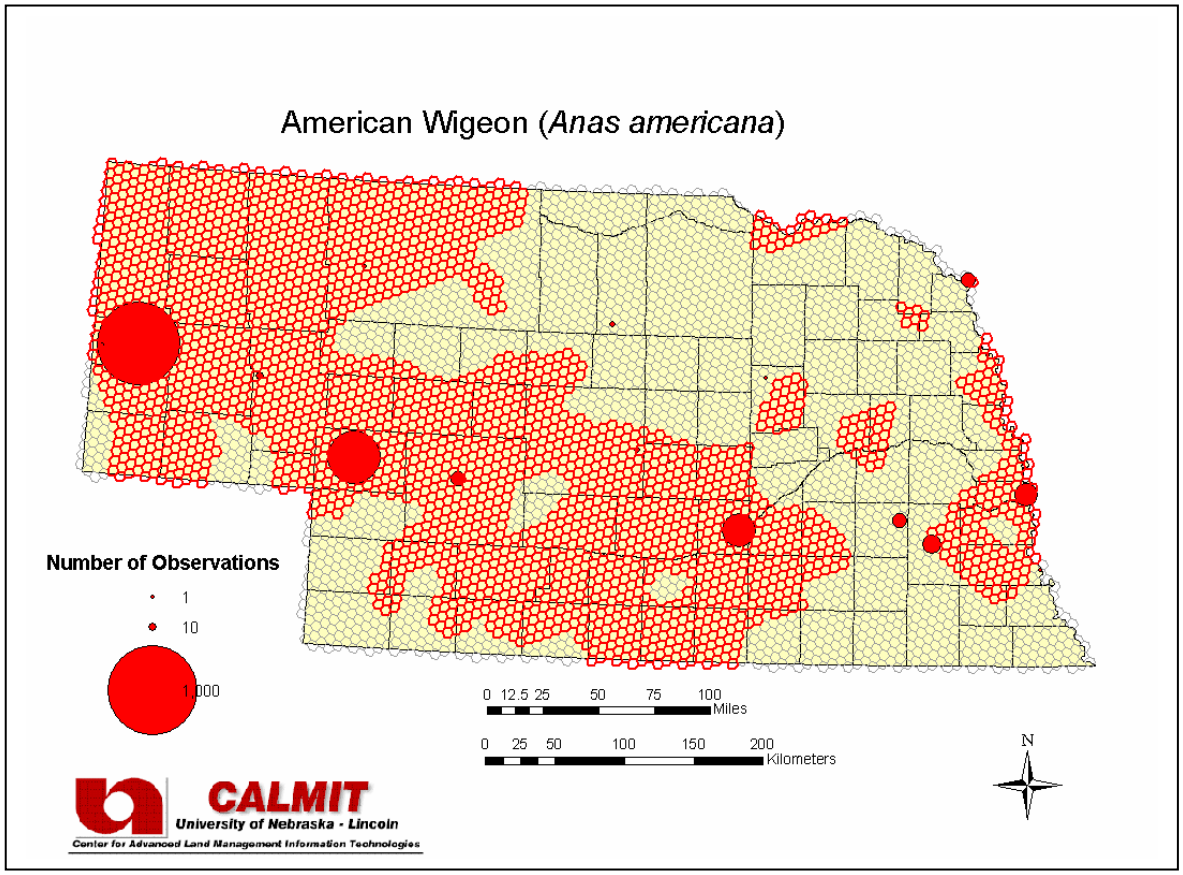
Common Name:	**American Wigeon**	TNC Global Status:	G5
Scientific Name:	***Anas americana***	Federal Status:	--
TNC Element Code:	ABNJB10180	State (NE) Status:	S2
AOU Code:	01370		

Habitat Description:
During migration found on large lakes or reservoirs, foraging where submerged plants can be easily reached from the surface or around the shorelines in grassy meadows (Johnsgard 1997). Breeding usually in marshes or lakes with abundant aquatic food at or near the surface, and especially those with adjacent sedge meadows or brushy, partially wooded habitats nearby.

Total Area of Modeled Habitat (ha): 1.08×10^7

Model Description:
Modeled distribution using the set of variables 'Average 30-year Maximum Temperature Coefficient of Variation for May > 4.9%' AND 'Average 30-year Minimum Temperature Coefficient of Variation for December > 32%'.

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



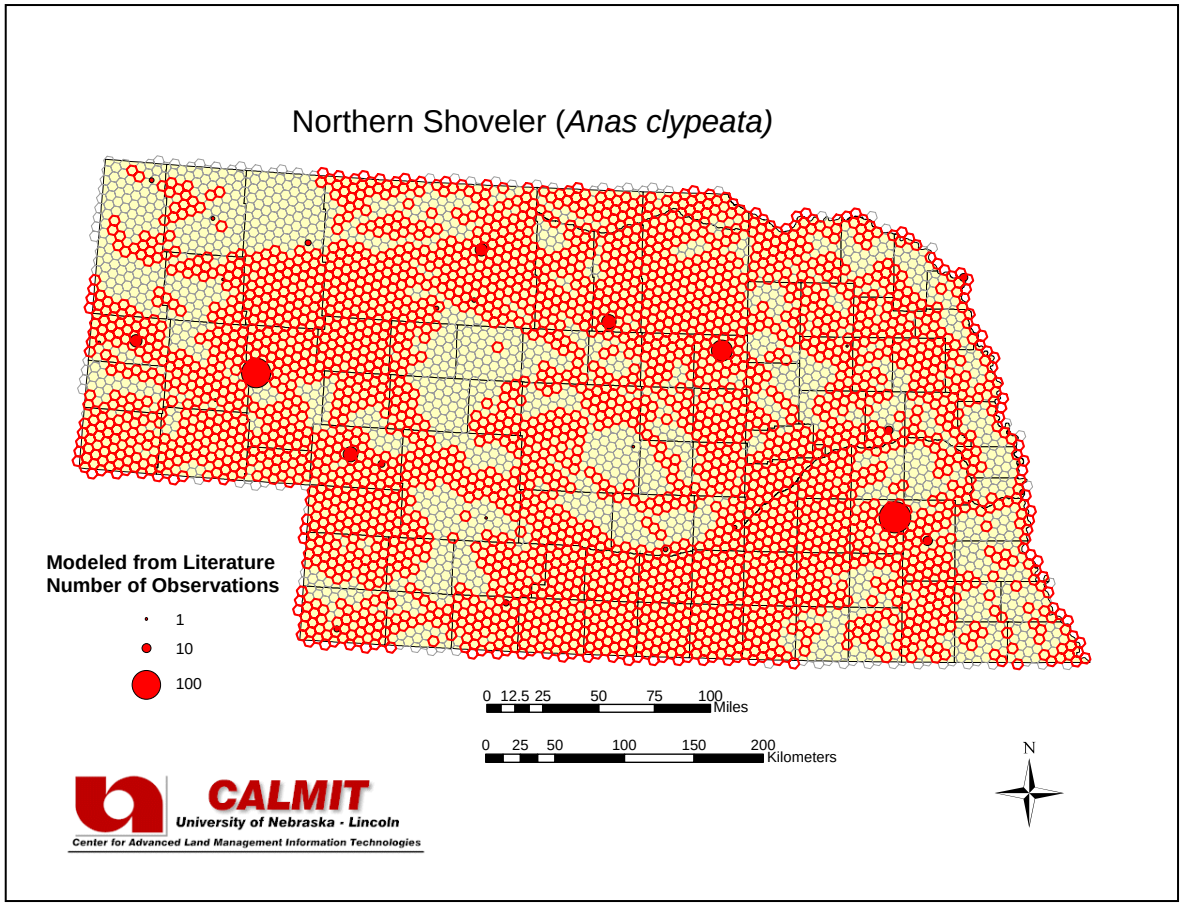
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Northern Shoveler**	TNC Global Status:	G5
Scientific Name:	***Anas clypeata***	Federal Status:	--
TNC Element Code:	ABNJB10150	State (NE) Status:	S4
AOU Code:	01420		

Habitat Description:
During the nesting season the birds favor shallow prairie marshes rich in zooplankton and phytoplankton (Johnsgard 1997). Found on marshy ponds and lakes with extensive emergent vegetation in the water and along the shoreline (Mollhoff 2001). Breeding pairs may be found statewide associated with marshes, but the largest concentrations are found in the Sandhill lakes region (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.27×10^7

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Emergent Wetland > 0.1%'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

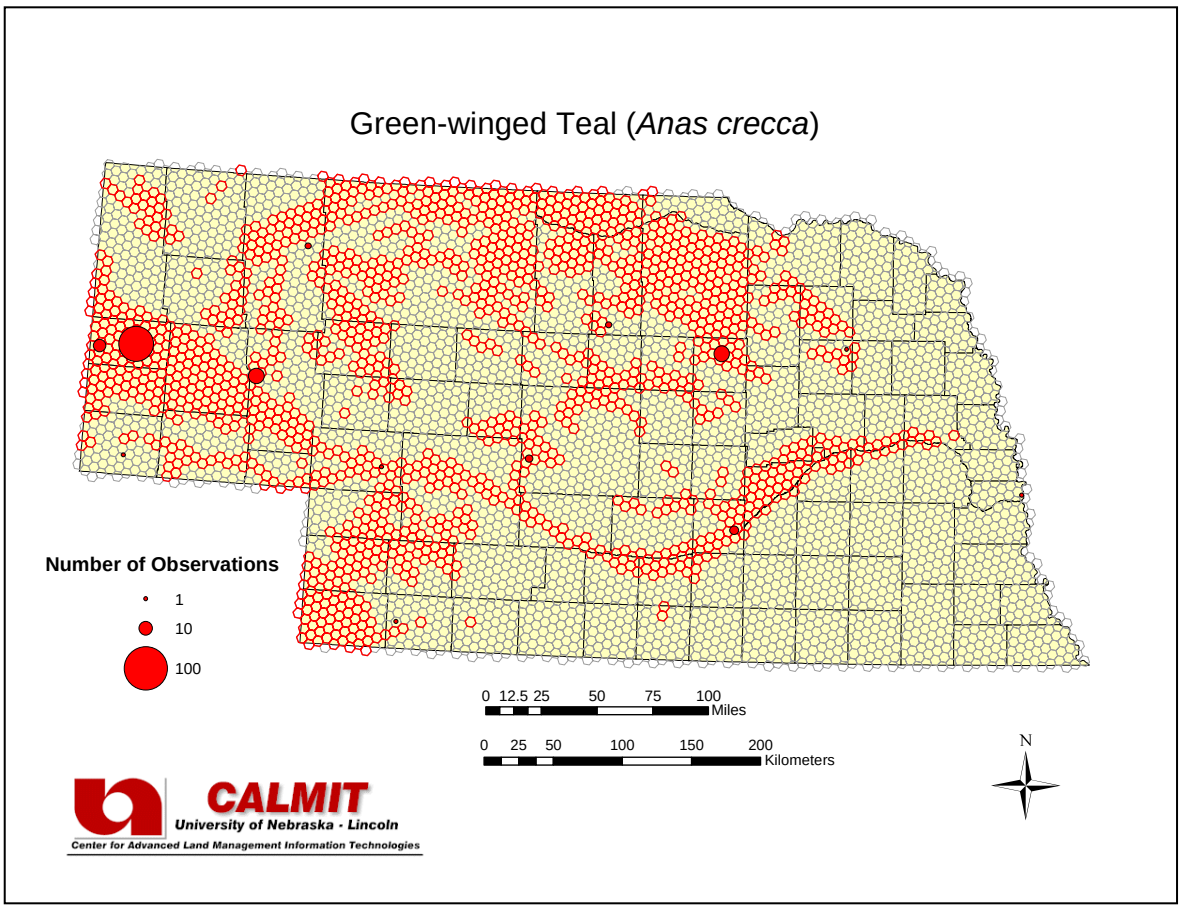
Common Name:	**Green-winged Teal**	TNC Global Status:	G5
Scientific Name:	***Anas crecca***	Federal Status:	--
TNC Element Code:	ABNJB10010	State (NE) Status:	S3S4
AOU Code:	01390		

Habitat Description:
During the breeding season they are found utilizing ponds, lakes, and reservoirs surrounded by a mixture of grassland, sedge meadows and areas supporting shrubby or woody vegetation. Found much less often on large bodies of water. Often occur in the Sandhill lakes and marshes during the breeding season, few records are found south of the Platte River (Johnsgard 1997, Mollhoff 2001, Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 6,085,961

Model Description:
Modeled distribution using the variable 'Percentage of Moderately Coarse-textured Soils > 7.5%'.

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



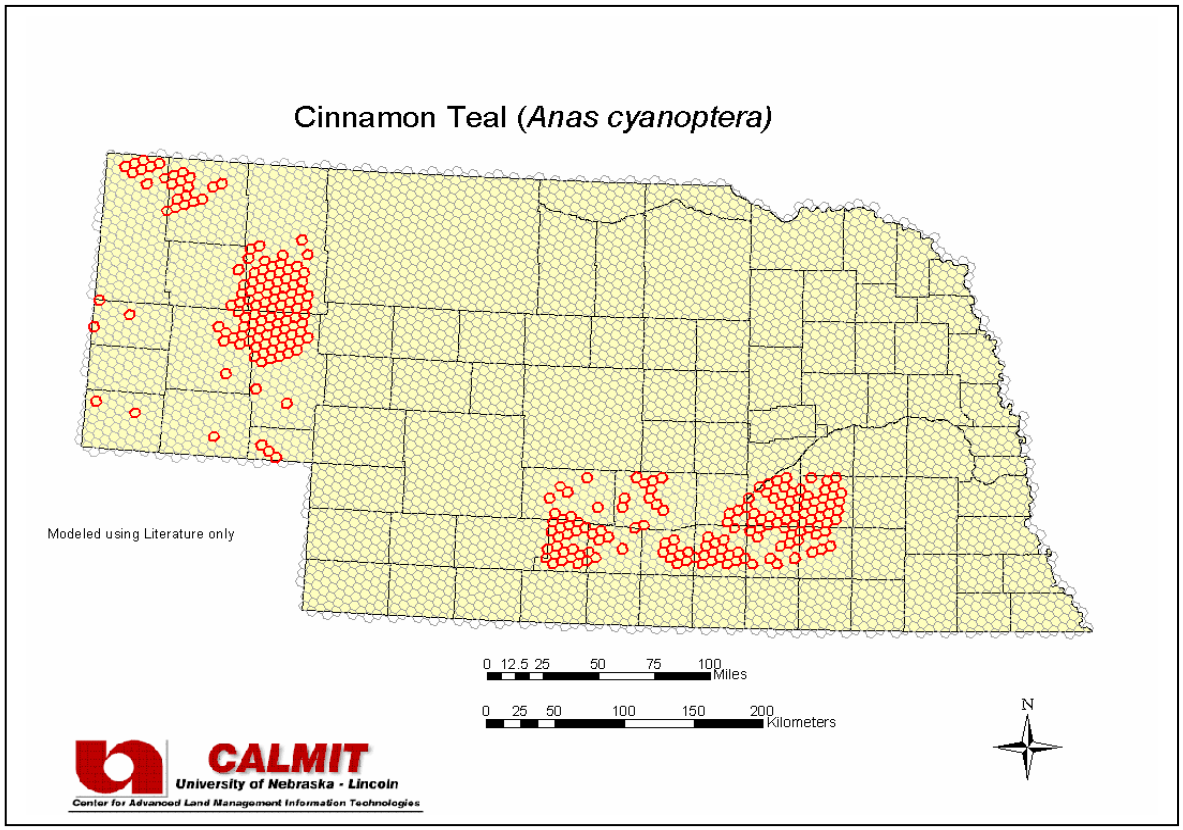
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Cinnamon Teal**	TNC Global Status:	G5
Scientific Name:	***Anas cyanoptera***	Federal Status:	--
TNC Element Code:	ABNJB10140	State (NE) Status:	S?N
AOU Code:	04160		

Habitat Description:
Found in shallow ponds, ditches, and marshes (rarely in deep water), typically in marshes surrounded by native prairies & grassy sedge meadows (Johnsgard 1997, Sharpe et al. 2001). Its status is uncertain, at least as a casual breeder (Mollhoff 2001). As a breeding bird, it is found regularly in alkaline marshes in the Panhandle, as well as on western Sandhills lakes, notable at Crescent Lake NWR. In recent years there have been multiple reports from Sheridan, Dawes, and Sioux Counties, as well as the Rainwater Basin, all locations where breeding may occur. Reports from the 'North American Breeding Bird Survey Results and Analysis, 1966-2000' (Sauer et al. 2001) shows a limited distribution that does not match the information from regional literature.

Total Area of Modeled Habitat (ha): 1,127,182

Model Description:
No observational data were available for this species. Distribution was modeled from literature using the set of variables 'Land Cover class Emergent Wetland > 0.05%' AND 'Land Cover class Aquatic Bed Wetland > 0.05%'. Extents clipped to areas of the state where breeding reports have been confirmed (Sharpe et al. 2001).



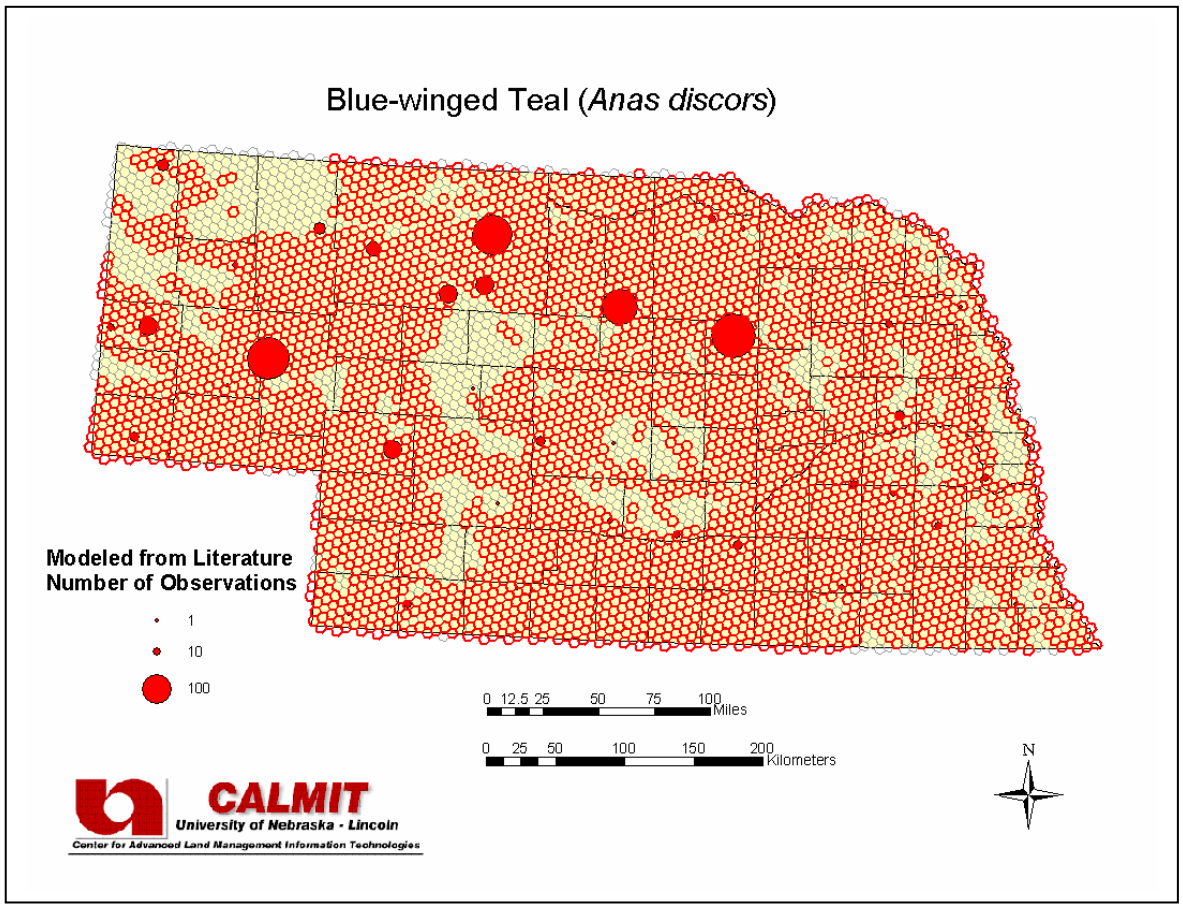
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Blue-winged Teal**	TNC Global Status:	G5
Scientific Name:	***Anas discors***	Federal Status:	--
TNC Element Code:	ABNJB10130	State (NE) Status:	S5
AOU Code:	01400		

Habitat Description:
Breeding is typically in marshes surrounded by native prairies and grassy sedge meadows (Johnsgard 1997). Prefers shallow lakes and ponds with marshy areas, but will also breed in seasonal stock ponds and water-filled ditches (Mollhoff 2001). Found statewide, normally associated with shallow standing water in marshes, flooded fields, ditches, oxbows, edges of lakes, and reservoirs; may also frequent small, slow-moving streams (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.50×10^7

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Emergent Wetland is present'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



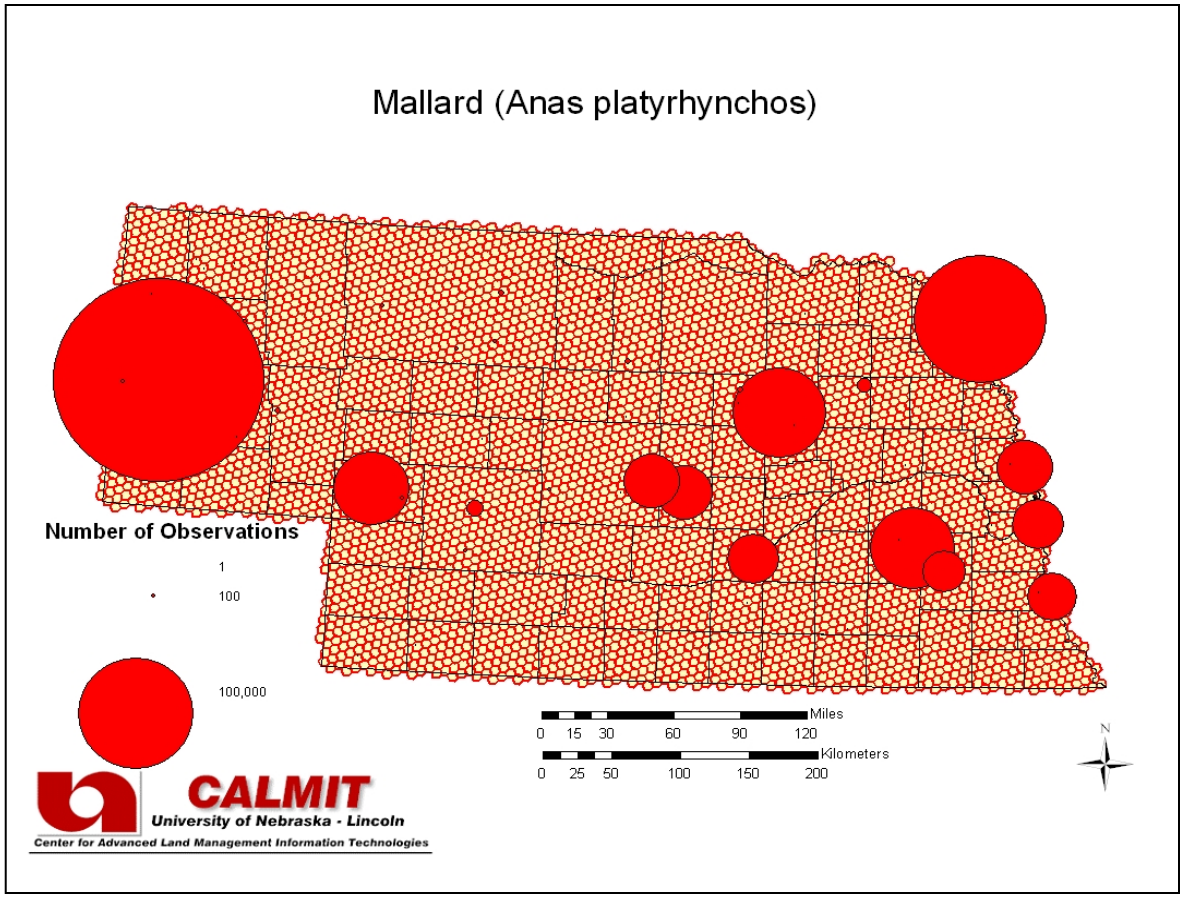
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Mallard**	TNC Global Status:	G5
Scientific Name:	***Anas platyrhynchos***	Federal Status:	--
TNC Element Code:	ABNJB10060	State (NE) Status:	S5
AOU Code:	01320		

Habitat Description:
Breeding birds favor shallow waters, such as marshes, potholes and small prairie rivers with marshy edges, with surrounding dry areas of non-forest vegetation (Johnsgard 1997, Sharpe et al. 2001). Breed successfully almost anywhere a lake or pond holds water through the breeding season (Mollhoff 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Habitat descriptions from literature were broad and general, resulting in no available variables for modeling.



Nebraska GAP Analysis 2004
Bird Species Atlas

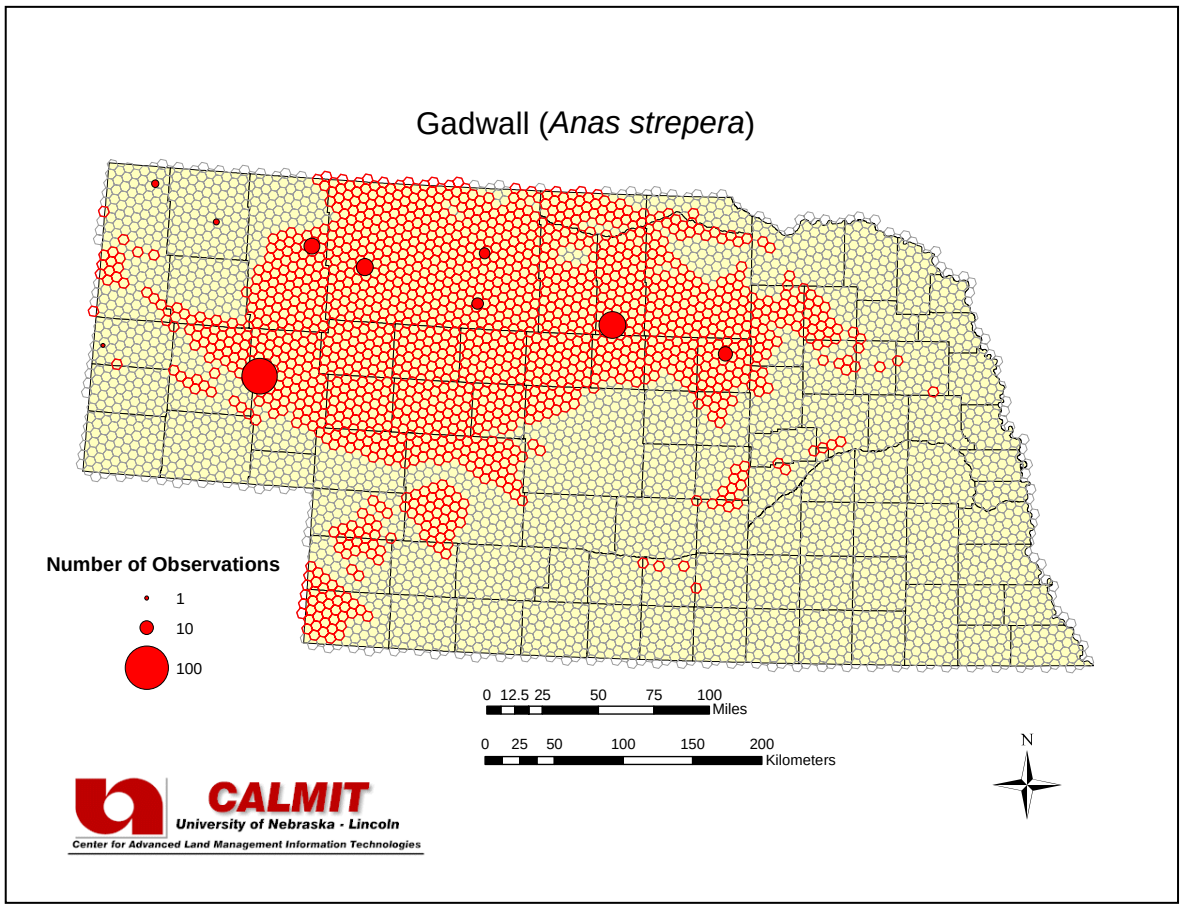
Common Name:	**Gadwall**	TNC Global Status:	G5
Scientific Name:	***Anas strepera***	Federal Status:	--
TNC Element Code:	ABNJB10160	State (NE) Status:	S3
AOU Code:	01350		

Habitat Description:
Species found primarily in the Sandhills, with a small concentration in the Rainwater Basin. Their breeding habitat consists of marshes and shallow lakes especially those having grassy or weedy islands or surrounding weedy cover (Johnsgard 1997, Mollhoff 2001, Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 668,607

Model Description:
Modeled distribution using the variable 'Percentage of Coarse-textured Soils > 50%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



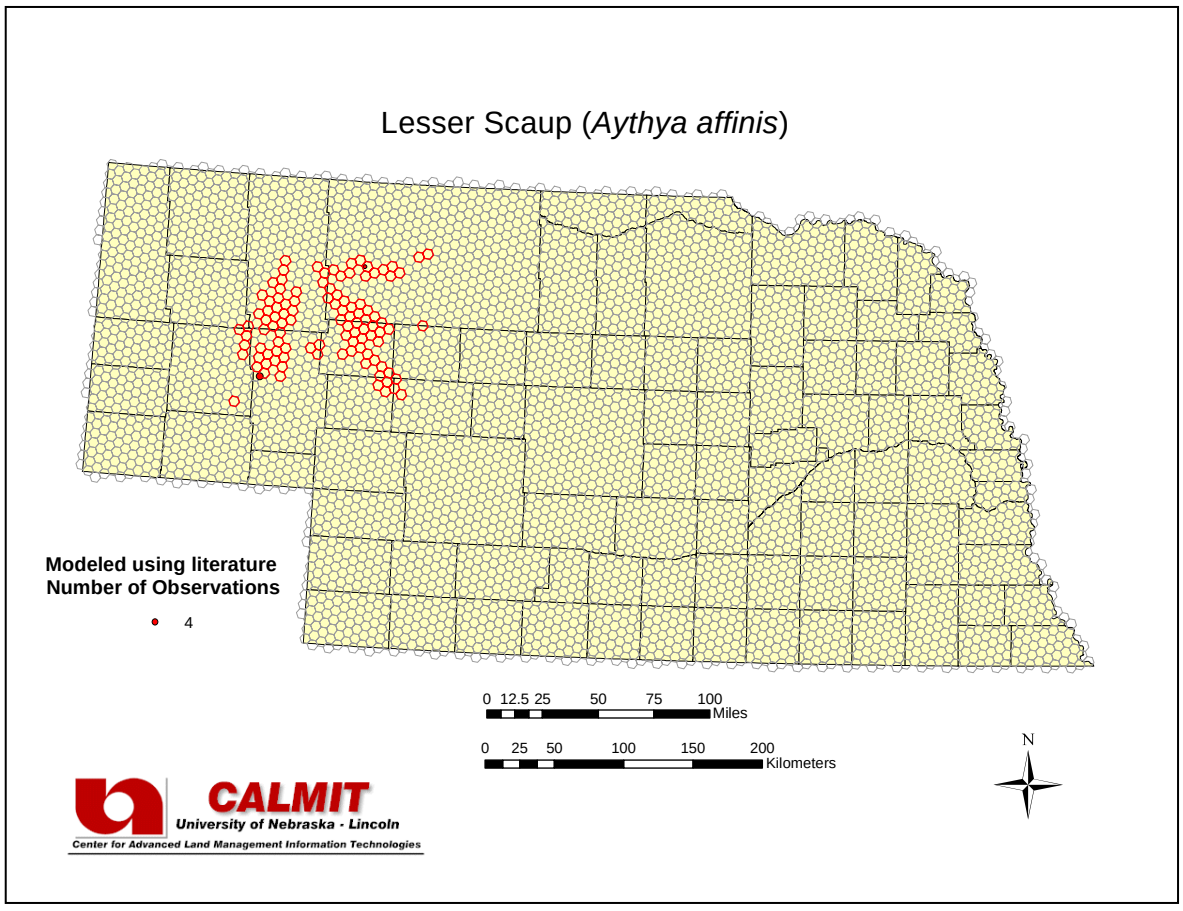
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Lesser Scaup**	TNC Global Status:	G5
Scientific Name:	***Aythya affinis***	Federal Status:	--
TNC Element Code:	ABNJB11070	State (NE) Status:	S3
AOU Code:	01490		

Habitat Description:
This species is a rare regular breeder in the north-central. Lesser Scaup utilize large lakes, reservoirs, grass-margined wetlands, and large deep marshes with extensive open water. Usually nests in upland areas adjacent to water but also in wet meadows and sloughs among bulrushes. Known to have nested and breeding in Crescent Lake (DeGraff and Rappole 1995, Johnsgard 1997, Levad 1998, Sharpe et al. 2001). Breeding females tend to return to the previous year's nesting pond in succeeding year (Levad 1998).

Total Area of Modeled Habitat (ha): 425,735

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the set of variables 'Percentage of Coarse-textured Soils > 50%' AND 'Land Cover class Emergent Wetland > 4%'. Extent was clipped to match area of known breeding records (Sharpe et al. 2001).



Nebraska GAP Analysis 2004
Bird Species Atlas

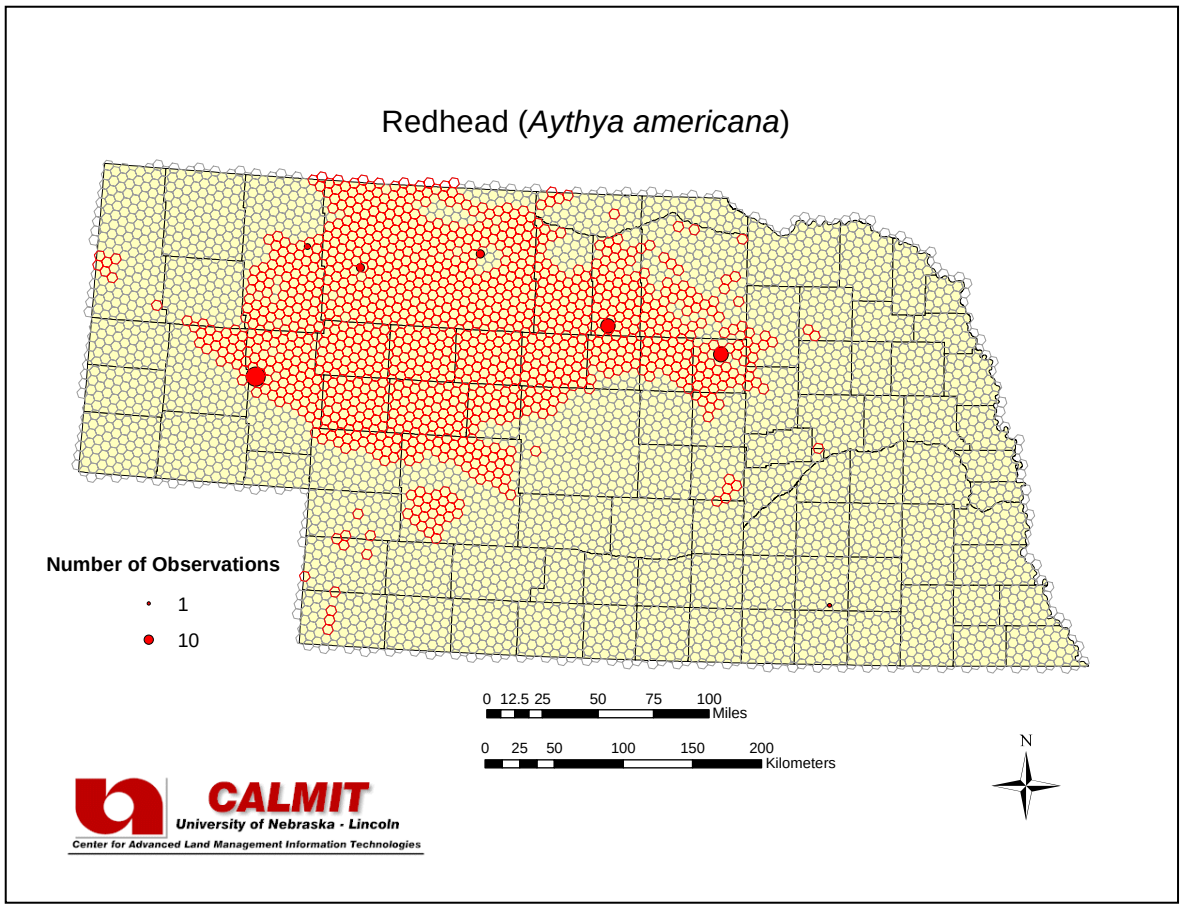
Common Name:	**Redhead**	TNC Global Status:	G5
Scientific Name:	***Aythya americana***	Federal Status:	--
TNC Element Code:	ABNJB11030	State (NE) Status:	S4
AOU Code:	01460		

Habitat Description:
During the breeding season this species requires extensive marshes that border expanses of open water and contain submerged vegetation. Such habitat is found scattered throughout the Sandhills and Panhandle. Breeding could occur in the Rainwater Basin although there are few documented records (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 5,027,734

Model Description:
Modeled distribution using the variable 'Percentage of Coarse-textured Soils > 80%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

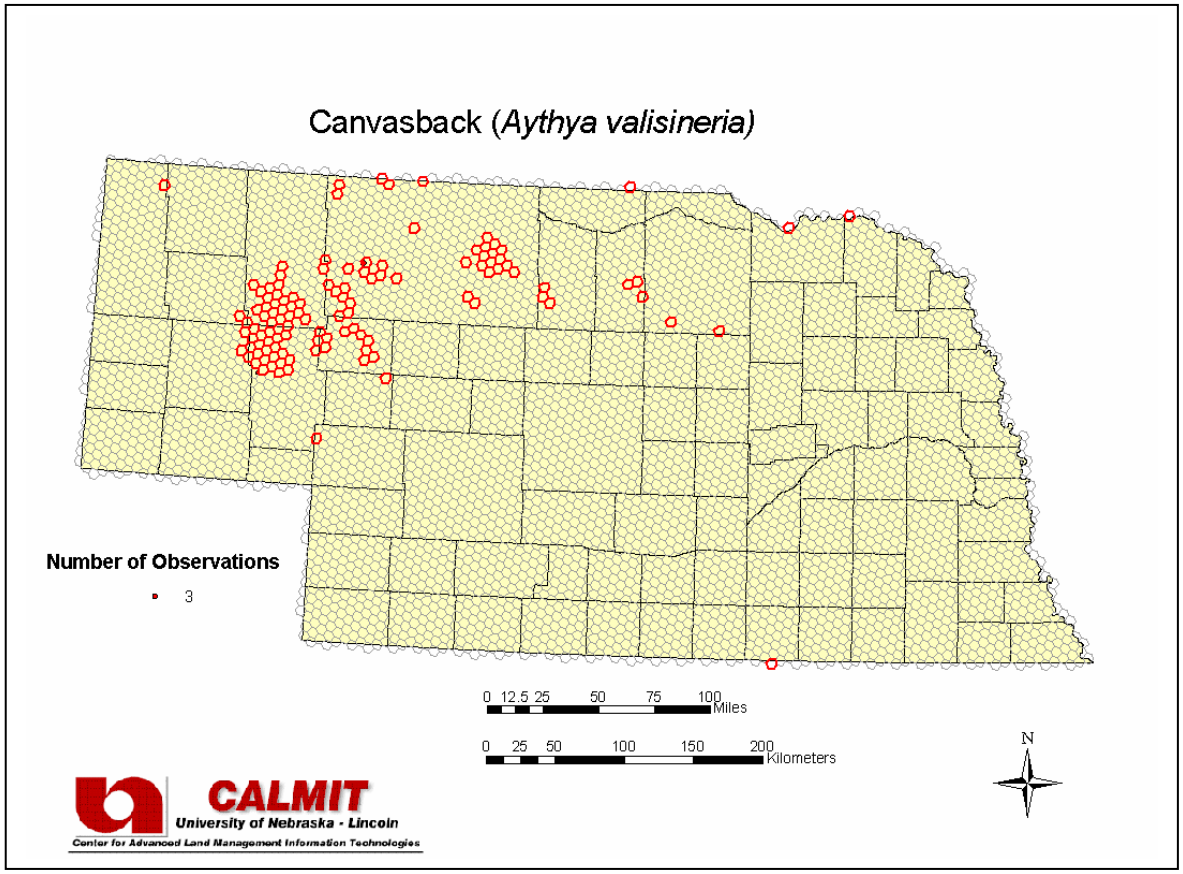
Common Name:	**Canvasback**	TNC Global Status:	G5
Scientific Name:	***Aythya valisineria***	Federal Status:	--
TNC Element Code:	ABNJB11020	State (NE) Status:	S3
AOU Code:	01470		

Habitat Description:
Prairie marshes with abundant emergent vegetation and areas of open water are preferred nesting habitats (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 474,389

Model Description:
Modeled distribution using the variable 'Land Cover class Aquatic Bed Wetland > 1.5%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



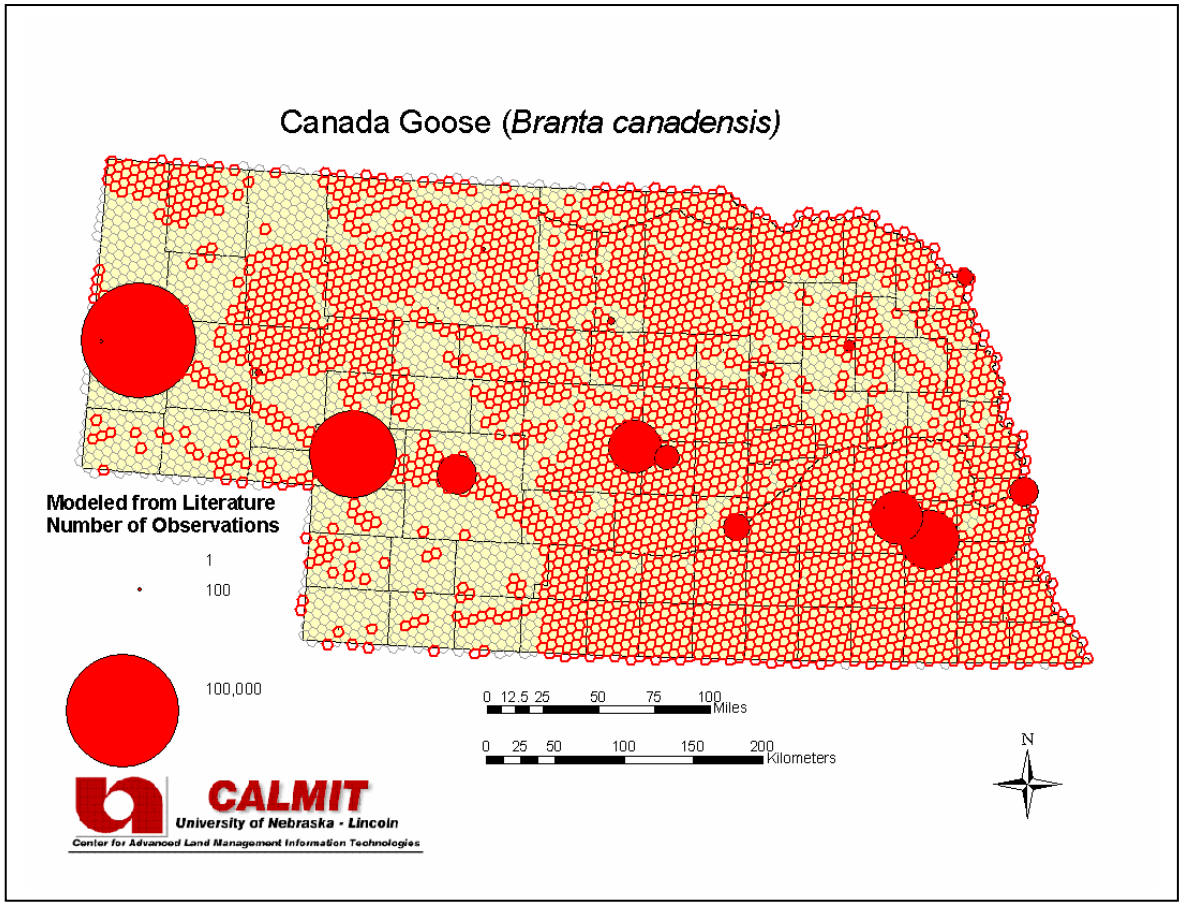
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Canada Goose**	TNC Global Status:	G5
Scientific Name:	***Branta canadensis***	Federal Status:	--
TNC Element Code:	ABNJB04020	State (NE) Status:	S?N
AOU Code:	01720		

Habitat Description:
Breeding is typical on prairie marshes, or sometimes on larger lakes with islands or muskrat houses (Johnsgard 1997, Mollhoff 2001). Also utilize marshy streams, river islands, and sandbars (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.19×10^7

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the set of variables 'Land Cover class Open Water is present' OR 'Land Cover class Aquatic Bed Wetland is present' OR 'Land Cover class Emergent Wetland > 5%'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

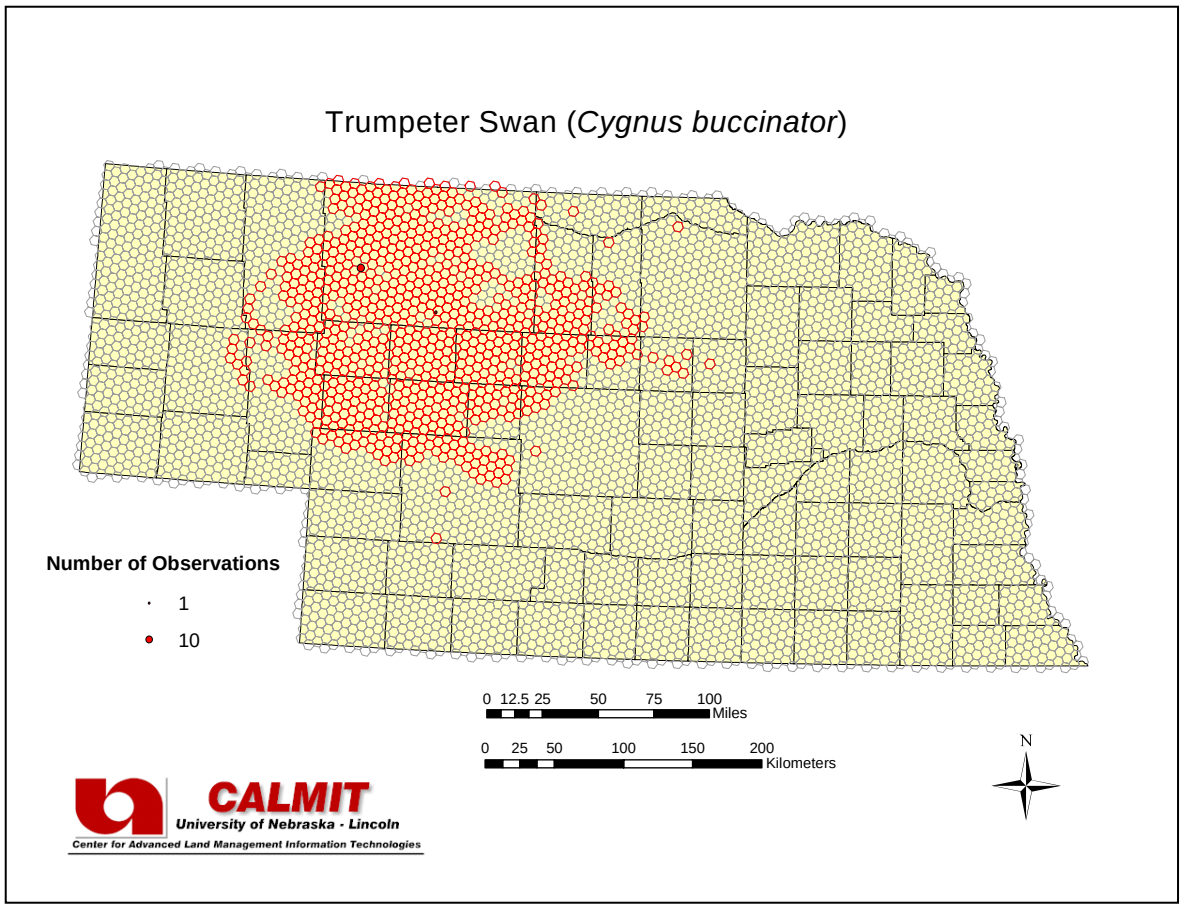
Common Name:	**Trumpeter Swan**	TNC Global Status:	G4
Scientific Name:	***Cygnus buccinator***	Federal Status:	--
TNC Element Code:	ABNJB02030	State (NE) Status:	S2
AOU Code:	01810		

Habitat Description:
Attracted to large marshes with open water supporting abundant food as well as extensive emergent vegetation that provides cover. Most appropriate habitat exists in the Sandhills in Cherry, Sheridan and Garden counties (Sharpe et al. 2001). Breeding occurs large shallow marshes or lakes having abundant submerged vegetation, emergent plants, and stable water levels (Johnsgard 1997, Mollhoff 2001).

Total Area of Modeled Habitat (ha): 3,438,327

Model Description:
Modeled distribution using the variable 'Land Cover class Sandhills Upland Prairie > 70%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

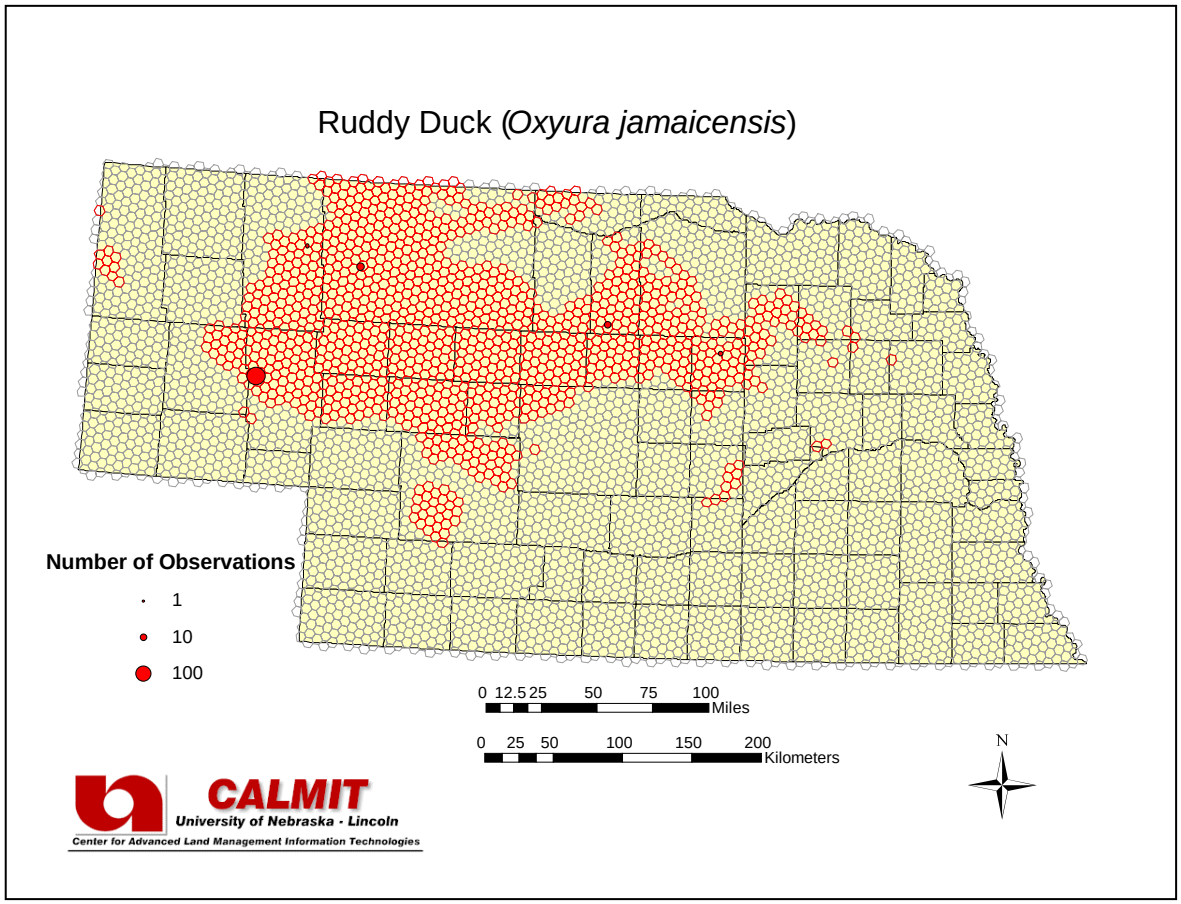
Common Name:	**Ruddy Duck**	TNC Global Status:	G5
Scientific Name:	***Oxyura jamaicensis***	Federal Status:	--
TNC Element Code:	ABNJB22010	State (NE) Status:	S4
AOU Code:	01670		

Habitat Description:
It was found most concentrated in the Sandhills with occasional occurrences in the Rainwater Basin and other appropriate habitat. It breeds on prairie marshes having stable water levels, that are bordered by dense stands of bulrushes and cattails, as well as patches of emergent vegetation interspersed with open water (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 4,938,533

Model Description:
Modeled distribution using the set of variables 'Percentage of Coarse-textured Soils > 65%' AND 'Average 30-year Minimum Temperature for October > 7.5°C'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



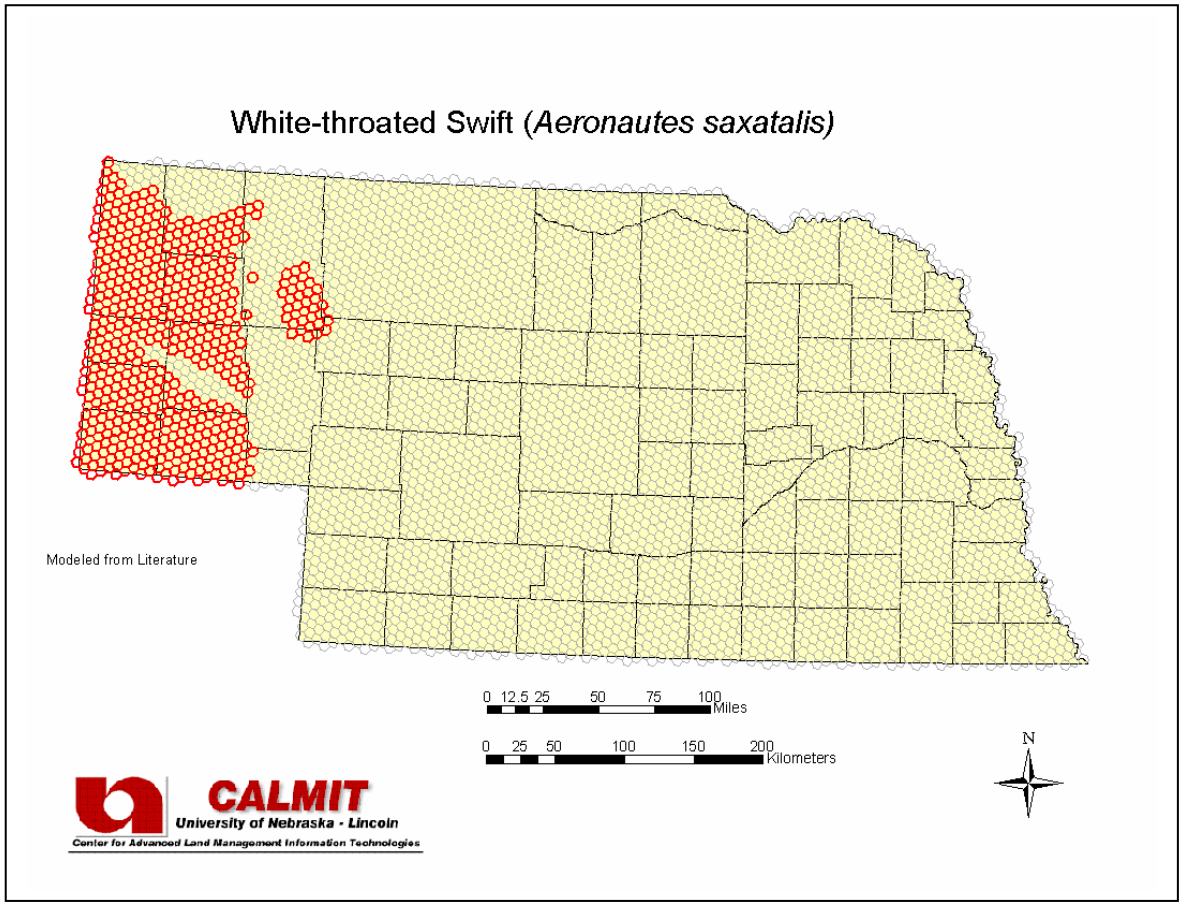
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**White-throated Swift**	TNC Global Status:	G5
Scientific Name:	***Aeronautes saxatalis***	Federal Status:	--
TNC Element Code:	ABNUA06010	State (NE) Status:	S4
AOU Code:	04250		

Habitat Description:
Prefers steep cliffs and deep canyons; nests in inaccessible rocks and crevices (DeGraff and Rappole 1995, Johnsgard 1997). In Nebraska, it is essentially restricted to nesting sites on cliffs in the Panhandle (Mollhoff 2001, Sharpe et al. 2001). This species has been noted as far east extreme western Sheridan County, although more recently easternmost sightings are from Jailhouse Rock, Morrill Co. It occurs in the rest of the Pine Ridge, most commonly westward, and in the Wildcat Hills and at Scotts Bluff. Limited to the western Panhandle with areas of vertical rock cliffs, with a minimum height of perhaps 15 meters (Mollhoff 2001).

Total Area of Modeled Habitat (ha): 2,278,672

Model Description:
No observational data were available for this species. Modeled from literature using the variable 'Elevation > 1200 m'.



Nebraska GAP Analysis 2004
Bird Species Atlas

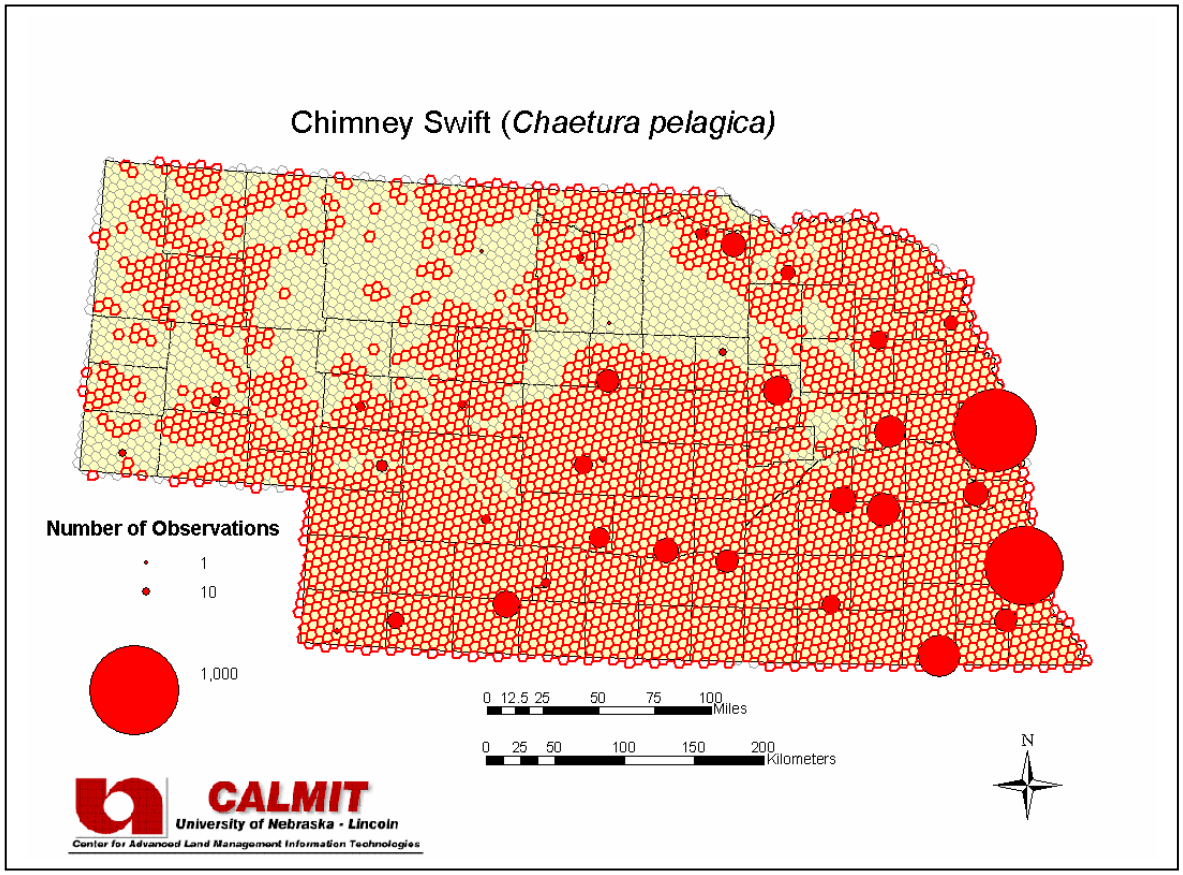
Common Name:	**Chimney Swift**	TNC Global Status:	G5
Scientific Name:	***Chaetura pelagica***	Federal Status:	--
TNC Element Code:	ABNUA03010	State (NE) Status:	S5
AOU Code:	04230		

Habitat Description:
Occurs in a wide variety of habitats; probably most common in cities, where chimneys and other similar structures provide suitable roosting and nesting sites (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 1.43×10^7

Model Description:
Modeled distribution using the set of variables 'Land Cover class Barren/Sand/Outcrop $\leq$ 0.45%' AND 'Land Cover class Lowland Tallgrass Prairie $\leq$ 6%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



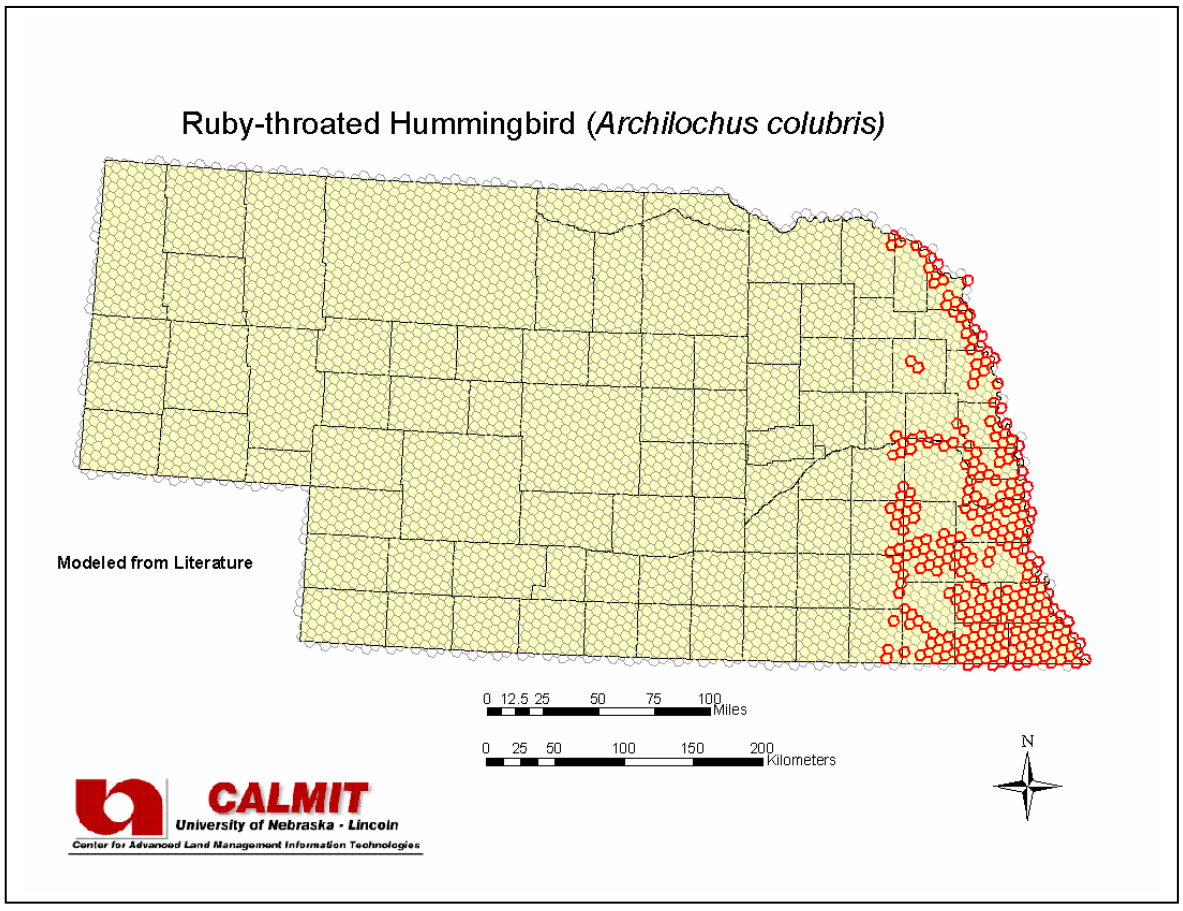
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Ruby-throated Hummingbird**	TNC Global Status:	G5
Scientific Name:	***Archilochus colubris***	Federal Status:	--
TNC Element Code:	ABNUC45010	State (NE) Status:	S3
AOU Code:	04280		

Habitat Description:
Breeds in woodlands, orchards, and parks, where large trees as well as flowering herbs are available (Johnsgard 1997). Utilizes a variety of wooded habitats, ranging from rather dense to open coniferous and deciduous woodlands, orchards, and shade trees in yards (DeGraff and Rappole 1995). Also inhabits mixed woodlands, parks, and gardens, often breeding in woodlands near streams or wooded swamps, especially in western portion of range. Uses a variety of trees for nesting, but appears to favor hardwoods over conifers, especially those with rough, lichen-covered bark. Restricted as a breeding species to the woodlands of the Missouri Valley and lower Platte Valley, where a variety of flowering plants provide suitable habitat for the breeding season. (Mollhoff 2001, Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1,212,334

Model Description:
No observational data were available for this species. Modeled from literature using the variable 'Land Cover class Deciduous Forests and Woodlands > 0.5%', clipped to areas of the state where breeding reports have been confirmed (Sharpe et al. 2001).



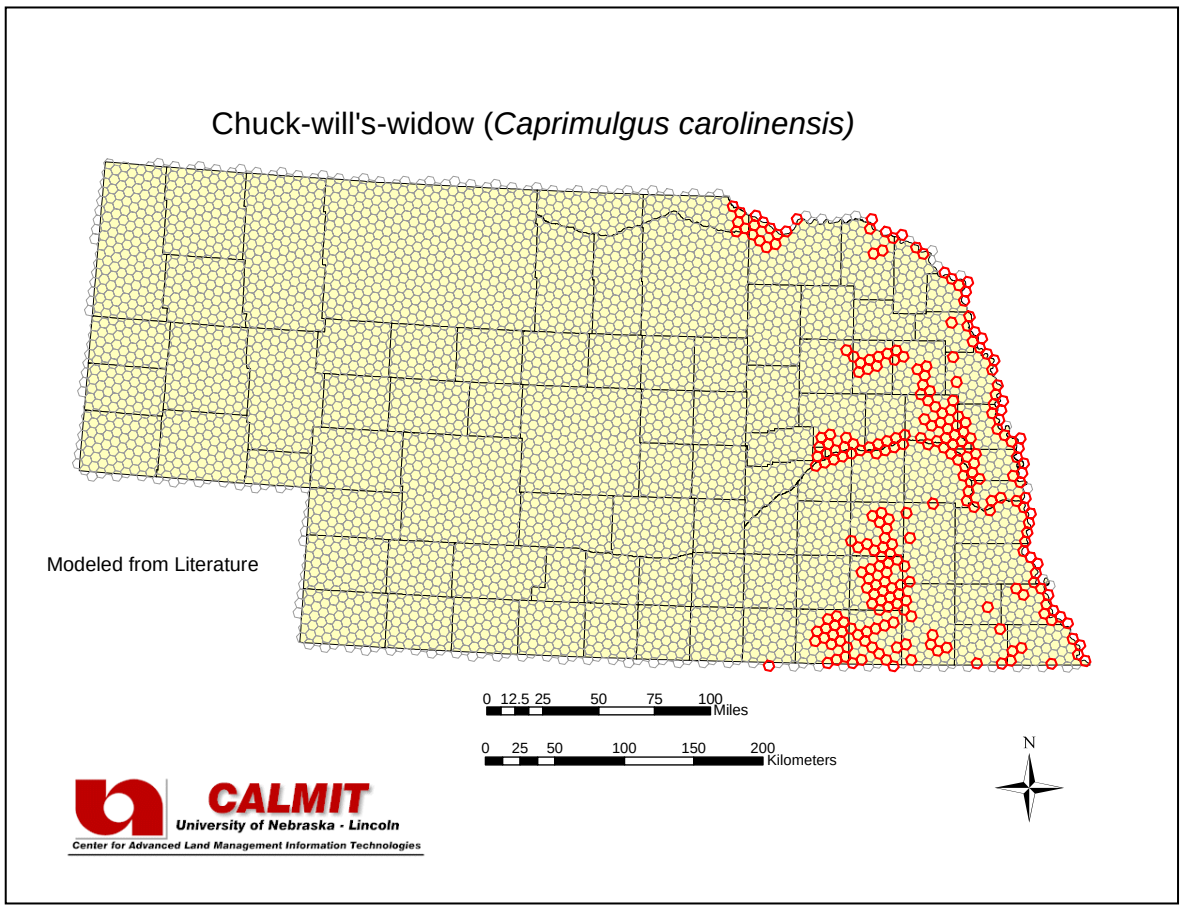
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Chuck-will's-widow**	TNC Global Status:	G5
Scientific Name:	***Caprimulgus carolinensis***	Federal Status:	--
TNC Element Code:	ABNTA07010	State (NE) Status:	S1
AOU Code:	04160		

Habitat Description:
Preferred breeding habitat is almost exclusively riparian woodlands, frequently comprised of mixed oaks and pines (Johnsgard 1997, Mollhoff 2001). Contemporary distribution of this species is the Missouri River Valley oak-hickory woodlands of extreme southeastern NE, northward in the river bluffs to Dakota Co, and westward in the Platte Valley to the Morse Bluff area (Sharpe et al. 2001). It also occurs a short way up the Elkhorn River. It is most often located along or near ridge tops of oak-hickory parkland. Reports from the 'Ranges of North American Breeding Birds/USGS Northern Prairie Science Center' (Price 1995) and the 'North American Breeding Bird Survey Results and Analysis, 1966-2000' (Sauer et al. 2001) support this very limited distribution in Nebraska.

Total Area of Modeled Habitat (ha): 1,037,980

Model Description:
No observational data were available for this species. Distribution was modeled from literature using the set of variables 'Land Cover class Riparian Woodland > 0.05%' AND 'Elevation < 475 m'.



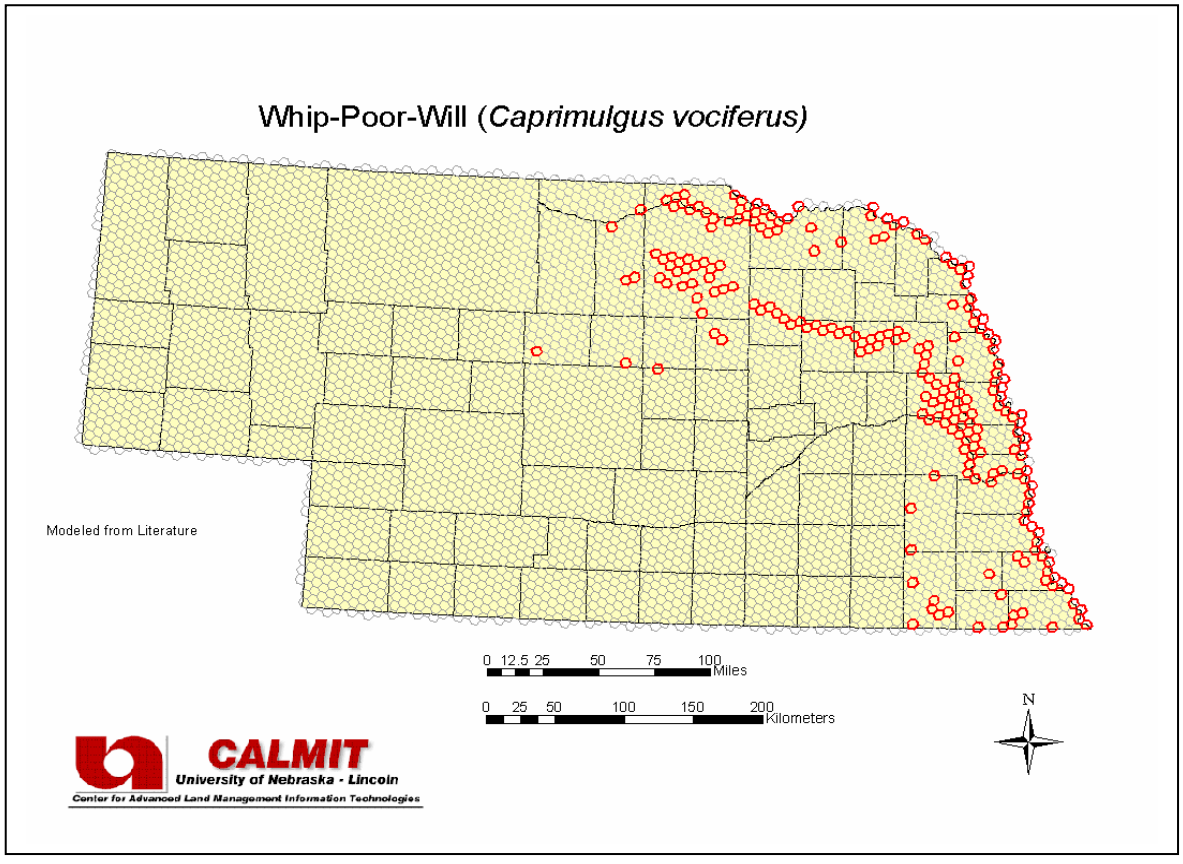
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Whip-poor-will**	TNC Global Status:	G5
Scientific Name:	***Caprimulgus vociferus***	Federal Status:	--
TNC Element Code:	ABNTA07070	State (NE) Status:	S2
AOU Code:	04170		

Habitat Description:
Open hardwood or mixed woodlands, especially younger stands in fairly dry habitats or woodlands with scattered clearings seem to be preferentially used (DeGraff and Rappole 1995, Johnsgard 1997). Found in oak-hickory forests of the southeast, west to Pawnee Co, in similar habitat throughout the Missouri Valley, in the Platte Valley where oak-dominated woodland occupies hillsides, west to the Morse Bluff area, and in the Niobrara Valley west to extreme eastern Cherry County in similar oak habitat (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 875,791

Model Description:
No observational data were available for this species. Modeled from literature using the set of variables 'Land Cover class Deciduous Forests and Woodlands > 0.05%' AND 'Land Cover class Riparian Woodland is present'. Extent clipped to areas of recorded breeding – southeastern Nebraska, west to Pawnee Co, throughout the Missouri Valley, in the Platte Valley to northern Saunders Co., and west to extreme eastern Cherry Co in the Niobrara Valley (Sharpe et al. 2001).



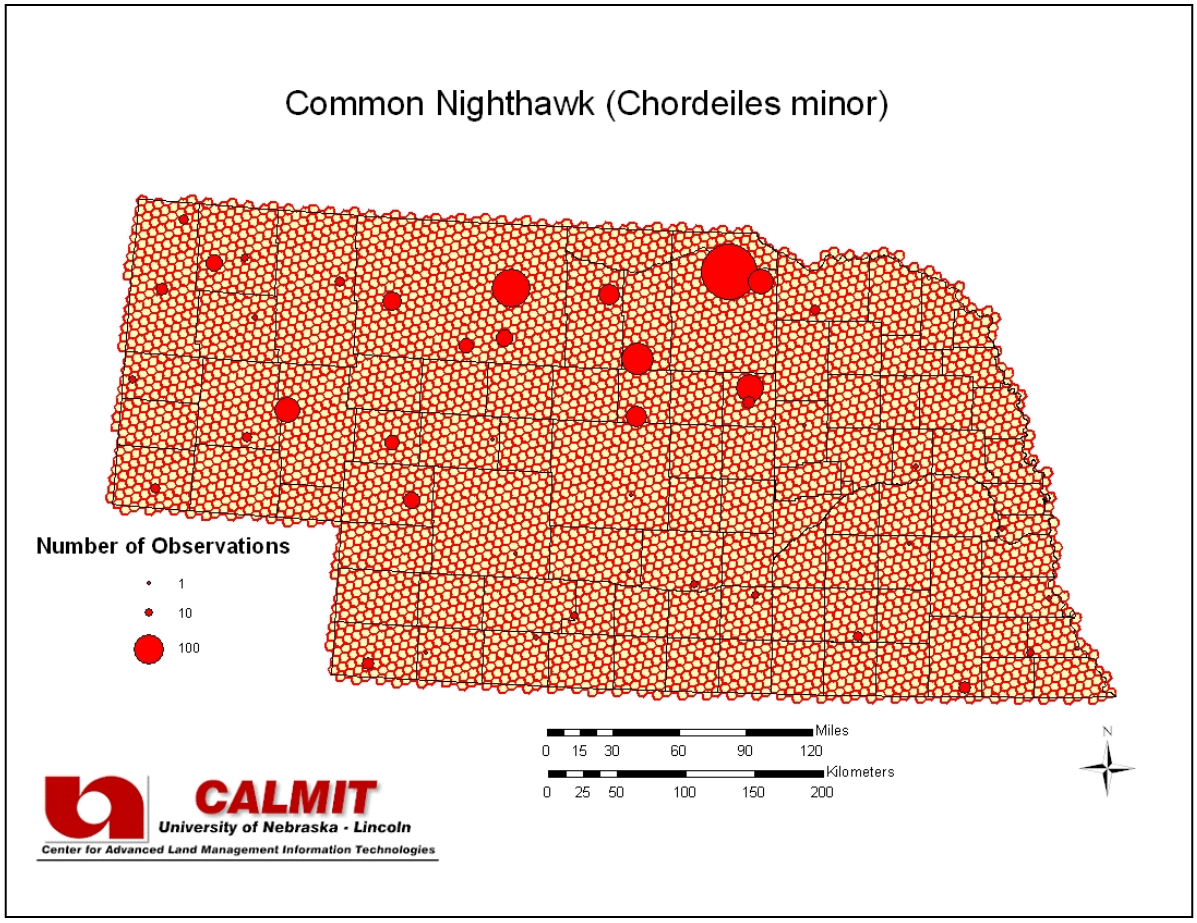
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Common Nighthawk**	TNC Global Status:	G5
Scientific Name:	***Chordeiles minor***	Federal Status:	--
TNC Element Code:	ABNTA02020	State (NE) Status:	S5
AOU Code:	04200		

Habitat Description:
Occurs widely in open habitats such as grasslands, sparse woods and cities (Johnsgard 1997). Species readily uses a wide variety of habitats, seems most common in Sandhills (Mollhoff 2001). Breeding birds occur throughout the state, but are most abundant in larger towns and cities, where they nest on flat, graveled roofs (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Habitat descriptions from literature were broad and general, resulting in no available variables for modeling..



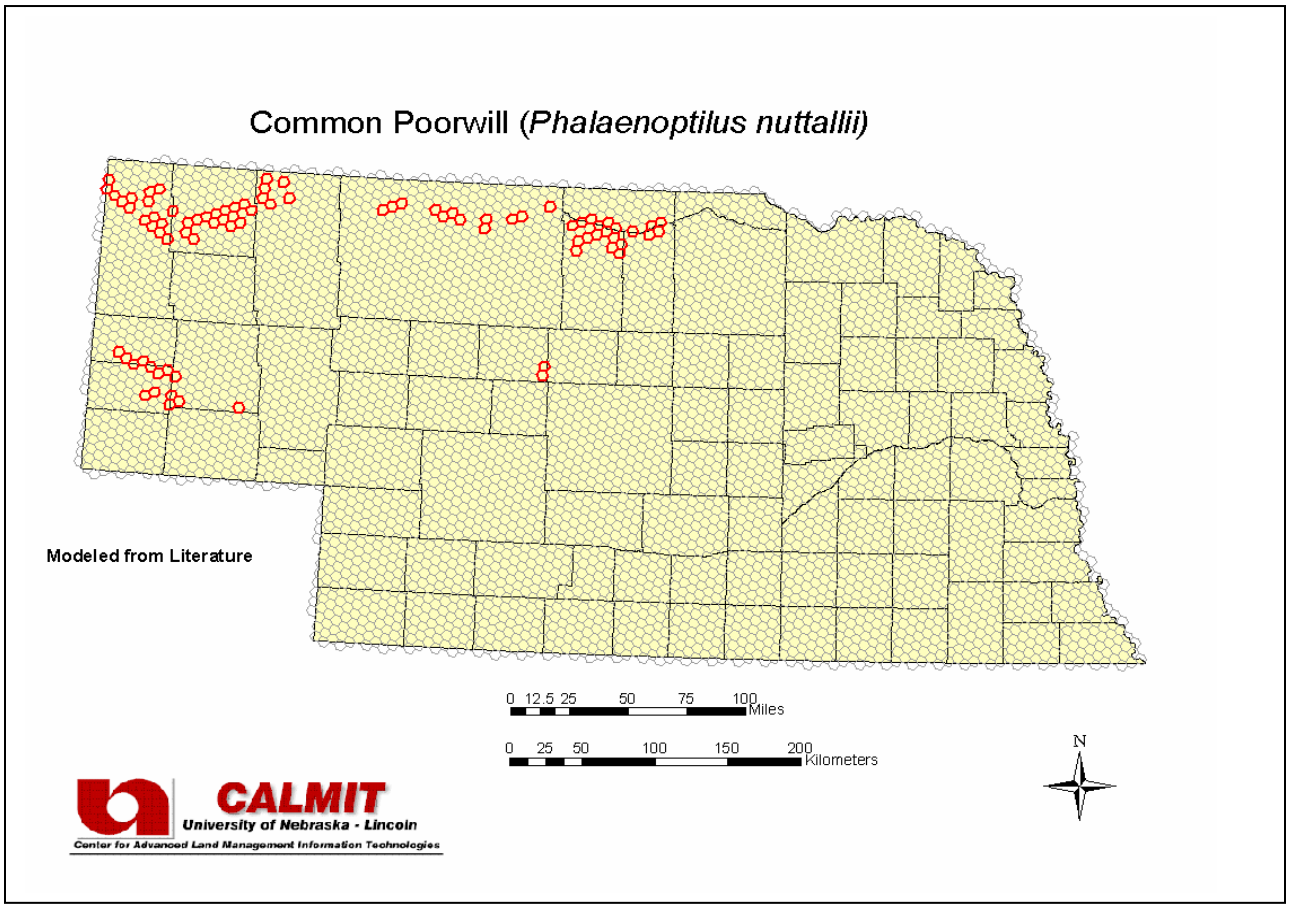
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Common Poorwill**	TNC Global Status:	G5
Scientific Name:	***Phalaenoptilus nuttallii***	Federal Status:	--
TNC Element Code:	ABNTA04010	State (NE) Status:	S2
AOU Code:	04180		

Habitat Description:
This species is common in rocky habitats with scrubby cover or dry woodlands and also locally extends into grasslands (Johnsgard 1997). However, the Sandhills area is evidently avoided by breeding birds. Nebraska is at the extreme eastern edge of this breeding range for this species, and while the range boundary is not well documented, it apparently encompasses any areas where pines or brushy woodlands are associated with rocky terrain (Sharpe et al. 2001). Such habitat occurs primarily in the northern Panhandle but extends along the Niobrara Valley east to at least Brown County, in the North Platte Valley at least to the Keystone area, and in the southwest, including scarps above Frenchman Creek in Chase, Hayes, and Hitchcock Cos. It may occupy mixed grassland-coniferous habitat in the upper Loup drainage and other native grasslands associated with rough rocky exposures, notably those south of the Platte River. Reports from the 'North American Breeding Bird Survey Results and Analysis, 1966-2000', (Sauer et al. 2001) show a limited distribution in the extreme northwest corner of the state that matches some of the regional breeding reports.

Total Area of Modeled Habitat (ha): 344,645

Model Description:
No observational data were available for this species. Distribution was modeled from literature using variables 'Land Cover class Ponderosa Pine Forests and Woodlands > 5%' AND 'Land Cover class Barren/Sand/Outcrop > 0.05%'. Extent was clipped to areas of the state where breeding reports have been confirmed (Sharpe et al. 2001).



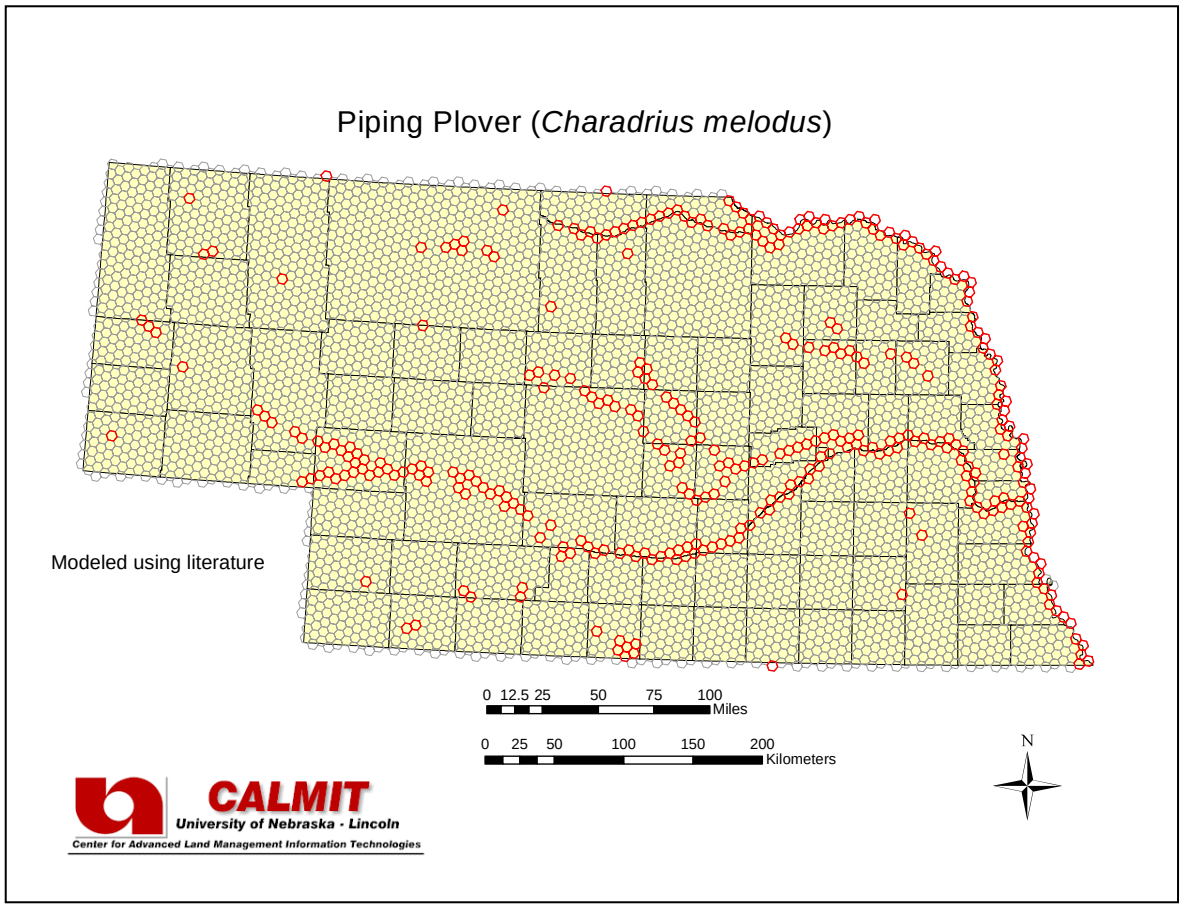
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Piping Plover**	TNC Global Status:	G3
Scientific Name:	***Charadrius melodus***	Federal Status:	LELT
TNC Element Code:	ABNNB03070	State (NE) Status:	S2
AOU Code:	02770		

Habitat Description:
This species is primarily found along larger river systems that provide high and dry, exposed midstream sandbars for nesting and a wide channel. They are also attracted to the large sandpiles produced in sand-mining operations adjacent to the Platte River, as well as barren shorelines of large impoundments and lakes (DeGraff and Rappole 1995; Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001). Nesting occurs on sand or gravel substrates, gravel or pebble substrates are preferred, with the nest constructed from a scrape with little or no lining (DeGraff and Rappole 1995). Nesting areas consist of exposed sand that supports little or no vegetation, and what vegetation does exist is usually less than 15cm (6 in) tall and often scattered with willow and cottonwood seedlings (Sharpe et al. 2001). Breeding birds are restricted to the Missouri, Platte, lower Niobrara, lower Loup, and the Elkhorn River systems (Mollhoff 2001, Sharpe et al. 2001). Suitable habitat appears to also be available along the Elkhorn River and the North and South forks of the Loup River (Mollhoff 2001). Adults tend to return to the same breeding area year after year (DeGraff and Rappole 1995).

Total Area of Modeled Habitat (ha): 1,394,782

Model Description:
No observational data were available for this species. Modeled from literature using the variable 'Land Cover class Open Water > 2.3%'.



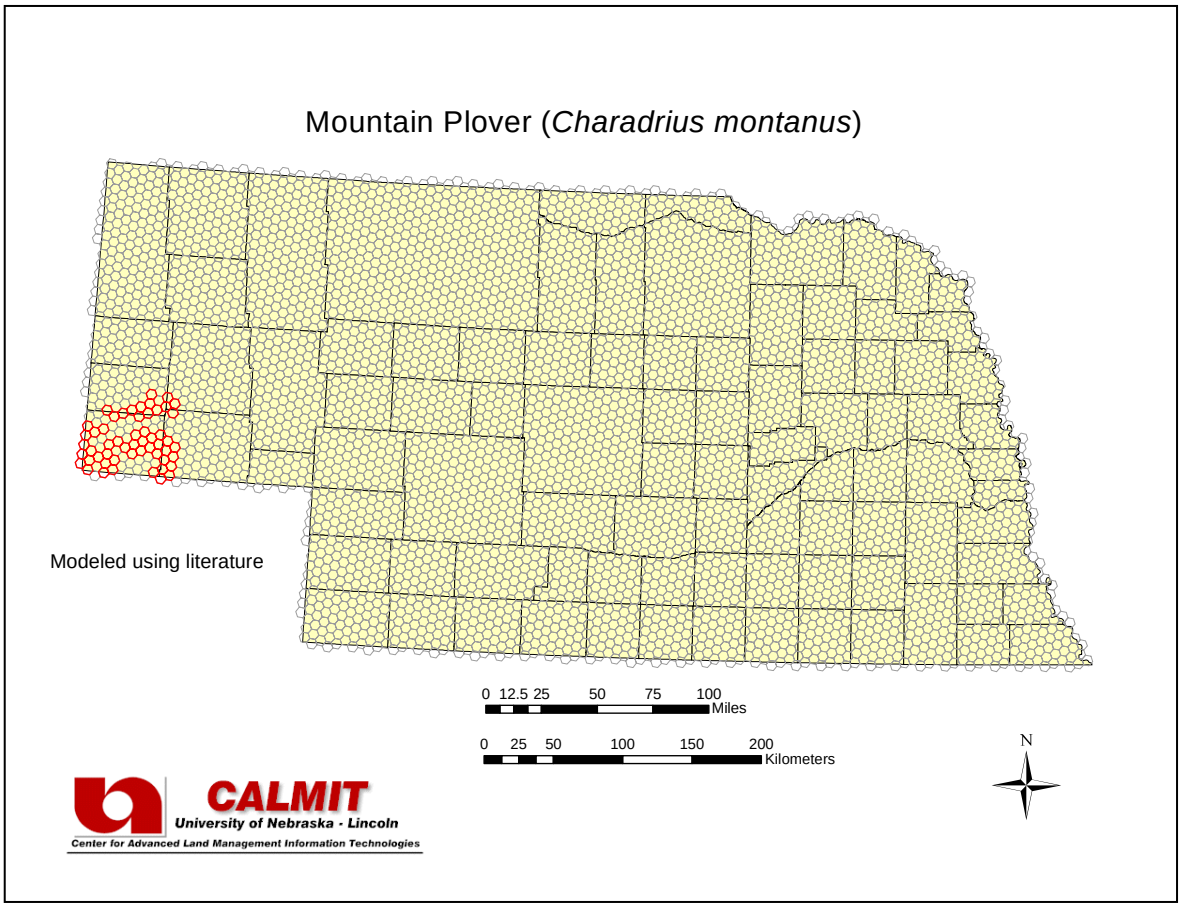
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Mountain Plover**	TNC Global Status:	G2
Scientific Name:	***Charadrius montanus***	Federal Status:	C
TNC Element Code:	ABNNB03100	State (NE) Status:	S1B
AOU Code:	02810		

Habitat Description:
This species is a rare regular breeder Kimball Co (Sharpe et al. 2001). Short-grass prairie is a specific habitat requirement this species is dependent upon for breeding. Typically nest in tracts of high-plains grassland dominated by blue grama and buffalo grass at sites that have at least 30% bare ground, a habitat that is present to a limited extent in Kimball Co (DeGraff and Rappole 1995; Johnsgard 1997; Sharpe et al. 2001). Prairie dog colonies are often utilized as nest sites in some parts of the breeding range. In Kimball Co they have been found in recent years nesting in June in fallow wheat fields, even those recently disked. May occur somewhat regularly in an area bounded by I-80 on the north, Highway 71 on the east, and a line starting 19km south of Kimball on Highway 71, passing west 6.4km and north about 16km back to I-80 (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 218,946

Model Description:
No observational data were available for this species. Modeled from literature using the variable 'Land Cover class Barren/Sand/Outcrop is present'. Extent was clipped to match area of known breeding records (Sharpe et al. 2001).



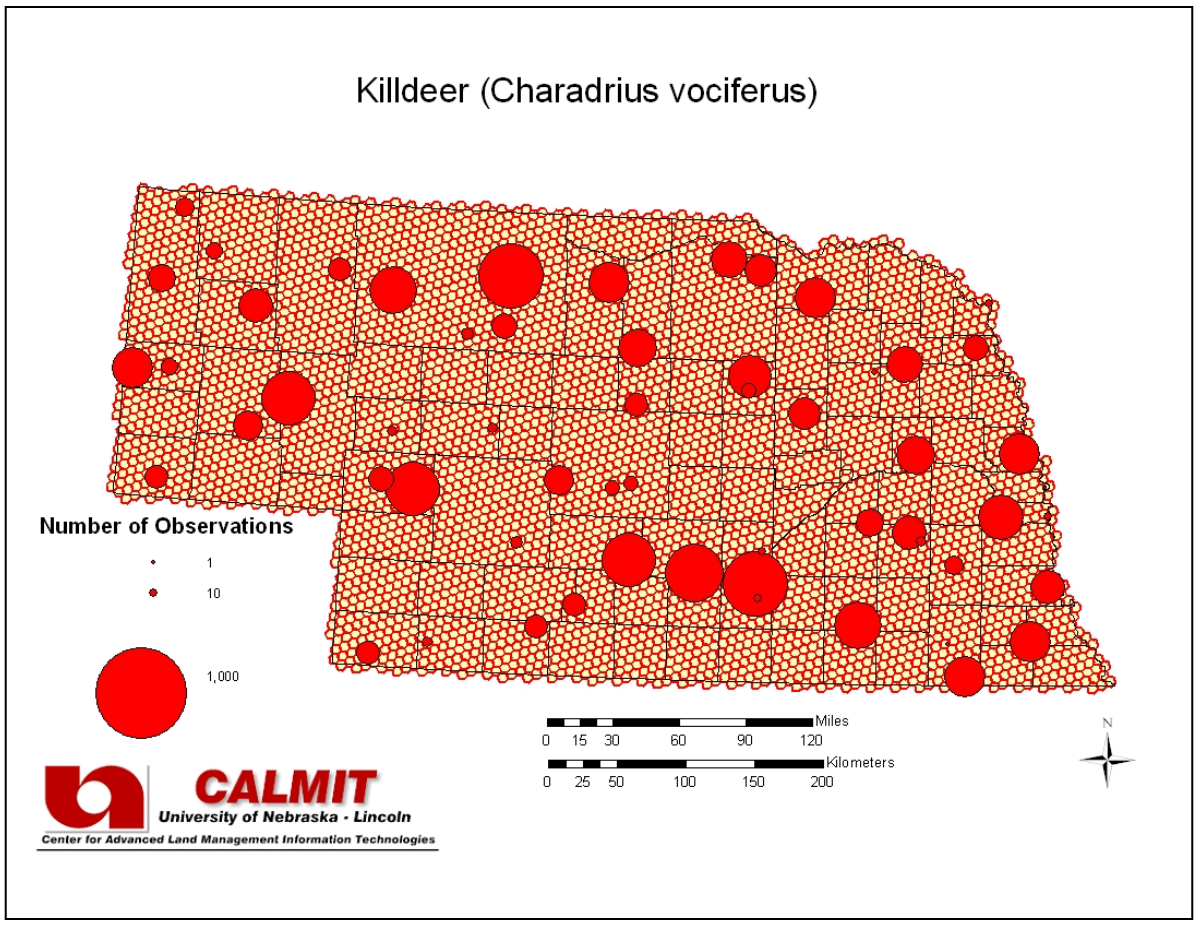
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Killdeer**	TNC Global Status:	G5
Scientific Name:	***Charadrius vociferus***	Federal Status:	--
TNC Element Code:	ABNNB03090	State (NE) Status:	S5
AOU Code:	02730		

Habitat Description:
Breeds near wetlands where there is exposed ground nearby (Johnsgard 1997). Most common in the Sandhills in the vicinity of lakes and ponds; also readily adapts to planted and fallow farm fields, wet meadows, short-grass prairies, gravel rooftops and river sandbars (Mollhoff 2001, Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Habitat descriptions from literature were broad and general, resulting in no available variables for modeling.



Nebraska GAP Analysis 2004
Bird Species Atlas

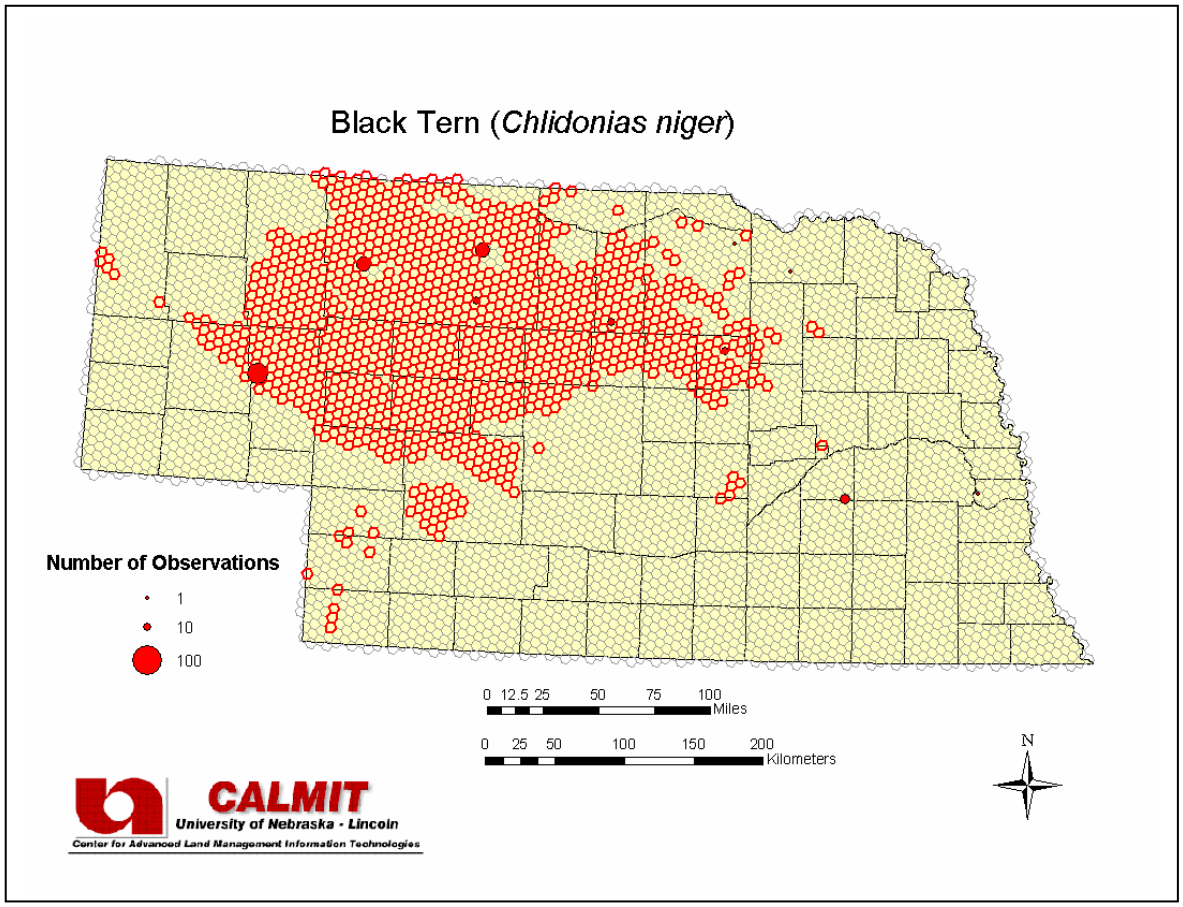
Common Name:	**Black Tern**	TNC Global Status:	G5
Scientific Name:	***Chlidonias niger***	Federal Status:	--
TNC Element Code:	ABNNM10020	State (NE) Status:	S3
AOU Code:	00770		

Habitat Description:
Found over a variety of aquatic habitats, sometimes foraging well away from water in adjoining grasslands (Johnsgard 1997). Breeding occurs on marsh areas having a combination of open water and stands of emergent vegetation.

Total Area of Modeled Habitat (ha): 4,829,057

Model Description:
Modeled distribution using the variable 'Percentage of Coarse-textured Soils > 82%'.

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



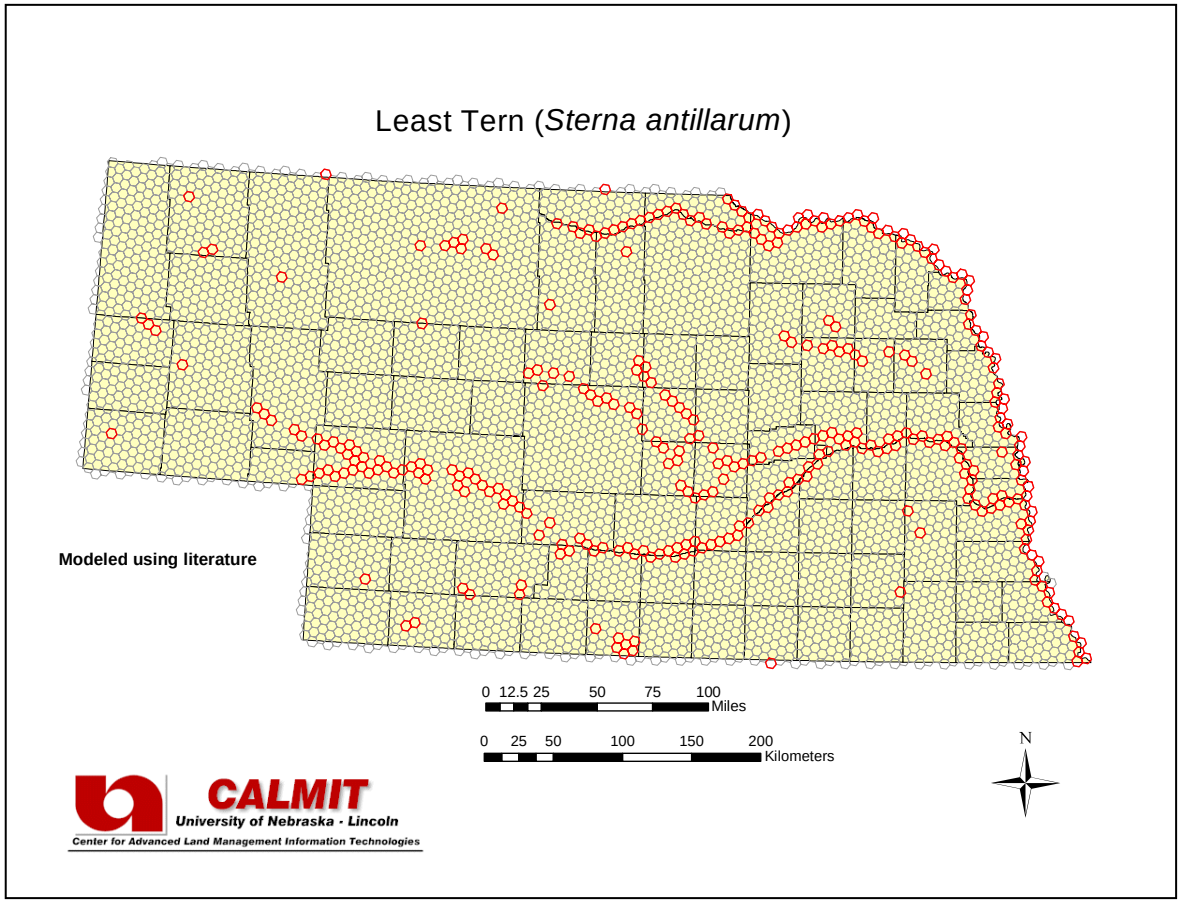
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Least Tern**	TNC Global Status:	G4T2
Scientific Name:	***Sterna antillarum***	Federal Status:	E
TNC Element Code:	ABNNM08100	State (NE) Status:	S2
AOU Code:	00740		

Habitat Description:
This species is primarily found along larger river systems that provide high and dry, exposed midstream sandbars for nesting and a wide channel. They are also attracted to the large sandpiles produced in sand-mining operations adjacent to the Platte River, as well as barren shorelines of large impoundments and lakes (DeGraff and Rappole 1995; Johnsgard 1997; Kirsch 1996; Mollhoff 2001; Sharpe et al. 2001). Nesting occurs on sand or gravel substrates, gravel or pebble substrates are preferred, with the nest constructed from a scrape with little or no lining (DeGraff and Rappole 1995). Breeding birds are restricted to the Missouri, Platte, lower Niobrara, lower Loup, and the lower Elkhorn River systems (Mollhoff 2001, Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1,394,782

Model Description:
No observational data were available for this species. Modeled from literature using the variable 'Land Cover class Open Water > 2.3%'.



Nebraska GAP Analysis 2004
Bird Species Atlas

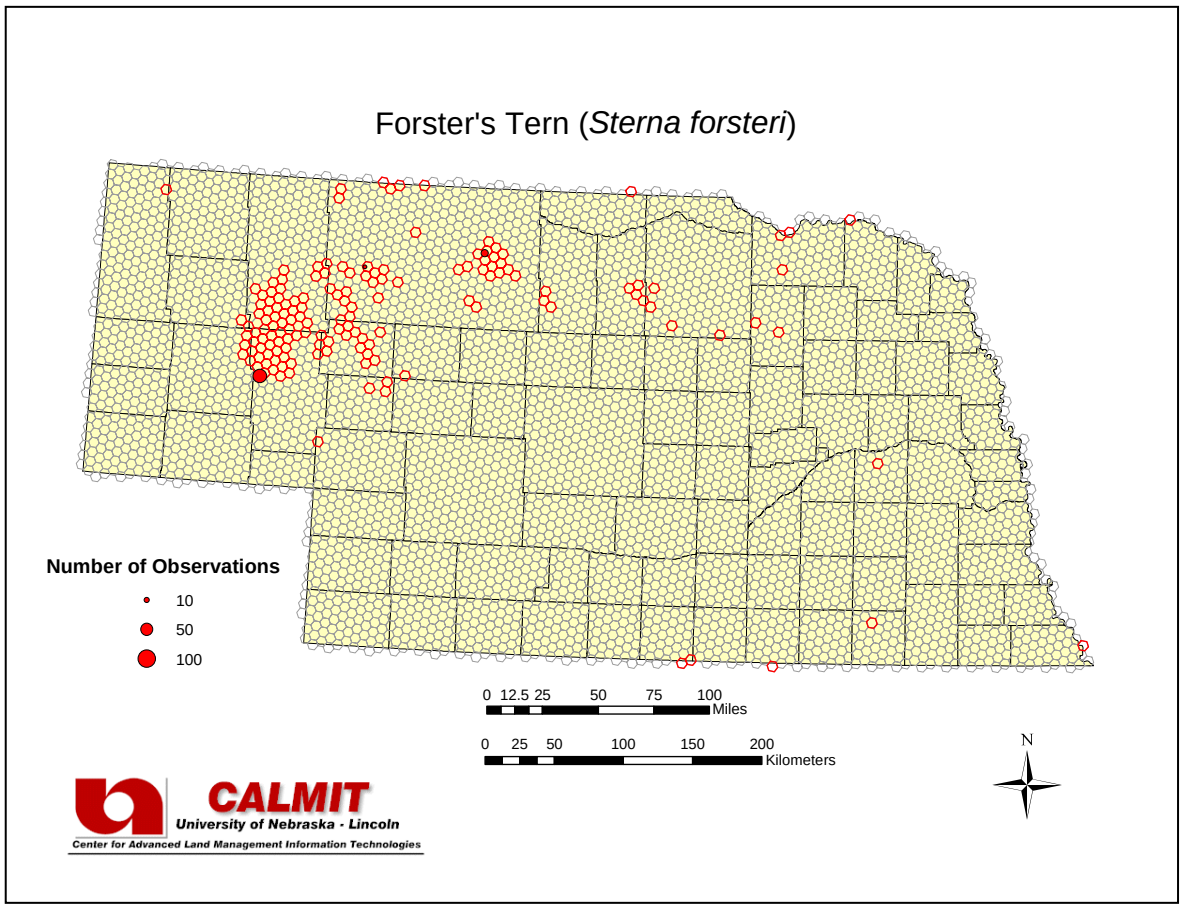
Common Name:	**Forster's Tern**	TNC Global Status:	G5
Scientific Name:	***Sterna forsteri***	Federal Status:	--
TNC Element Code:	ABNNM08090	State (NE) Status:	S3
AOU Code:	00690		

Habitat Description:
Localized summer resident in the Sandhills, especially Garden, Cherry and Grant counties (Johnsgard 1997). Breeding birds are most often found associated with large Sandhills lakes, where they forage over open water and nest in shallower waters with emergent marsh vegetation. Small marshes seem to be avoided for nesting. Occupied lakes typically had bulrushes scattered over large areas of the lake, plus extensive stands of bulrushes and cattails along the shorelines (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 616,301

Model Description:
Modeled distribution using the variable 'Land Cover class Aquatic Bed Wetland > 1%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



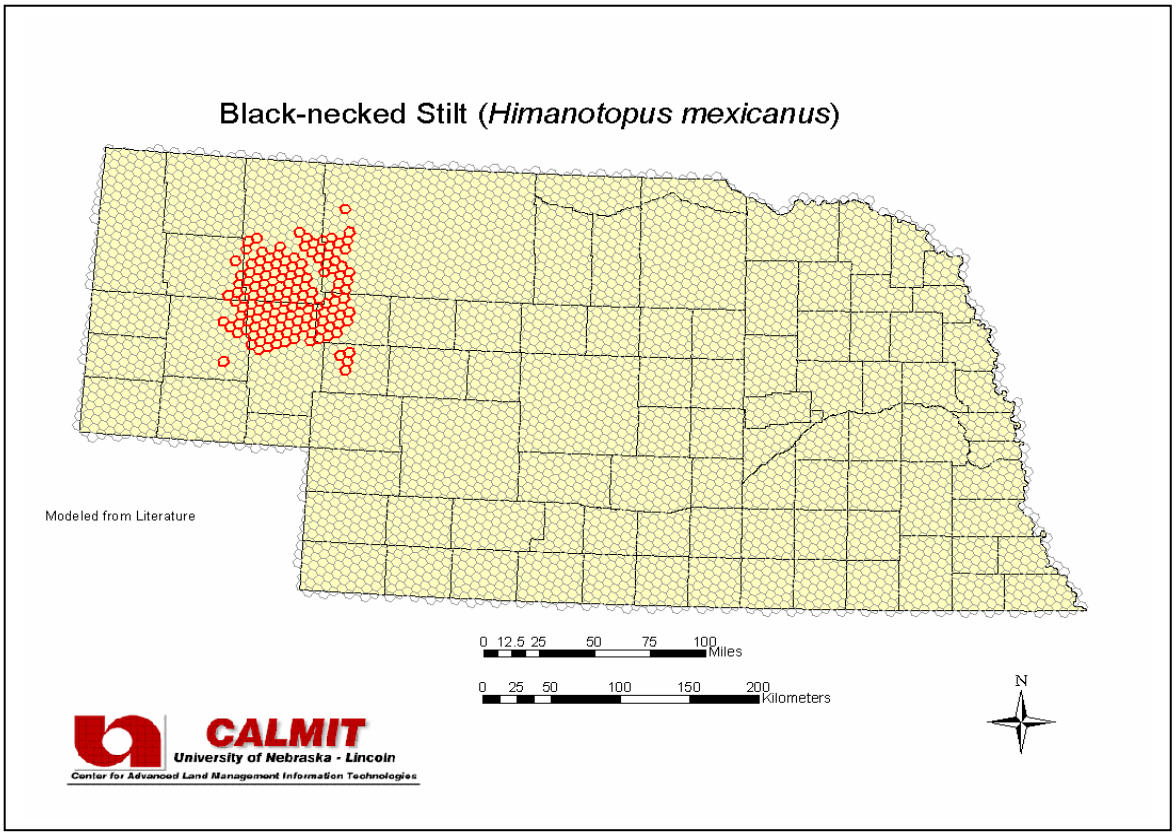
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Black-necked Stilt**	TNC Global Status:	G5
Scientific Name:	***Himantopus mexicanus***	Federal Status:	--
TNC Element Code:	ABNND01010	State (NE) Status:	S1
AOU Code:	02260		

Habitat Description:
Species is recently established and a regular breeder, although with a very restricted distribution (Mollhoff 2001). Species is associated with alkali ponds and marshes, (Johnsgard 1997), shallow freshwater and brackish ponds, alkaline lakes, wet meadows, open marshes, and flooded fields and pastures (Robinson et al. 1999). It requires shallow wetlands and is commonly found along the edges of salt ponds, sewage ponds, or shallow inland wetlands, but usually in fresher parts of a wetland with emergent vegetation. Breeding birds have been restricted to wetlands in the Panhandle, primarily Sandhills marshes. There have been breeding reports from Crescent Lake NWR as recently as 1985 and 1987 and a stable colony since 1987 in Sheridan Co. Attempts to locate birds in 1997 and 1998 were unsuccessful. However, because many marshes and potholes in Sheridan and Garden Counties are remote, it is possible that part of the existing breeding population has so far been overlooked (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 612,246

Model Description:
No observational data were available for this species. Distribution modeled from literature using the set of variables 'Land Cover class Emergent Wetland > 0.05%' AND 'Land Cover class Aquatic Bed Wetland > 0.05%'. Extent was clipped to match area of known breeding records (Sharpe et al. 2001).



Nebraska GAP Analysis 2004
Bird Species Atlas

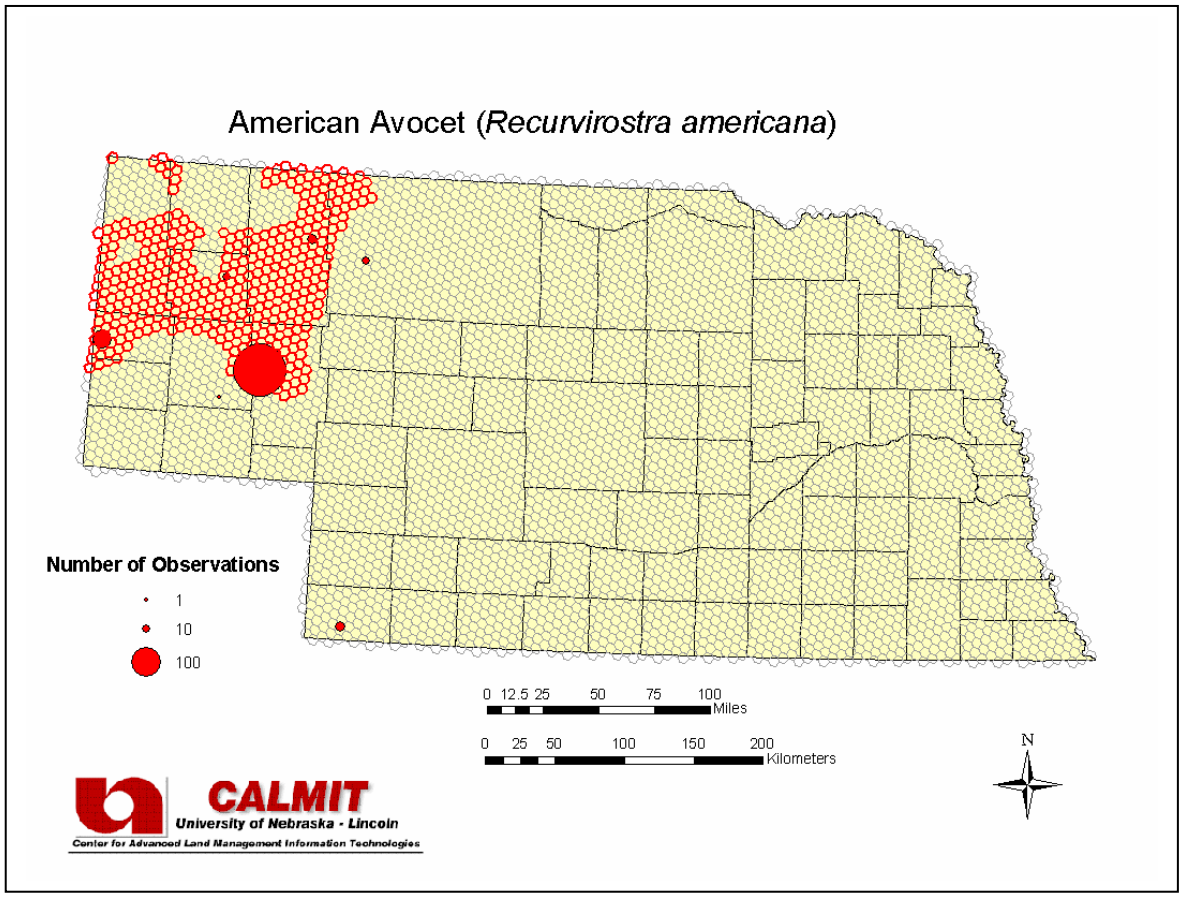
Common Name:	**American Avocet**	TNC Global Status:	G5
Scientific Name:	***Recurvirostra americana***	Federal Status:	--
TNC Element Code:	ABNND02010	State (NE) Status:	S4
AOU Code:	02250		

Habitat Description:
Associated with shallow ponds or marshes with exposed and sparsely vegetated shorelines, often in association with strongly saline waters (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 1,739,418

Model Description:
Modeled distribution using variables 'Average 30-year Precipitation for March $\leq$ 24 mm' AND 'Average 30-year Maximum Temperature for August $\leq$ 30ºC'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

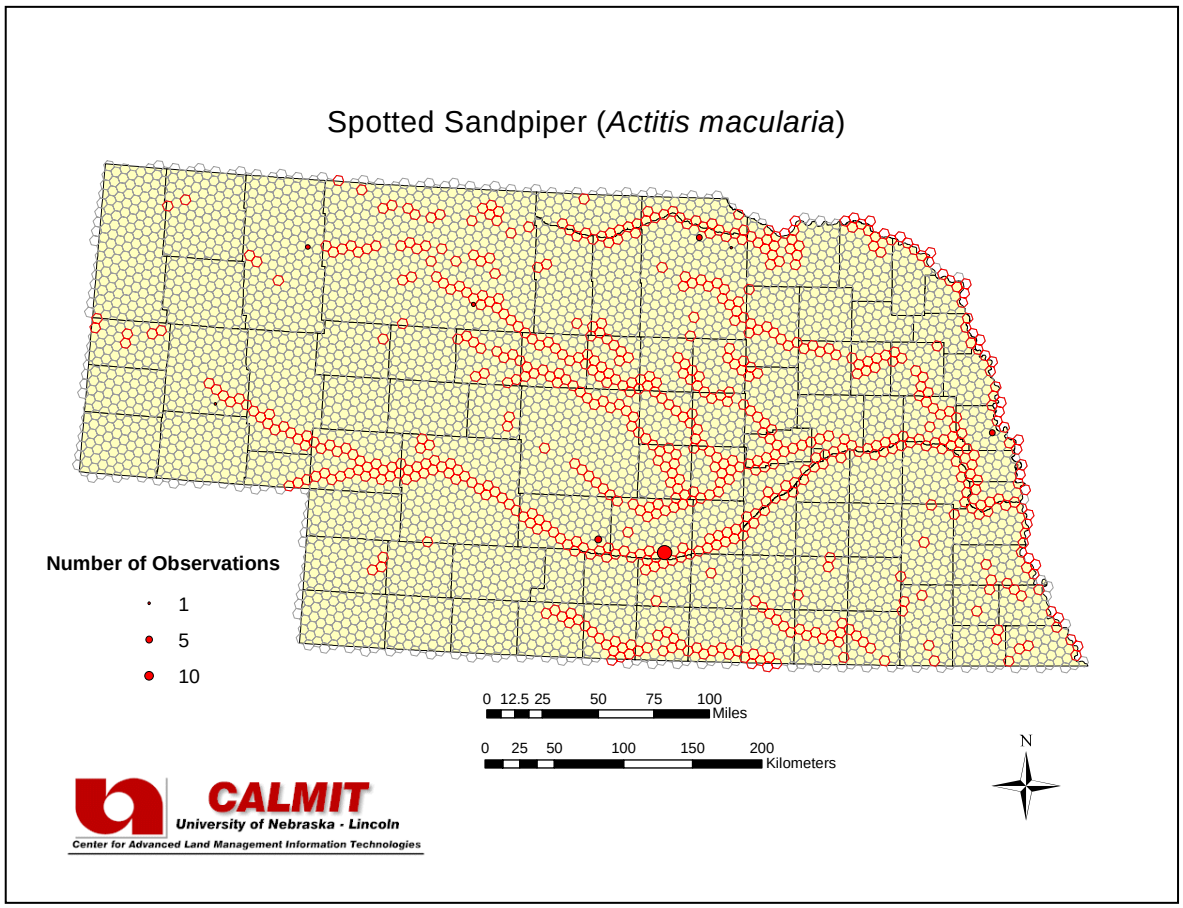
Common Name:	**Spotted Sandpiper**	TNC Global Status:	G5
Scientific Name:	***Actitis macularia***	Federal Status:	--
TNC Element Code:	ABNNF04020	State (NE) Status:	S5
AOU Code:	02630		

Habitat Description:
This species breeds in suitable habitat throughout the state but appears to be a low-density breeder (Sharpe et al. 2001). It is associated with wetlands having exposed or sparsely vegetated shorelines, and ranging from rapidly flowing streams to stillwater habitats (Johnsgard 1997, Mollhoff 2001). The shoreline features are more important than the characteristics of the water.

Total Area of Modeled Habitat (ha): 2,671,987

Model Description:
Modeled distribution using the variable 'Land Cover class Riparian Shrubland is present'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



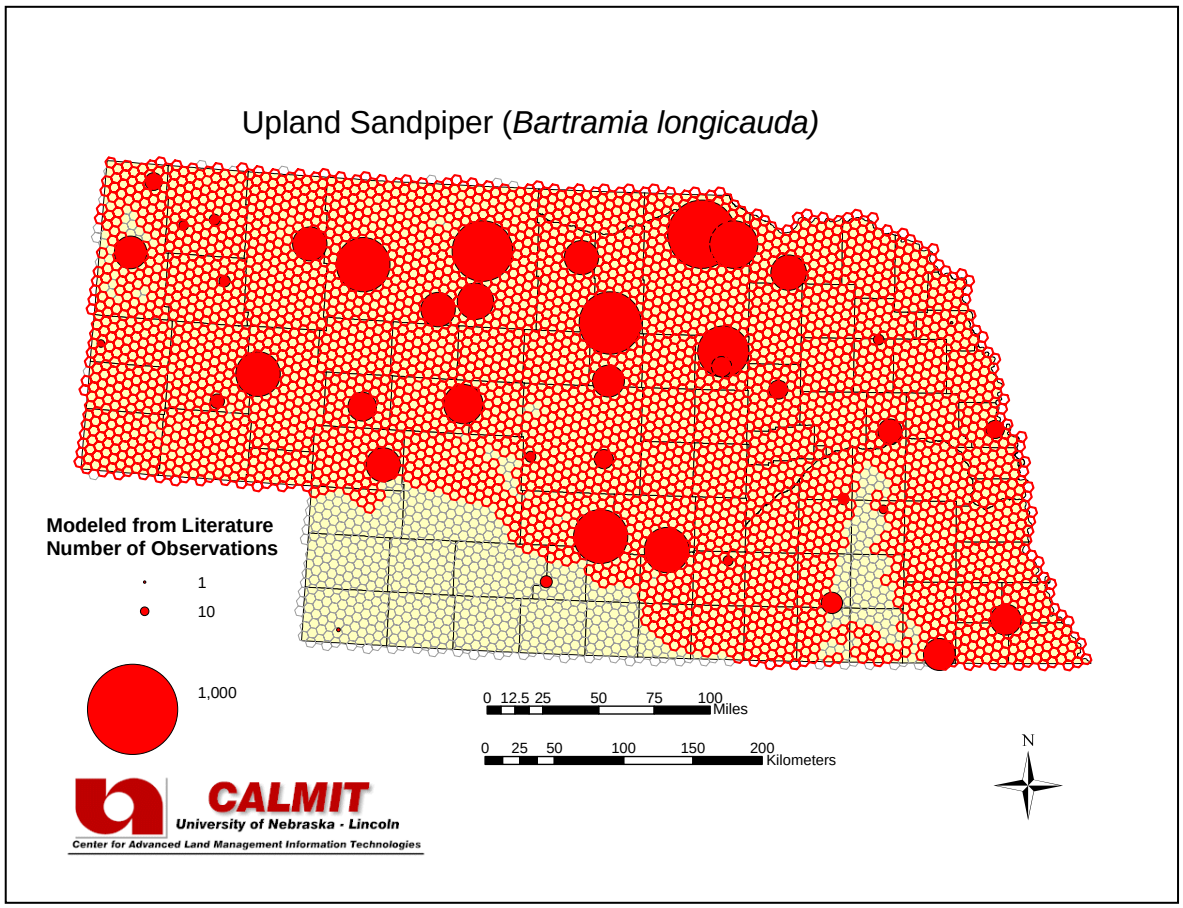
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Upland Sandpiper**	TNC Global Status:	G5
Scientific Name:	***Bartramia longicauda***	Federal Status:	--
TNC Element Code:	ABNNF06010	State (NE) Status:	S5
AOU Code:	02610		

Habitat Description:
Occurs on native prairies, especially mixed-grass and tall grass, on wet meadows, hayfields, retired croplands and, to a limited extent, fields planted to small grains (Johnsgard 1997¸ Mollhoff 2001). Breeds statewide with the possible exception of the extreme southwest and the southern Panhandle (Sharpe et al. 2001). Breeding densities greatest in the Sandhills and northern Panhandle.

Total Area of Modeled Habitat (ha): 1.73×10^7

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the set of variables 'Land Cover class Lowland Tallgrass Prairie is present' OR 'Land Cover class Upland Tallgrass Prairie is present'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

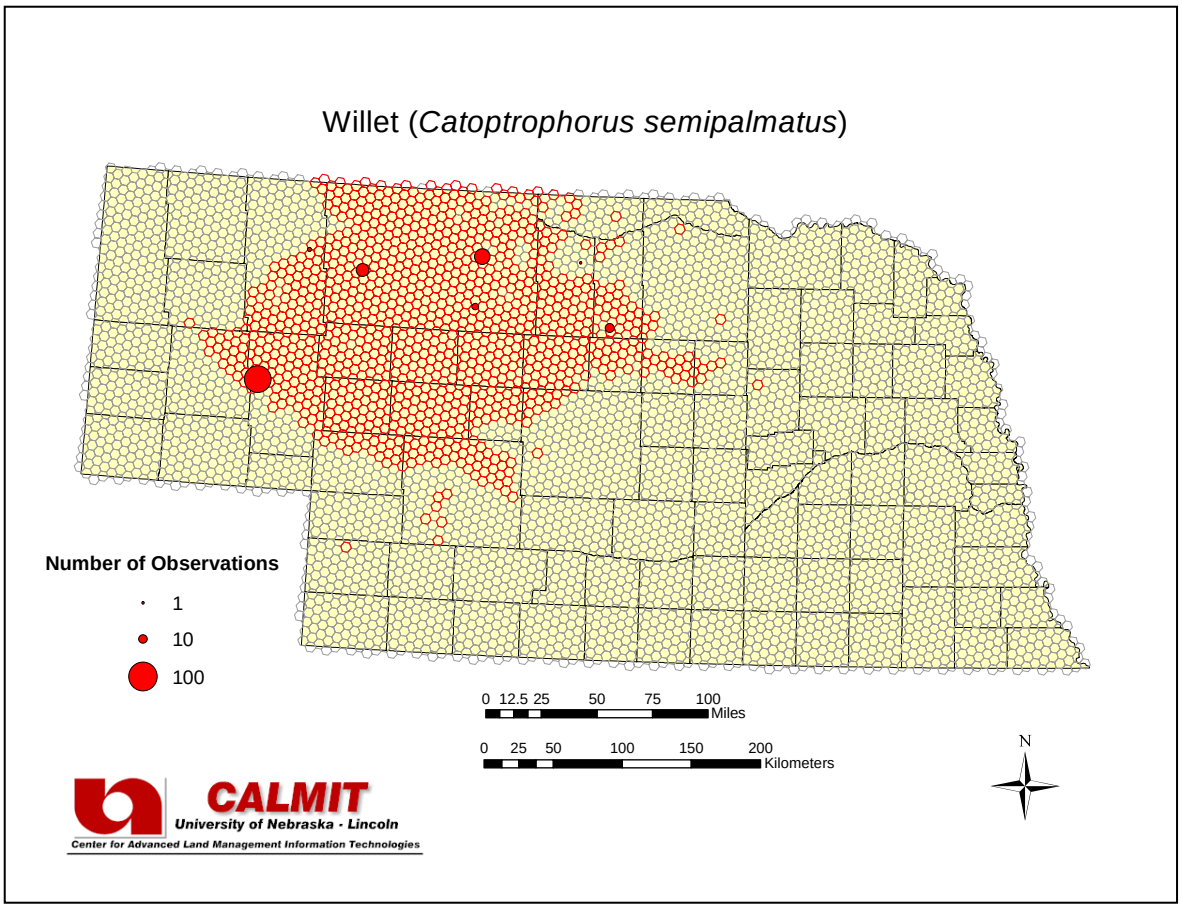
Common Name:	**Willet**	TNC Global Status:	G5
Scientific Name:	***Catoptrophorus semipalmatus***	Federal Status:	--
TNC Element Code:	ABNNF02010	State (NE) Status:	S3
AOU Code:	02580		

Habitat Description:
Breeding birds are limited to the Sandhills, where they are associated with playas, marshy edges of lakes, flooded meadows, and other wetland sites with prairie vegetation nearby. Prefer sparse or no emergent and bordering (cattails and bulrushes) vegetation (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 4,350,613

Model Description:
Modeled distribution using the variable 'Land Cover class Sandhills Upland Prairie > 55%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

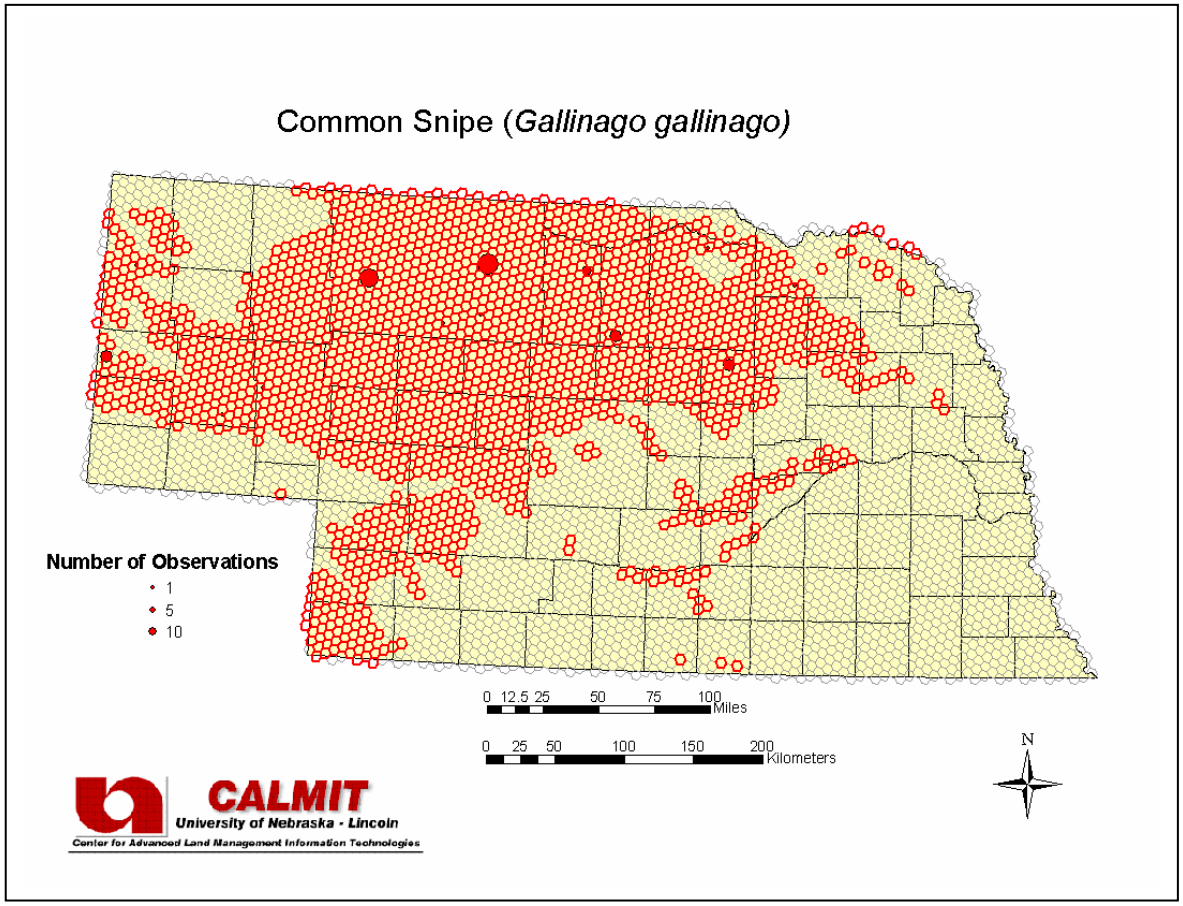
Common Name:	**Common Snipe**	TNC Global Status:	G5
Scientific Name:	***Gallinago gallinago***	Federal Status:	--
TNC Element Code:	ABNNF18010	State (NE) Status:	S2
AOU Code:	02300		

Habitat Description:
Found in moist hay meadows, periodic wetlands, shallow-water marshes, and ditches with standing water (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 8,676,873

Model Description:
Modeled distribution using the variable 'Percentage of Coarse-textured Soils > 17.5%'.

Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

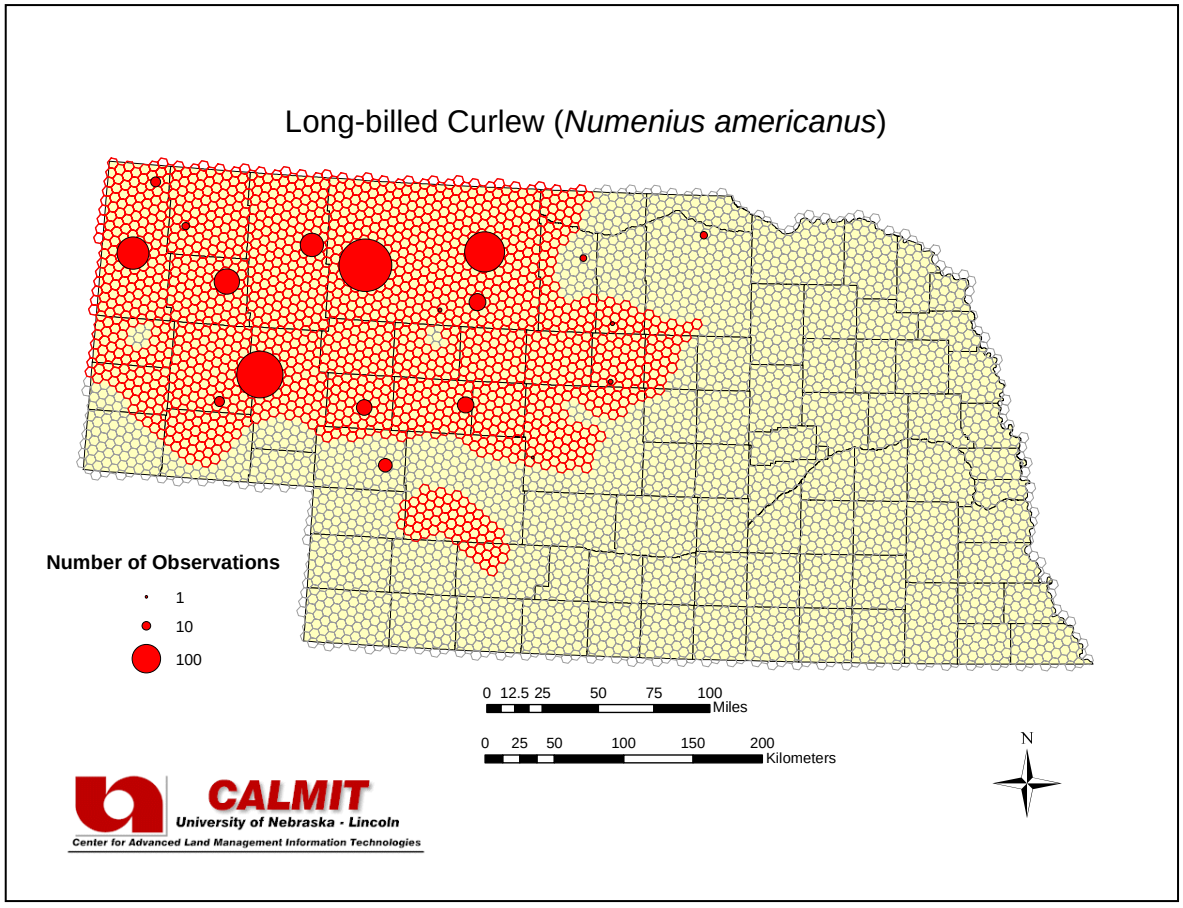
Common Name:	**Long-billed Curlew**	TNC Global Status:	G5
Scientific Name:	***Numenius americanus***	Federal Status:	--
TNC Element Code:	ABNNF07070	State (NE) Status:	S3
AOU Code:	02640		

Habitat Description:
Breeding birds are found on native prairie, where dry upland prairie lay close to low-lying wet meadows and/or ponds. Most common in the western Sandhills and Panhandle and with decreasing frequency in the shortgrass plains to the west (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001). Nests are hollow, grass-lined depressions on the ground and are typically located near ridgetops in upland Sandhills within several hundred meters of a meadow foraging area (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 7,342,906

Model Description:
Modeled distribution using the set of variables 'Average 30-year Precipitation for September $\leq$ 55 mm' AND 'Average 30-year Minimum Temperature Coefficient of Variation for November < 14.5%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

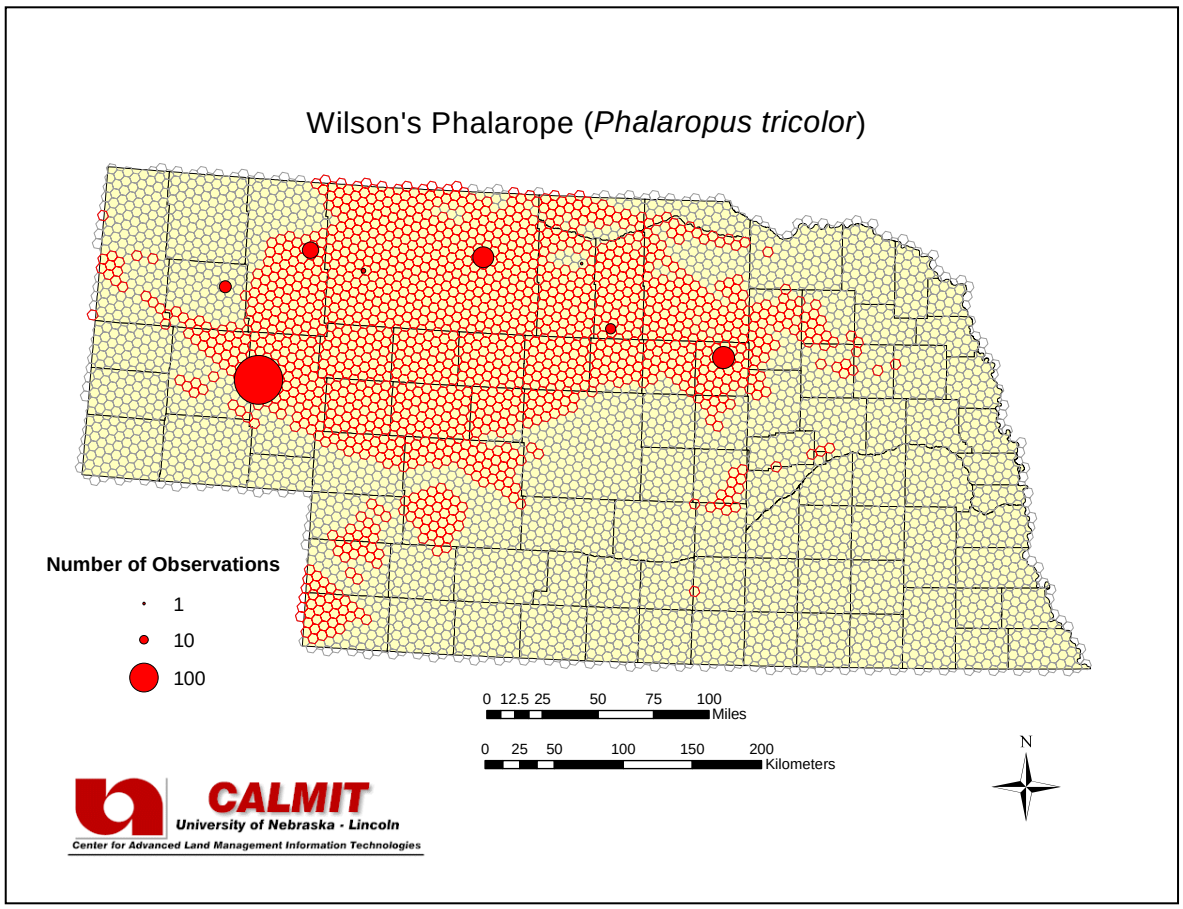
Common Name:	**Wilson's Phalarope**	TNC Global Status:	G5
Scientific Name:	***Phalaropus tricolor***	Federal Status:	--
TNC Element Code:	ABNNF20010	State (NE) Status:	S4
AOU Code:	02240		

Habitat Description:
Alkaline marshes in the Sandhills and Panhandle are preferred during the breeding season for habitat. They can utilize wet meadows near aquatic habitats ranging from flooded ditches to ponds and marshes. This species has also been found breeding in the Rainwater Basin (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 6,446,849

Model Description:
Modeled distribution using the variable 'Percentage of Coarse-textured Soils > 55%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



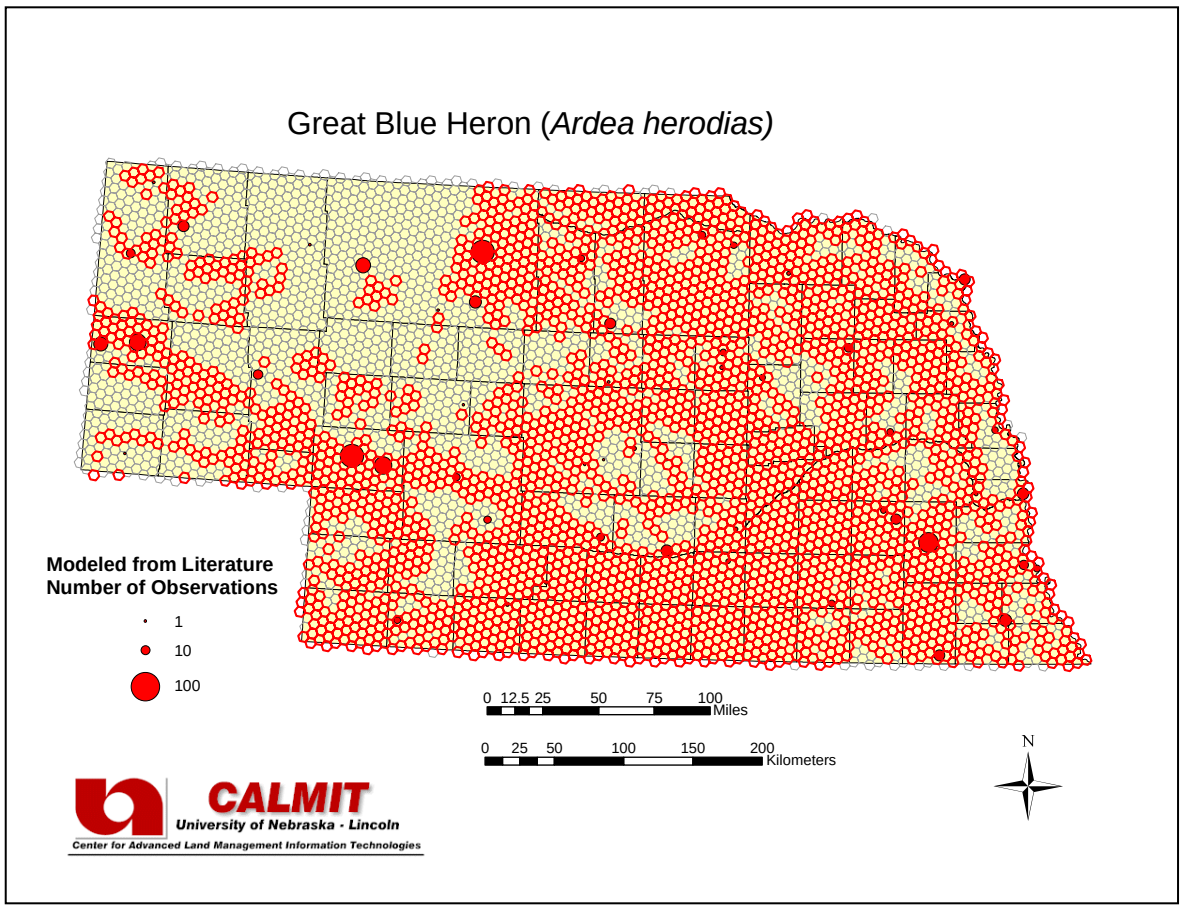
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Great Blue Heron**	TNC Global Status:	G5
Scientific Name:	***Ardea herodias***	Federal Status:	--
TNC Element Code:	ABNGA04010	State (NE) Status:	S4
AOU Code:	01940		

Habitat Description:
Nesting usually occurs among groves of tall trees, but sometimes have been reported on the ground, on rock ledges, among bulrushes, or other elevated situations; cottonwood groves seem to be favored (Johnsgard 1997). Breeding colonies are usually located in large trees near water, most frequently in mature cottonwoods (Mollhoff 2001). Breeding locations are distributed across the state (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.21×10^7

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the set of variables 'Land Cover class Deciduous Forests and Woodlands is present' AND 'Land Cover class Emergent Wetland is present'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

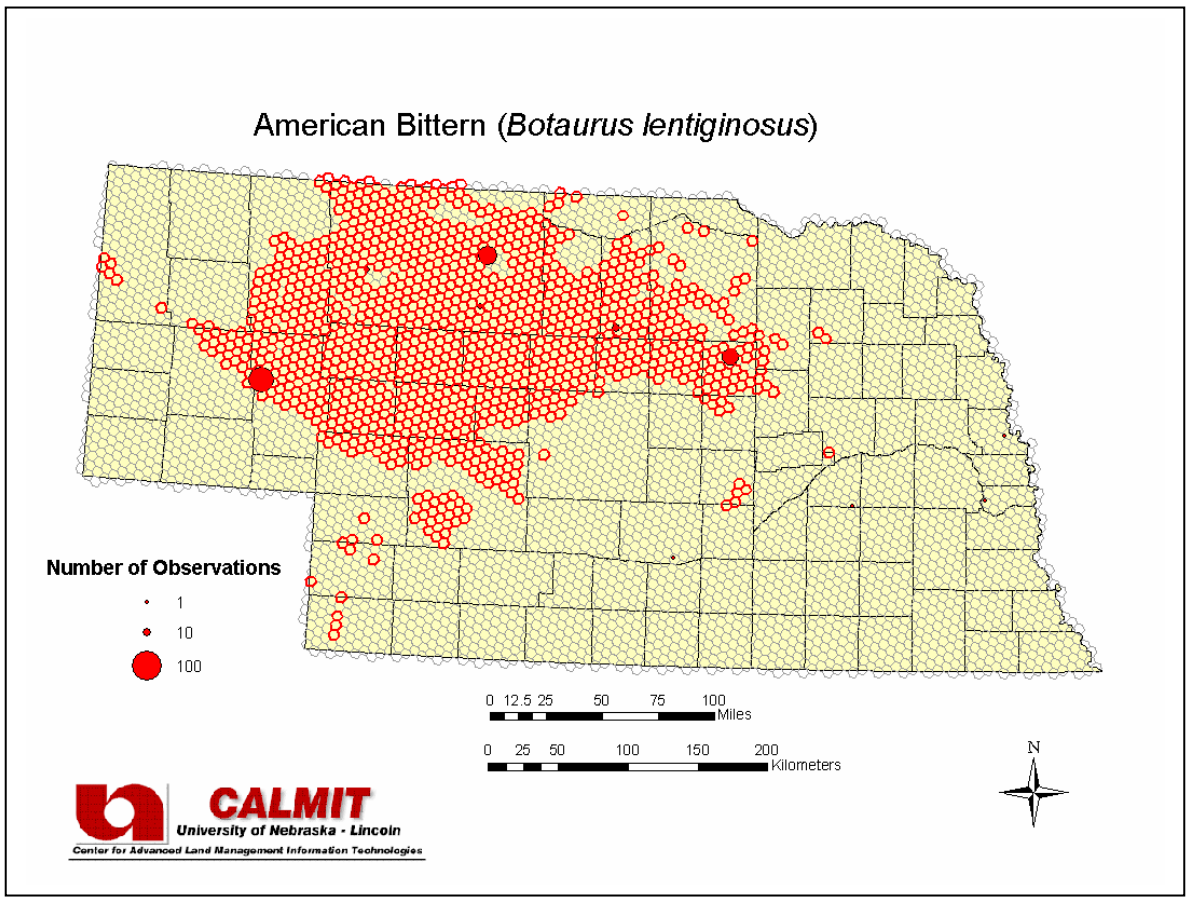
Common Name:	**American Bittern**	TNC Global Status:	G4
Scientific Name:	***Botaurus lentiginosus***	Federal Status:	--
TNC Element Code:	ABNGA01020	State (NE) Status:	S3
AOU Code:	01900		

Habitat Description:
Normally found in marshes, swamps and bogs having heavy emergent vegetation or with adjacent wet swales or tall grassy meadows (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 4,833,112

Model Description:
Modeled distribution using the variable 'Percentage of Coarse-textured Soils > 81.9%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

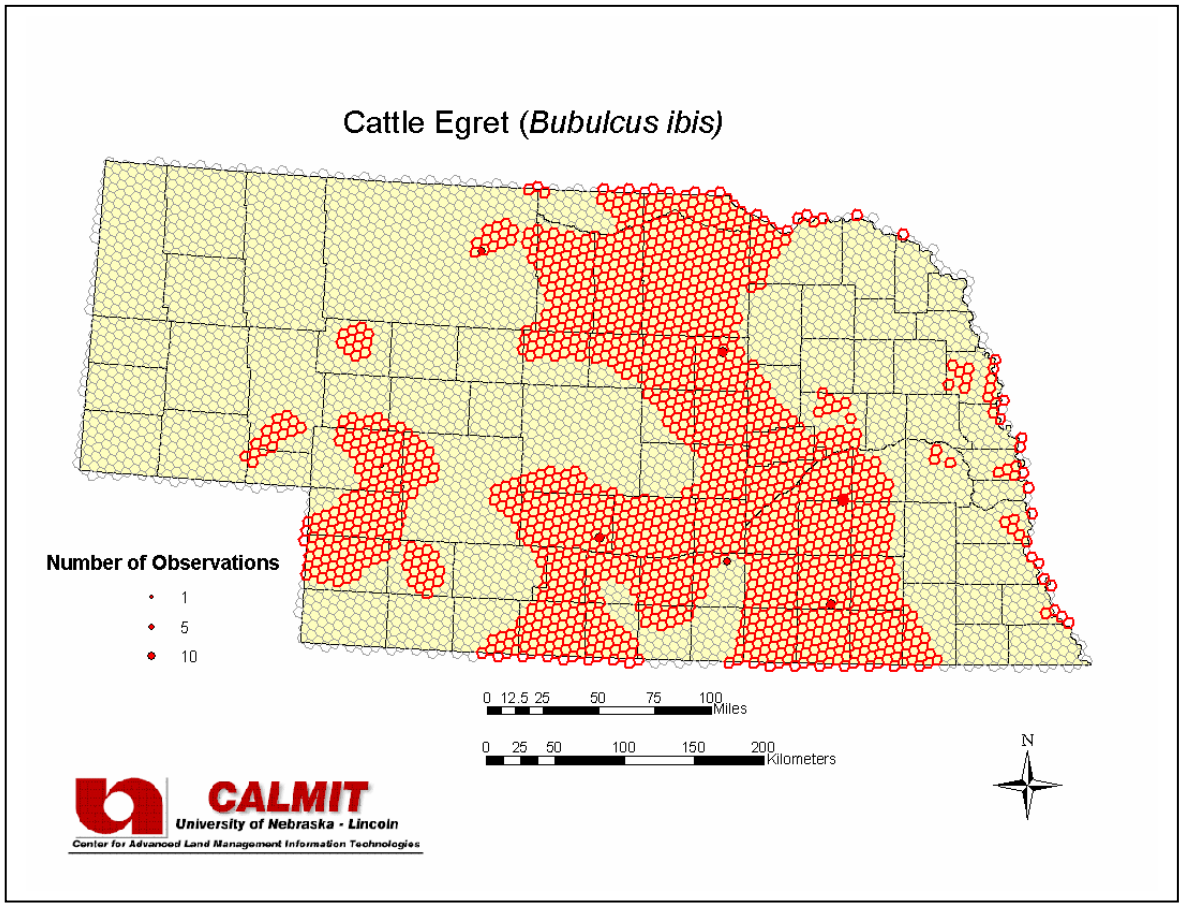
Common Name:	**Cattle Egret**	TNC Global Status:	G5
Scientific Name:	***Bubulcus ibis***	Federal Status:	--
TNC Element Code:	ABNGA07010	State (NE) Status:	S?N
AOU Code:	02001		

Habitat Description:
Utilize shallow wetlands and damp pastures; breed over fairly shallow waters, often in willows (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 7,050,997

Model Description:
Modeled distribution using variables 'Average 30-year Minimum Temperature Coefficient of Variation for September $\leq$ 5.8%' AND 'Land Cover class Upland Tallgrass Prairie $\leq$ 5.8%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



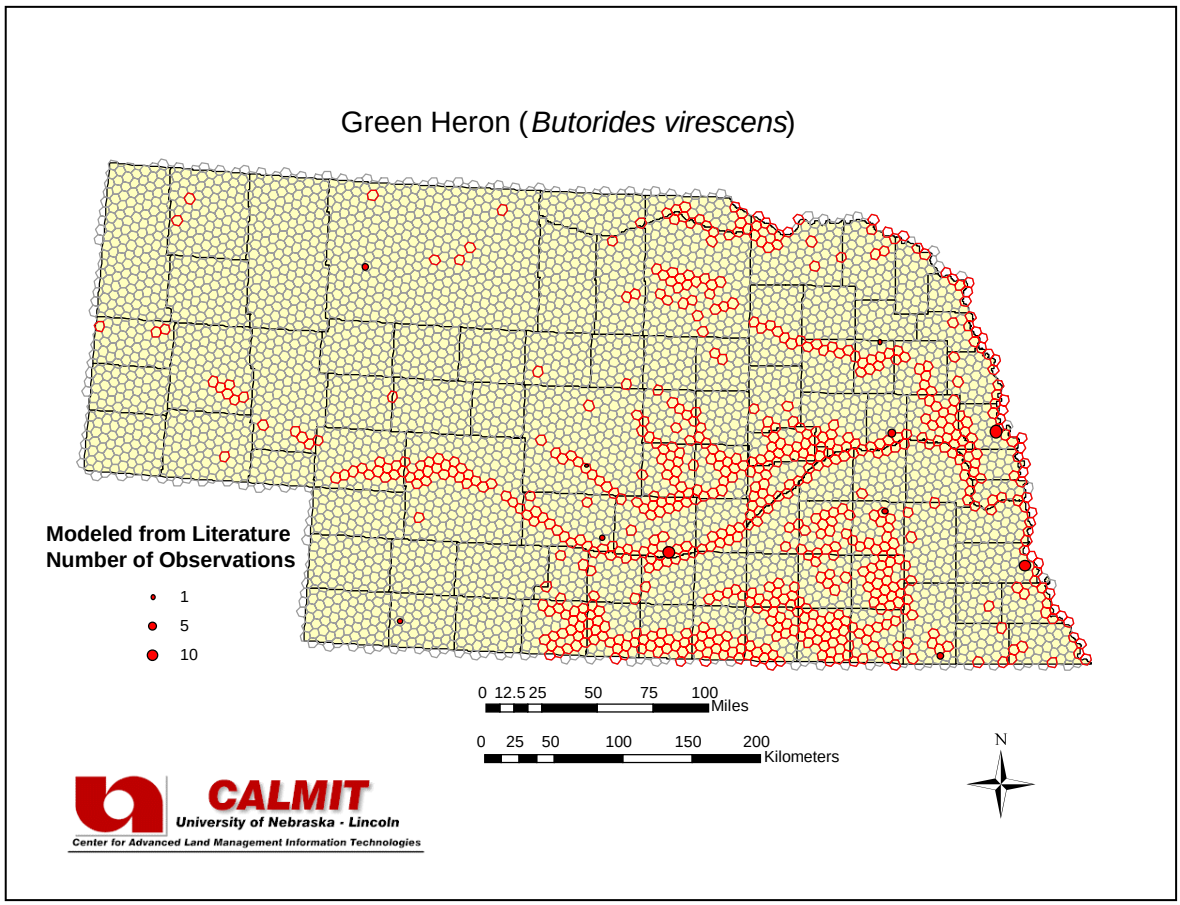
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Green Heron**	TNC Global Status:	G5
Scientific Name:	***Butorides virescens***	Federal Status:	--
TNC Element Code:	ABNGA08010	State (NE) Status:	S4
AOU Code:	02010		

Habitat Description:
This species is most commonly found associated with riparian woodland habitat, seeming to prefer areas with small trees and extensive brushy growth rather than mature hardwood forest and less commonly found in marshes and along lake edges (Mollhoff 2001, Sharpe et al. 2001). Breeding usually occurs near trees, but some nesting is in marshlands well away from tree cover (Johnsgard 1997). It has been found breeding mainly in the eastern two-thirds of the state, areas such as the Sandhills and the Panhandle support little appropriate habitat (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 2,777,416

Model Description:
Adequate model could not be resolved using QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Riparian Woodland is present'.



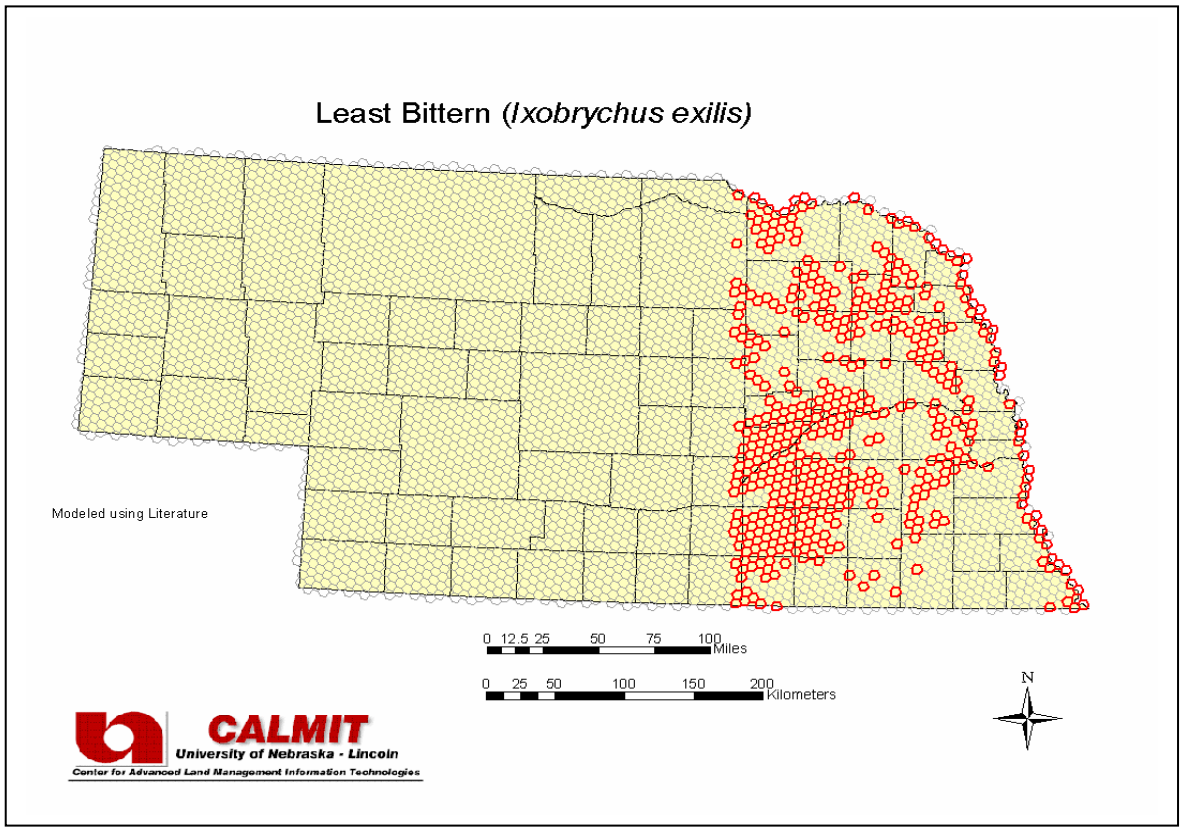
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Least Bittern**	TNC Global Status:	G5
Scientific Name:	***Ixobrychus exilis***	Federal Status:	--
TNC Element Code:	ABNGA02010	State (NE) Status:	S2
AOU Code:	01910		

Habitat Description:
Freshwater or slightly brackish marshes or lake edges with dense emergent vegetation as well as scattered bushes or similar woody growth (DeGraff and Rappole 1995; Johnsgard 1997; Sharpe et al. 2001). The species was found in marshes, with or without open water present, although dense stands of cattails and bulrushes were an important component of the sites reported (Mollhoff 2001). Although this kind of habitat may be found throughout the state and in particular in the Sandhills, recent records suggest that the species is most numerous in the eastern third of the state (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1,998,920

Model Description:
No observational data were available for this species. Modeled distribution from literature using the variable 'Land Cover class Emergent Wetland > 0.5%', clipped to the eastern part of the state to reflect areas of breeding records (Sharpe et al. 2001).



Nebraska GAP Analysis 2004
Bird Species Atlas

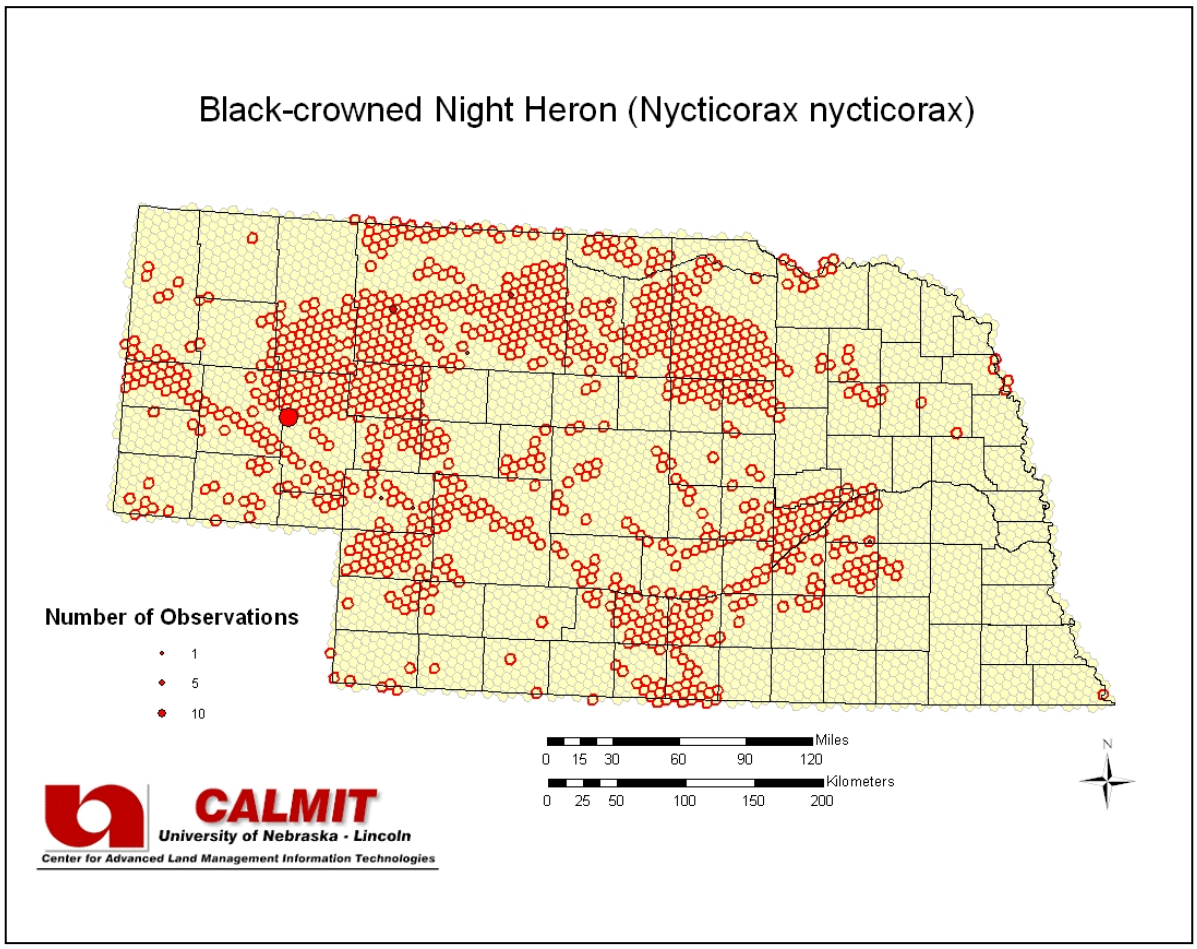
Common Name:	**Black-crowned Night Heron**	TNC Global Status:	G5
Scientific Name:	***Nycticorax nycticorax***	Federal Status:	--
TNC Element Code:	ABNGA11010	State (NE) Status:	S2
AOU Code:	02020		

Habitat Description:
Found in a wide array of aquatic habitats, with nesting occurring in swamps, marshes, and even urban areas, where water is nearby (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 4,403,314

Model Description:
Modeled distribution using the set of variables 'Moderately Fine-Textured Soils < 5%' AND 'Land Cover Class Emergent Wetland > 1%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

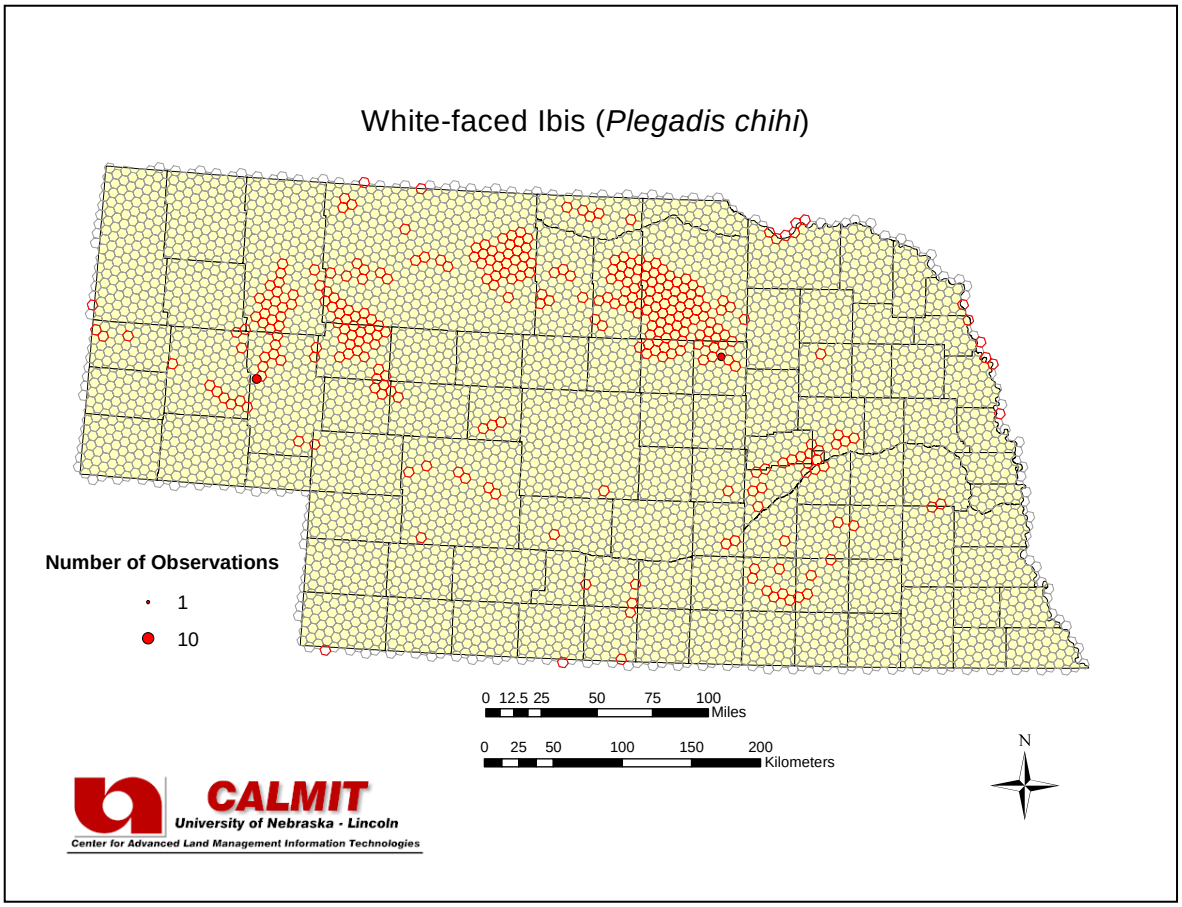
Common Name:	**White-faced Ibis**	TNC Global Status:	G5
Scientific Name:	***Plegadis chihi***	Federal Status:	--
TNC Element Code:	ABNGE02020	State (NE) Status:	S1
AOU Code:	01870		

Habitat Description:
Nesting is limited to shallow marshes having extensive emergent vegetation. Breeding has occurred in Garden and Cherry counties (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1,285,315

Model Description:
Modeled distribution using the variable 'Land Cover class Emergent Wetland > 5%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



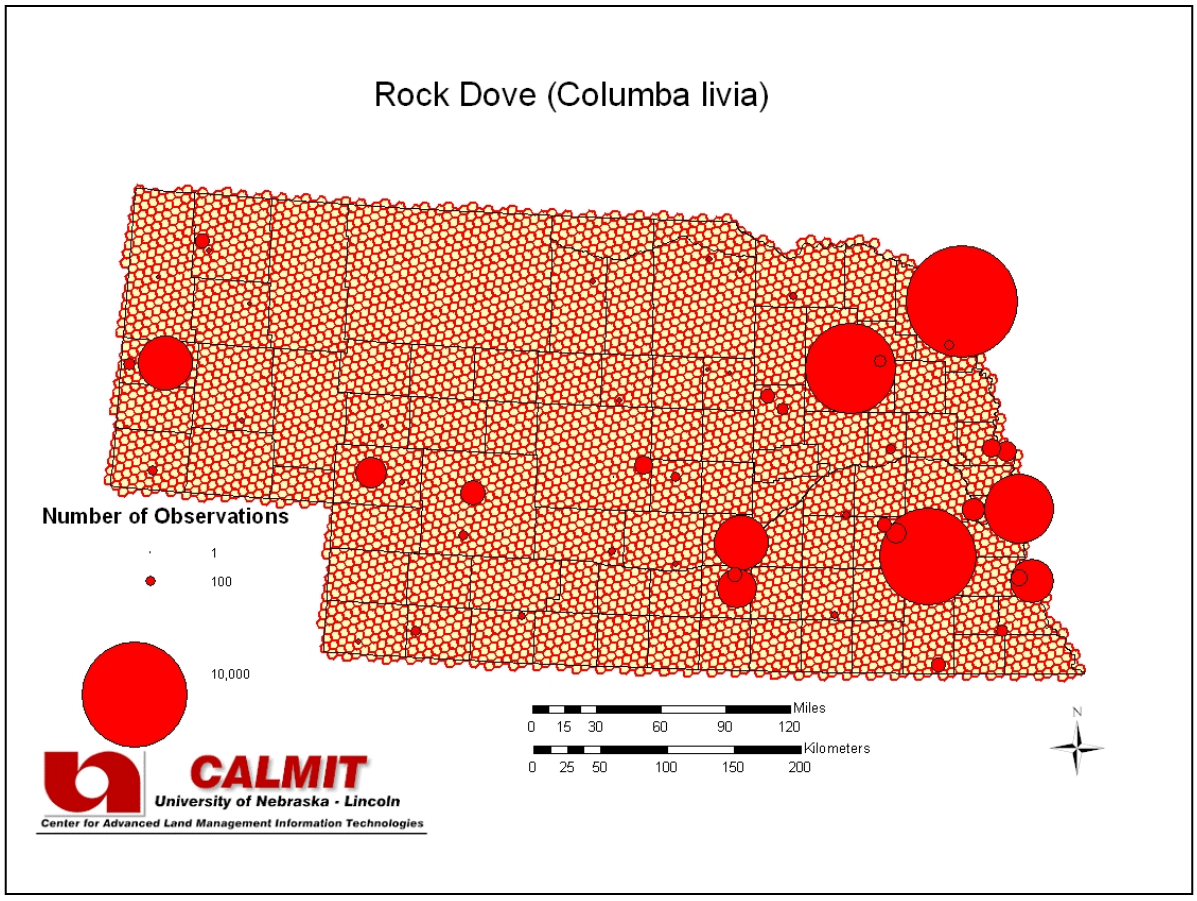
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Rock Dove**	TNC Global Status:	G5
Scientific Name:	***Columba livia***	Federal Status:	--
TNC Element Code:	ABNPB01010	State (NE) Status:	SE
AOU Code:	03131		

Habitat Description:
Mostly associated with human habitations in cities and farms; also occurs to a limited extent around bluffs and cliffs in western Nebraska (Johnsgard 1997, Mollhoff 2001). Occurs statewide, most common in the larger towns and cities in the east (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Habitat descriptions from literature were broad and general, resulting in no available variables for modeling.



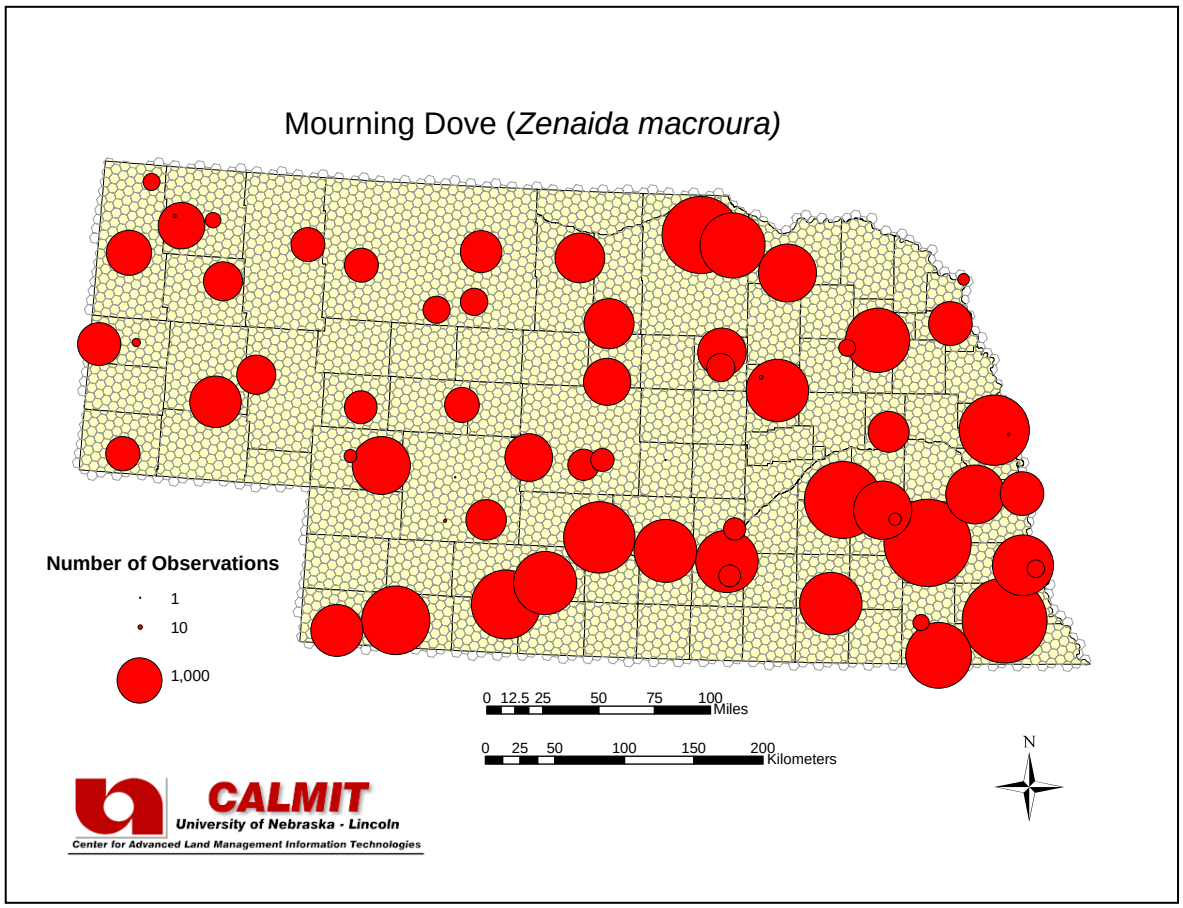
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Mourning Dove**	TNC Global Status:	G5
Scientific Name:	***Zenaida macroura***	Federal Status:	--
TNC Element Code:	ABNPB04040	State (NE) Status:	S5
AOU Code:	03160		

Habitat Description:
A widely adaptable species, occurring in open woods and edge areas, in parks and cities, on grasslands far from trees, and in cultivated fields (Johnsgard 1997). Almost ubiquitous on dry land; in open treeless grasslands, in field/grassland/woodland margins, in towns, city parks, brushy swamps, cultivated fields, the ponderosa pine forest of the Pine Ridge, and the riparian woodlands of the southeast (Mollhoff 2001). Occurs statewide in edge and shrubby habitats and even in open treeless country (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Habitat descriptions from literature were broad and general, resulting in no available variables for modeling.



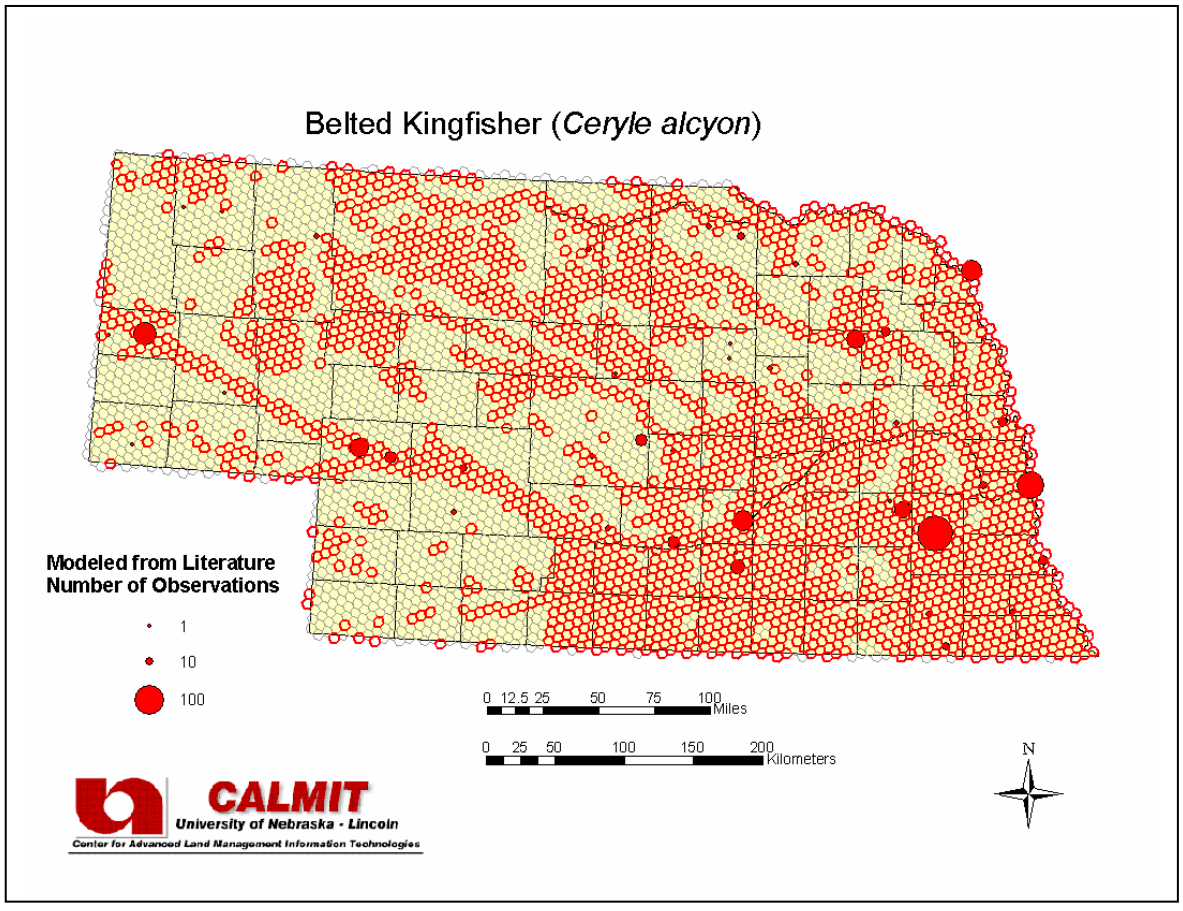
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Belted Kingfisher**	TNC Global Status:	G5
Scientific Name:	***Ceryle alcyon***	Federal Status:	--
TNC Element Code:	ABNXD01020	State (NE) Status:	S4
AOU Code:	03900		

Habitat Description:
Occurs statewide in areas of permanent water supporting populations of fish, amphibians, and similar aquatic life (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 9,264,816

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Open Water is present'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

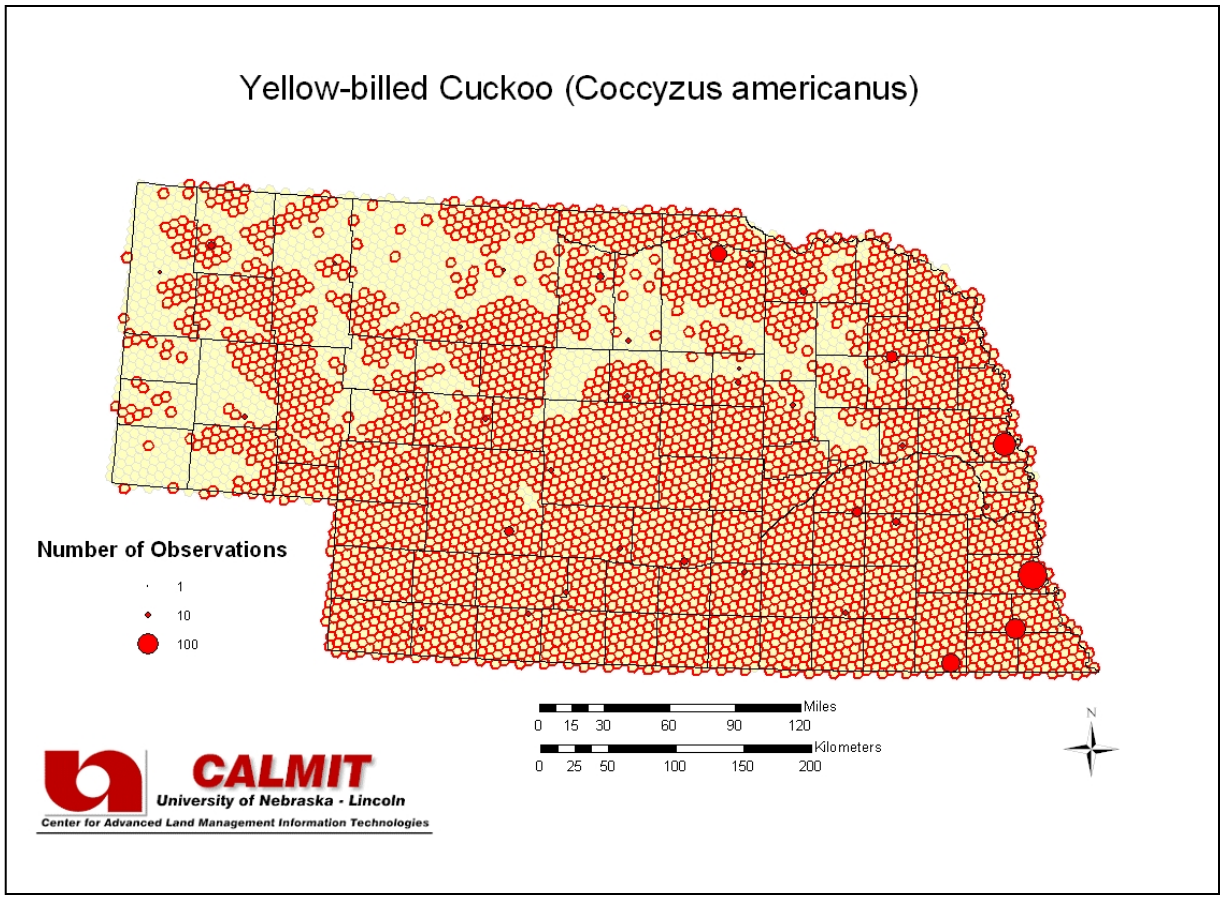
Common Name:	**Yellow-billed Cuckoo**	TNC Global Status:	G5
Scientific Name:	***Coccyzus americanus***	Federal Status:	--
TNC Element Code:	ABNRB02020	State (NE) Status:	S5
AOU Code:	03870		

Habitat Description:
Common in the east, but less common westward, and becoming rare in the Panhandle (Johnsgard 1997). Relatively dense wooded habitats are favored. In Nebraska, found almost statewide, although becoming scarce in Panhandle (Mollhoff 2001). Species found in brushy areas with scattered trees or open woodland. Species occurs statewide in its habitat of open woodland edge, regenerating woodland, and shrublands, especially riparian (Sharpe et al. 2001). Most common in the east and north and least common toward the west away from riparian habitat.

Total Area of Modeled Habitat (ha): 15,000,000

Model Description:
Modeled distribution using the variable 'Land Cover class Barren/Sand/Outcrop < 0.25%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

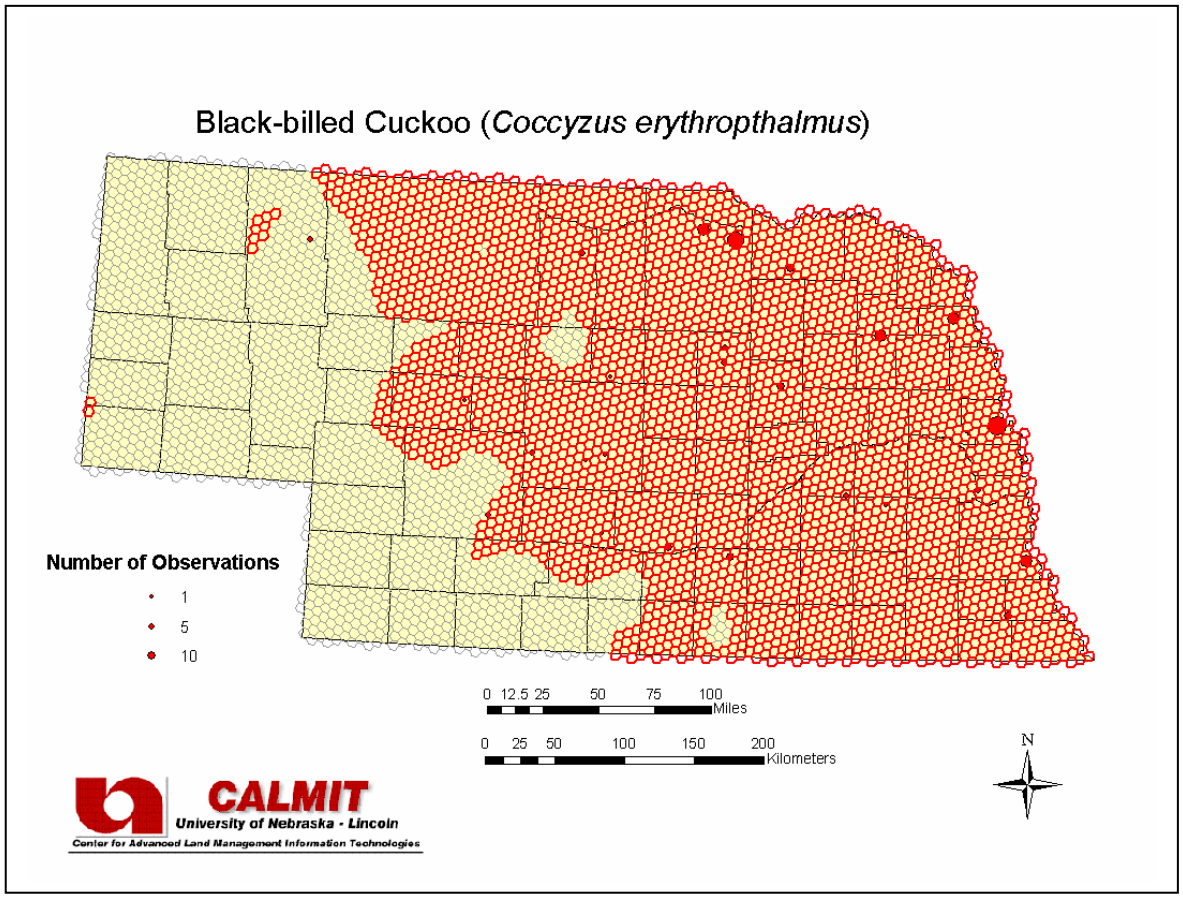
Common Name:	**Black-billed Cuckoo**	TNC Global Status:	G5
Scientific Name:	***Coccyzus erythropthalmus***	Federal Status:	--
TNC Element Code:	ABNRB02010	State (NE) Status:	S5
AOU Code:	03880		

Habitat Description:
Favors dense woodlands, especially those that provide a variety of trees, bushes and vines for possible nesting sites (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 1.34×10^7

Model Description:
Modeled distribution using the variable 'Average 30-year Precipitation Coefficient of Variation for September $\leq$ 85%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



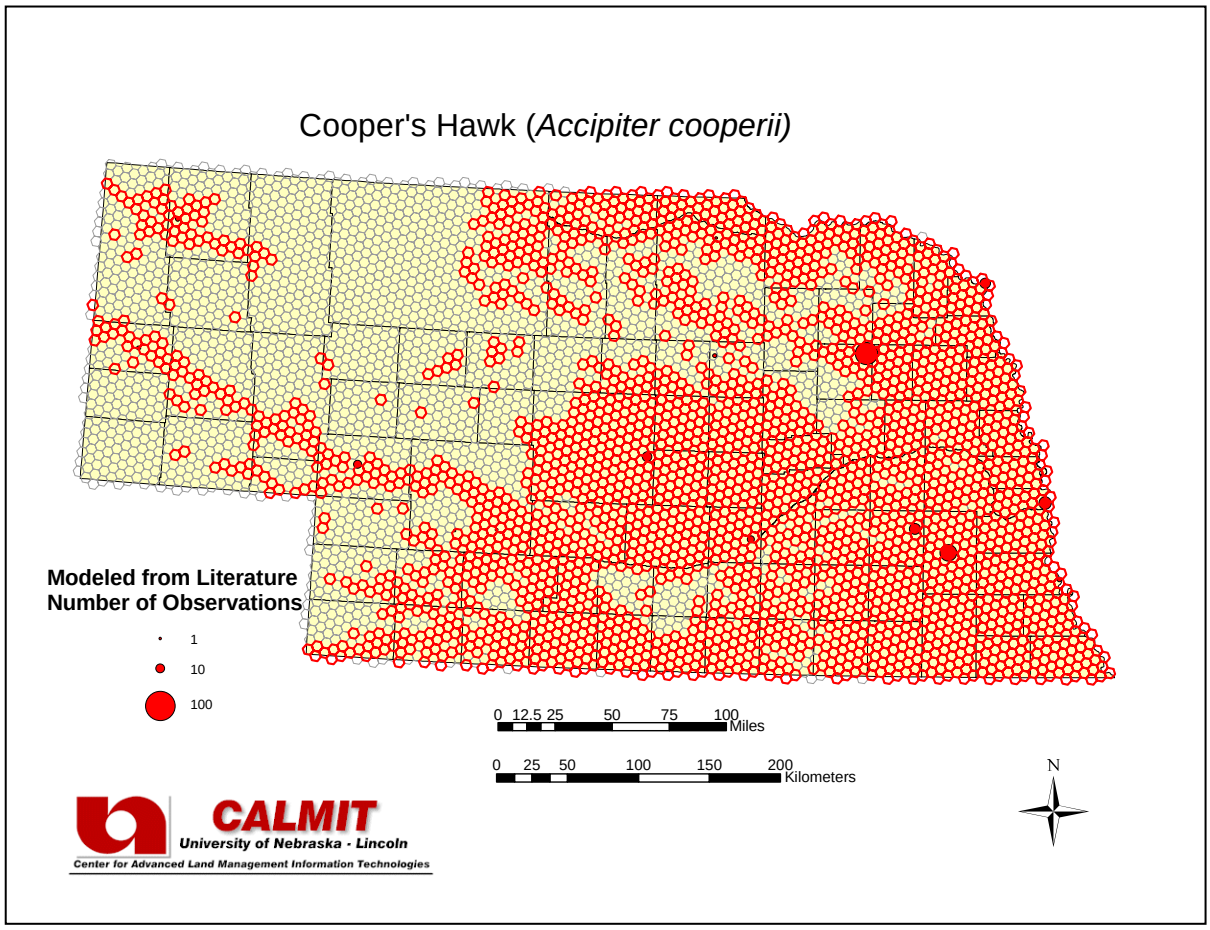
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Cooper's Hawk**	TNC Global Status:	G5
Scientific Name:	***Accipiter cooperii***	Federal Status:	--
TNC Element Code:	ABNKC12040	State (NE) Status:	S1
AOU Code:	03330		

Habitat Description:
Found year-round in mature forests, especially hardwoods (Johnsgard 1997). Usually nests in deciduous or coniferous trees near the edge of a wooded area, with large open fields and water nearby. Others include mature coniferous woodlands in its breeding habitat (DeGraff and Rappole 1995; Toolen 1998; Mollhoff 2001), as well as the floodplain woodlands associated with major streams and the Pine Ridge (Sharpe et al.2001). In Nebraska, it is found nearly at the four corners of the state, including the Republican River drainage in the southwest, along the Niobrara River, in the Pine Ridge and in a few blocks of the southeast (Mollhoff 2001). It is absent from large areas of the state, including the Sandhills (Sharpe et al. 2001). Although regularly occurring in very small numbers in scattered locations, few nesting records exist. Reports from the 'North American Breeding Bird Survey Results and Analysis, 1966-2000' (Sauer et al. 2001) show a more limited distribution (along the Niobrara and Republican Rivers) than that reported in regional literature.

Total Area of Modeled Habitat (ha): 1.11×10^7

Model Description:
Adequate model could not be resolved using QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the variable 'Land Cover class Deciduous Forests and Woodlands > 0.4%'.



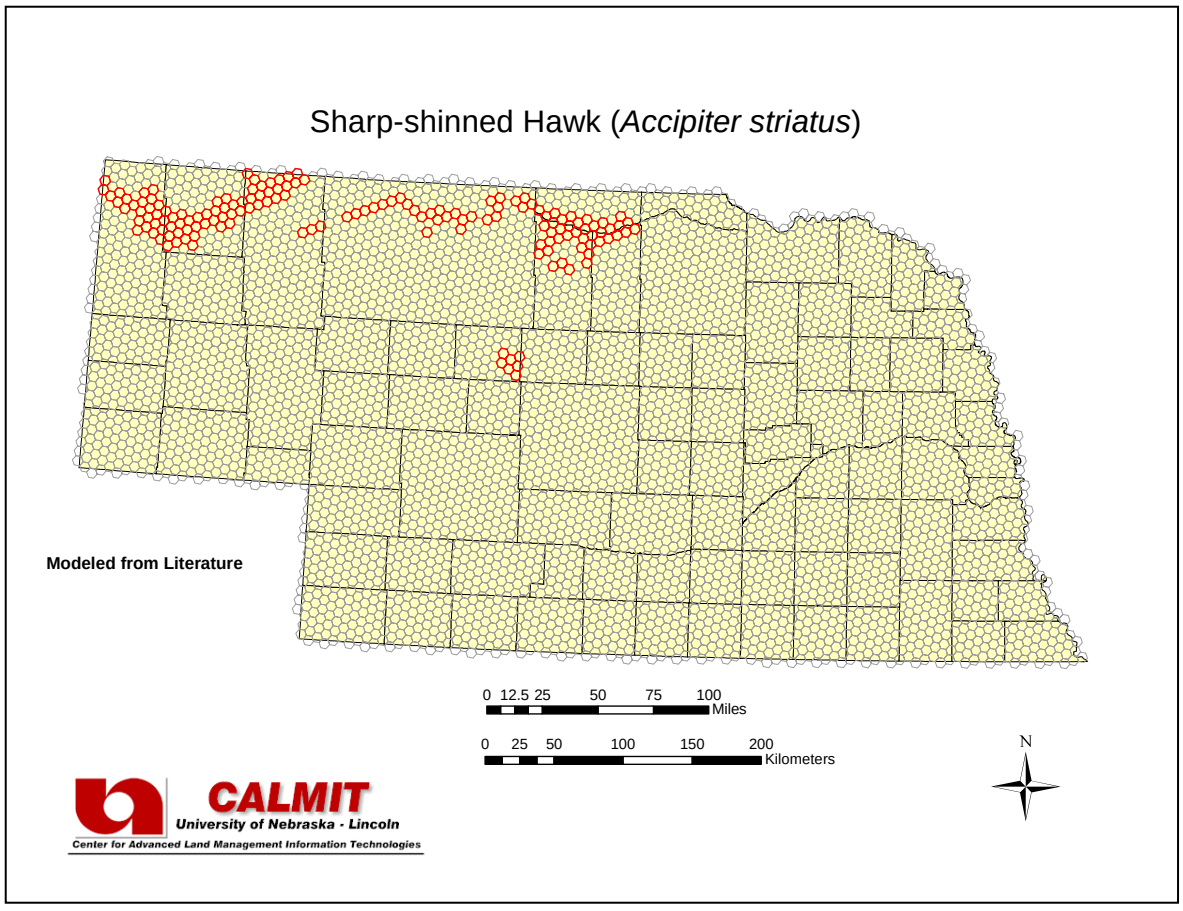
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Sharp-shinned Hawk**	TNC Global Status:	G5
Scientific Name:	***Accipiter striatus***	Federal Status:	--
TNC Element Code:	ABNKC12020	State (NE) Status:	S1
AOU Code:	03320		

Habitat Description:
Breeding habitat includes ponderosa pine forests with an occasional use of mixed coniferous/ deciduous woodland (Johnsgard 1997, Mollhoff 2001). Breeds only in the central Niobrara River, the Pine Ridge, and the Nebraska National Forest in Thomas County (Mollhoff 2001, Sharpe et al. 2001)

Total Area of Modeled Habitat (ha): 624,418

Model Description:
Adequate model could not be resolved using QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Ponderosa Pine Forests and WoodlandsForests and Woodlands > 2%'. Extent clipped to Nebraska National Forest, Pine Ridge, and the Niobrara (Mollhoff 2001, Sharpe et al. 2001).



Nebraska GAP Analysis 2004
Bird Species Atlas

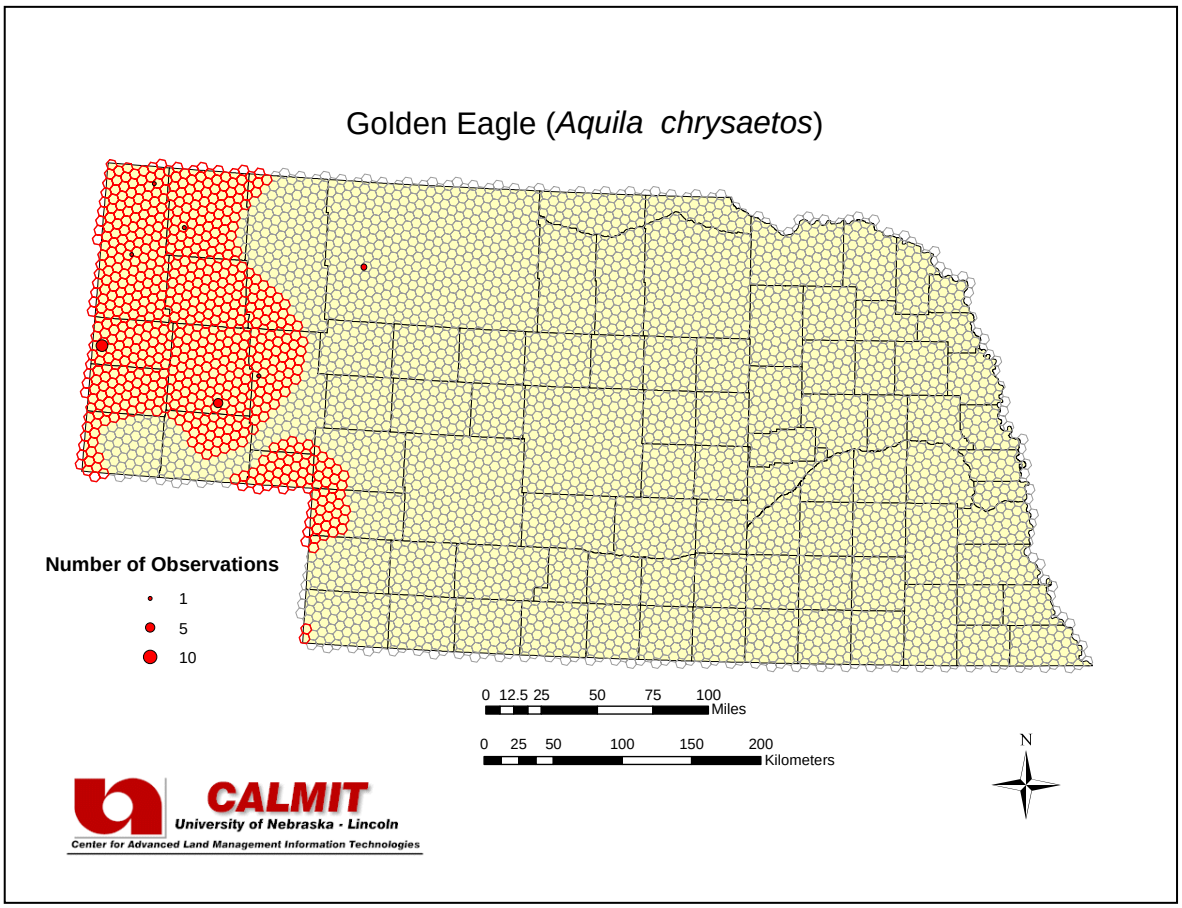
Common Name:	**Golden Eagle**	TNC Global Status:	G5
Scientific Name:	***Aquila chrysaetos***	Federal Status:	--
TNC Element Code:	ABNKC22010	State (NE) Status:	S3
AOU Code:	03490		

Habitat Description:
Breeding occurs at scattered sites across the Panhandle. The species occupy isolated habitat requiring sites associated with cliffs offering remote nesting sites and extensive grasslands for foraging. This species seems to have a low tolerance for human presence (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 2,846,313

Model Description:
Modeled distribution using the variable 'Average 30-year Precipitation for July $\leq$ 66.5 mm'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



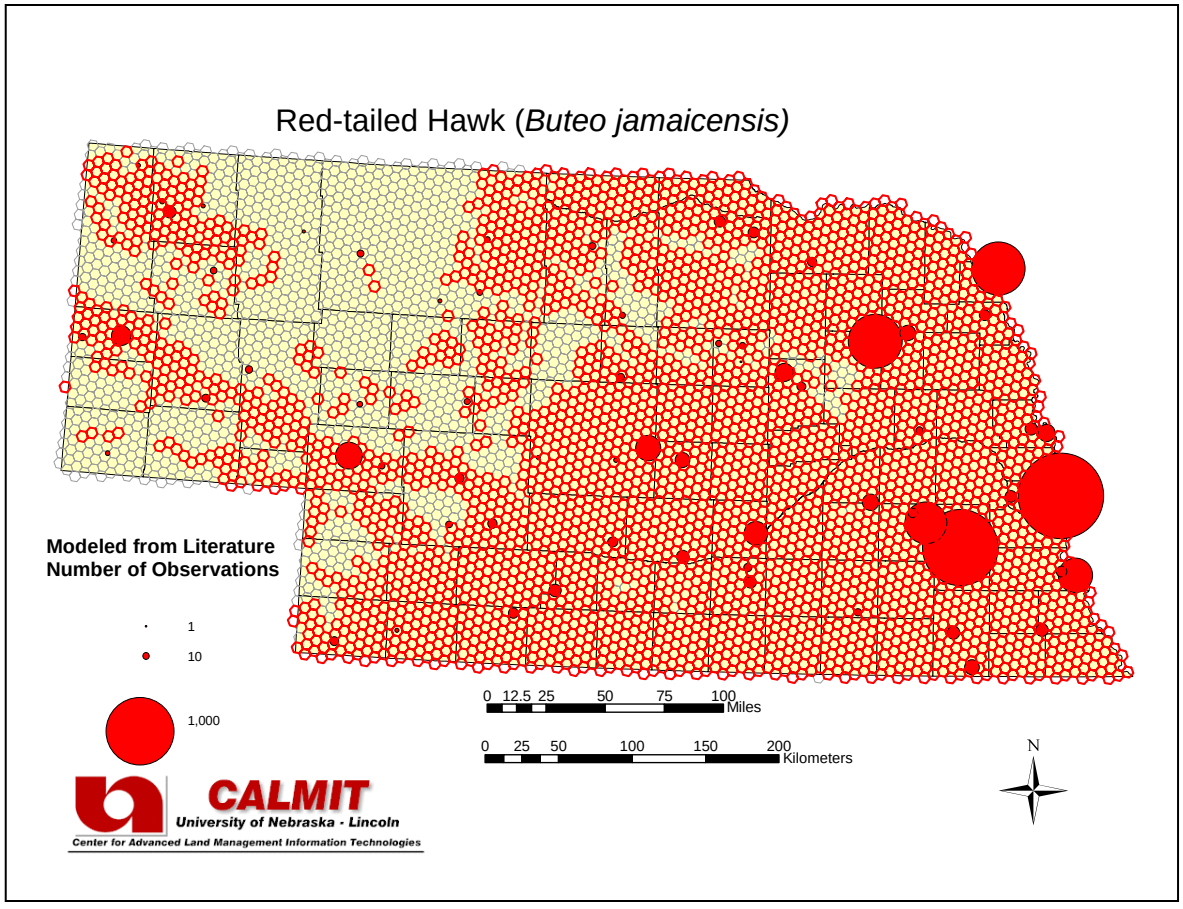
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Red-tailed Hawk**	TNC Global Status:	G5
Scientific Name:	***Buteo jamaicensis***	Federal Status:	--
TNC Element Code:	ABNKC19110	State (NE) Status:	S4
AOU Code:	03370		

Habitat Description:
Nests in scattered clumps or groves of trees (Johnsgard 1997). Found most frequently in areas of scattered trees, intermixed with fields, pastures, and other open lands; seemed to be greatly reduced in numbers or absent from parts of the Sandhills (Mollhoff 2001). Fairly common regular breeder statewide (Sharpe et al. 2001). Woodland edges with tall trees preferred for nest sites.

Total Area of Modeled Habitat (ha): 1.43×10^7

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Deciduous Forests and Woodlands is present'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



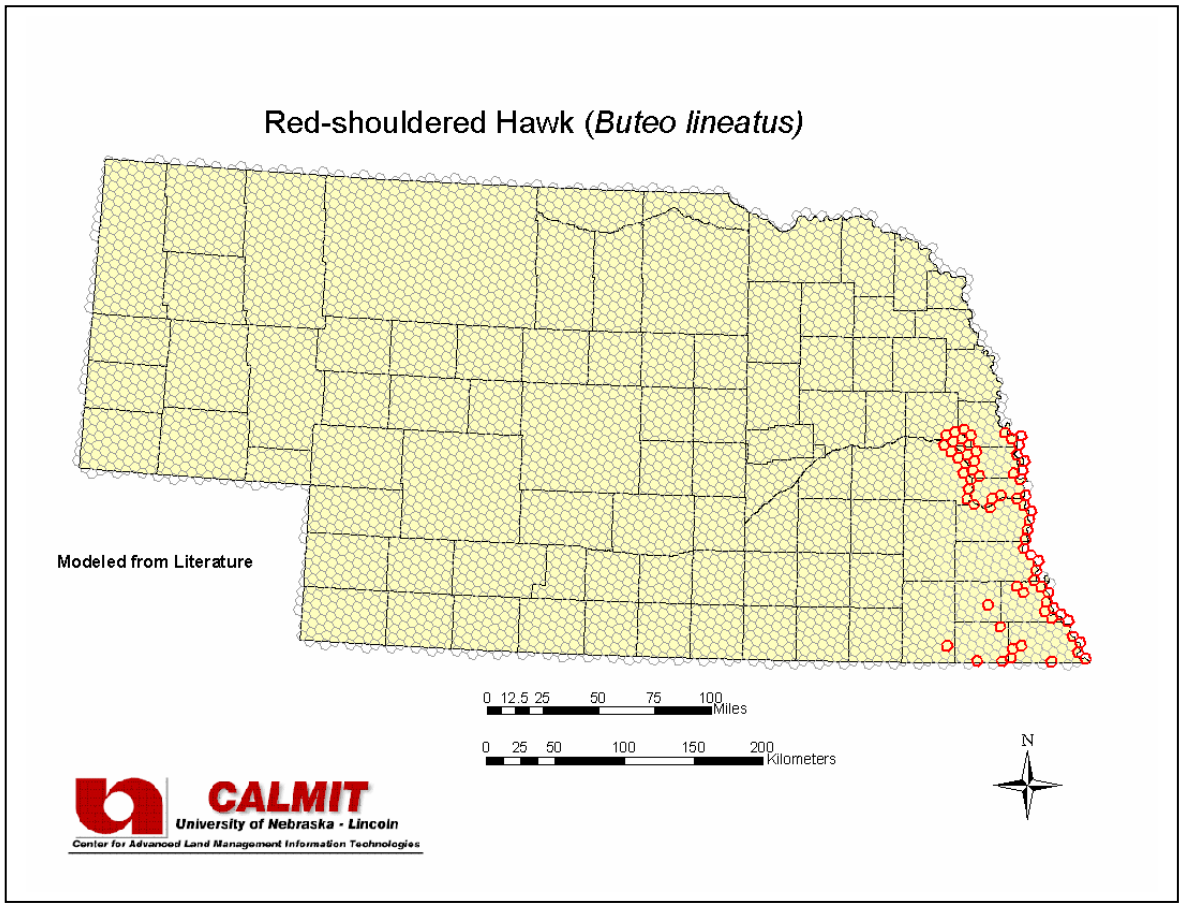
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Red-shouldered Hawk**	TNC Global Status:	G5
Scientific Name:	***Buteo lineatus***	Federal Status:	--
TNC Element Code:	ABNKC19030	State (NE) Status:	S1
AOU Code:	03390		

Habitat Description:
Species is found in relatively moist woodlands, especially floodplain forests, with adjacent open country for foraging (Johnsgard 1997). During the breeding season species occupies floodplain and upland deciduous woodlands, often adjacent to marshes (Sharpe et al. 2001). Most appropriate breeding habitat is found in the eastern quarter of Nebraska.

Total Area of Modeled Habitat (ha): 275,713

Model Description:
No observational data were available for this species. Modeled from literature using the variable 'Land Cover class Riparian Woodland > 0.05%', clipped to limit distribution to areas of the state where breeding reports have been confirmed (Sharpe et al. 2001).



Nebraska GAP Analysis 2004
Bird Species Atlas

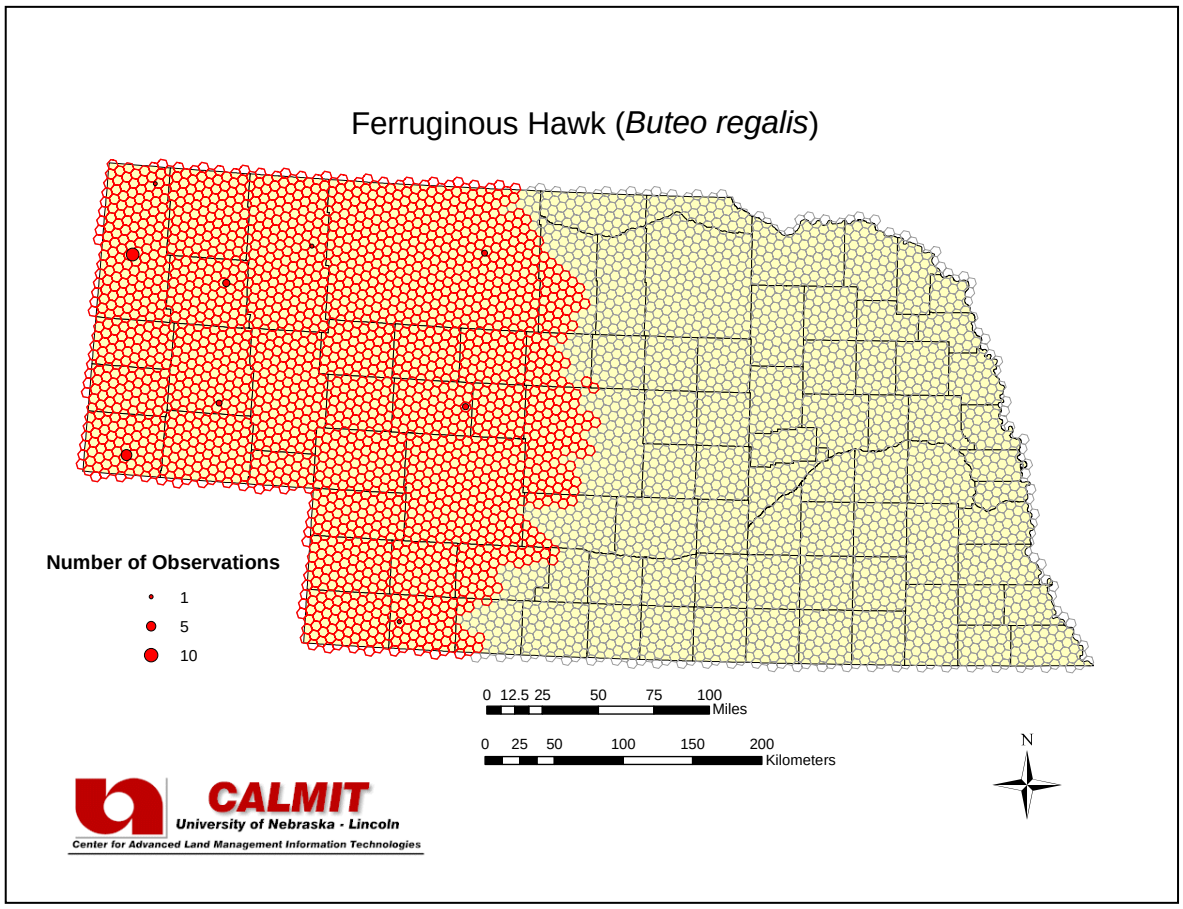
Common Name:	**Ferruginous Hawk**	TNC Global Status:	G4
Scientific Name:	***Buteo regalis***	Federal Status:	--
TNC Element Code:	ABNKC19120	State (NE) Status:	S2
AOU Code:	03480		

Habitat Description:
Species occurs in extensive grasslands having scattered trees or clay buttes or bluffs for nesting sites (Sharpe et al. 2001). Regular breeding occurs west of a line from Dundy to Keya Paha counties in the western Sandhills and Panhandle (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 9,443,188

Model Description:
Modeled distribution using the variable 'Elevation > 800 m'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



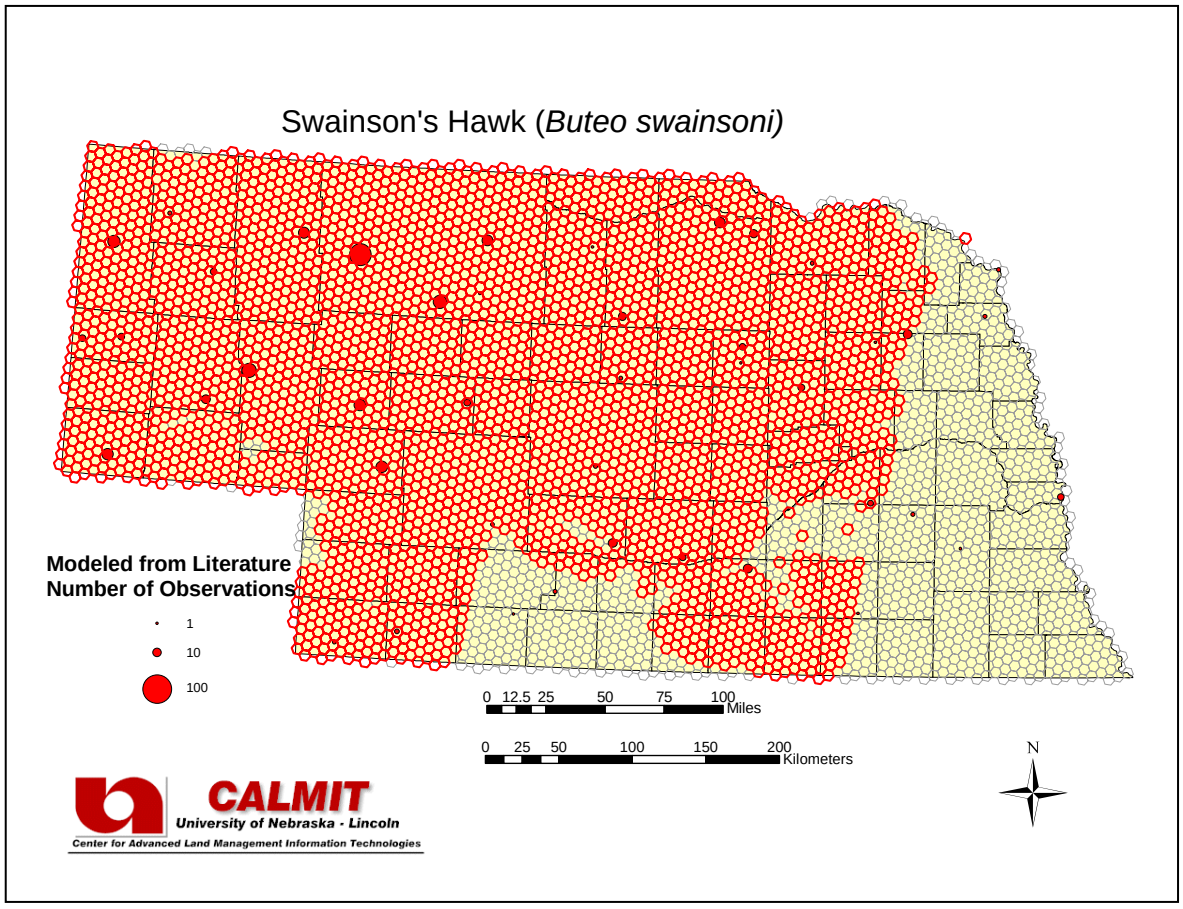
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Swainson's Hawk**	TNC Global Status:	G5
Scientific Name:	***Buteo swainsoni***	Federal Status:	--
TNC Element Code:	ABNKC19070	State (NE) Status:	S3
AOU Code:	03420		

Habitat Description:
Associated with open country, especially high plains and Sandhills with only scattered trees for nesting sites (Johnsgard 1997). Fairly common with a scattered distribution; found in greatest numbers in open country, decreases eastward with increasing woodland (Mollhoff 2001). Most suitable habitat is found in the Sandhills and much of the Panhandle; in the east found in areas where considerable pastureland is available to support prey (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.53×10^7

Model Description:
Adequate model could not be resolved using QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Sandhills Upland Prairie > 0.1%'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



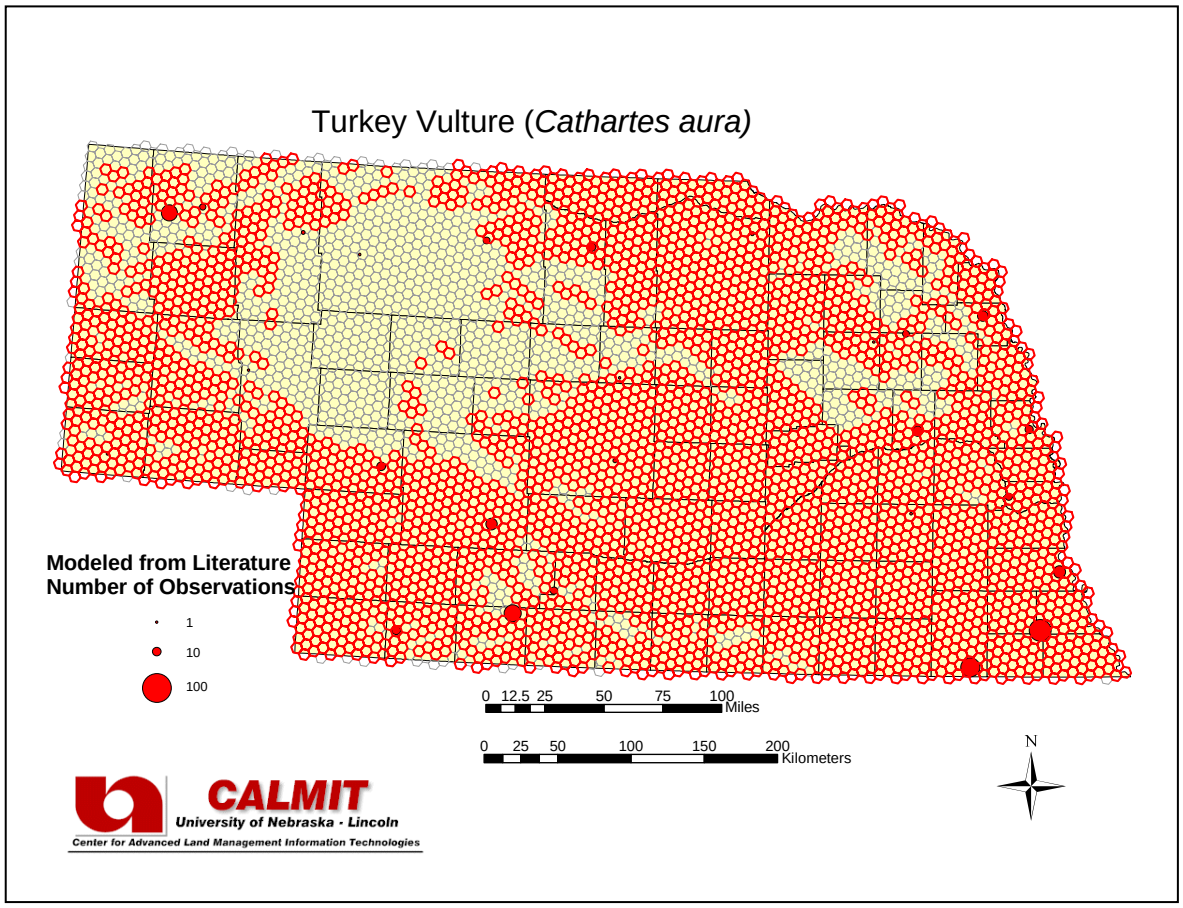
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Turkey Vulture**	TNC Global Status:	G5
Scientific Name:	***Cathartes aura***	Federal Status:	--
TNC Element Code:	ABNKA02010	State (NE) Status:	S3
AOU Code:	03250		

Habitat Description:
Mostly associated with brushy woodlands adjoining open grasslands or croplands during breeding season; cliffs, crevices, abandoned buildings or other cavities needed for nesting (Johnsgard 1997). Found widely scattered across the state during the breeding season- along the Missouri River, along the central and western Niobrara River and the Pine Ridge, along the Republican River-Medicine Creek and along the North Platte River above Lincoln County, as well as some southeastern counties (Mollhoff 2001); throughout much of the Panhandle and western Platte Valley (Sharpe et al. 2001). Known nest sites concentrated in the west, north, and southeast.

Total Area of Modeled Habitat (ha): 1.42×10^7

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the set of variables 'Slope 2-5° < 30%' OR 'Land Cover class Deciduous Forests and Woodlands > 1%'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



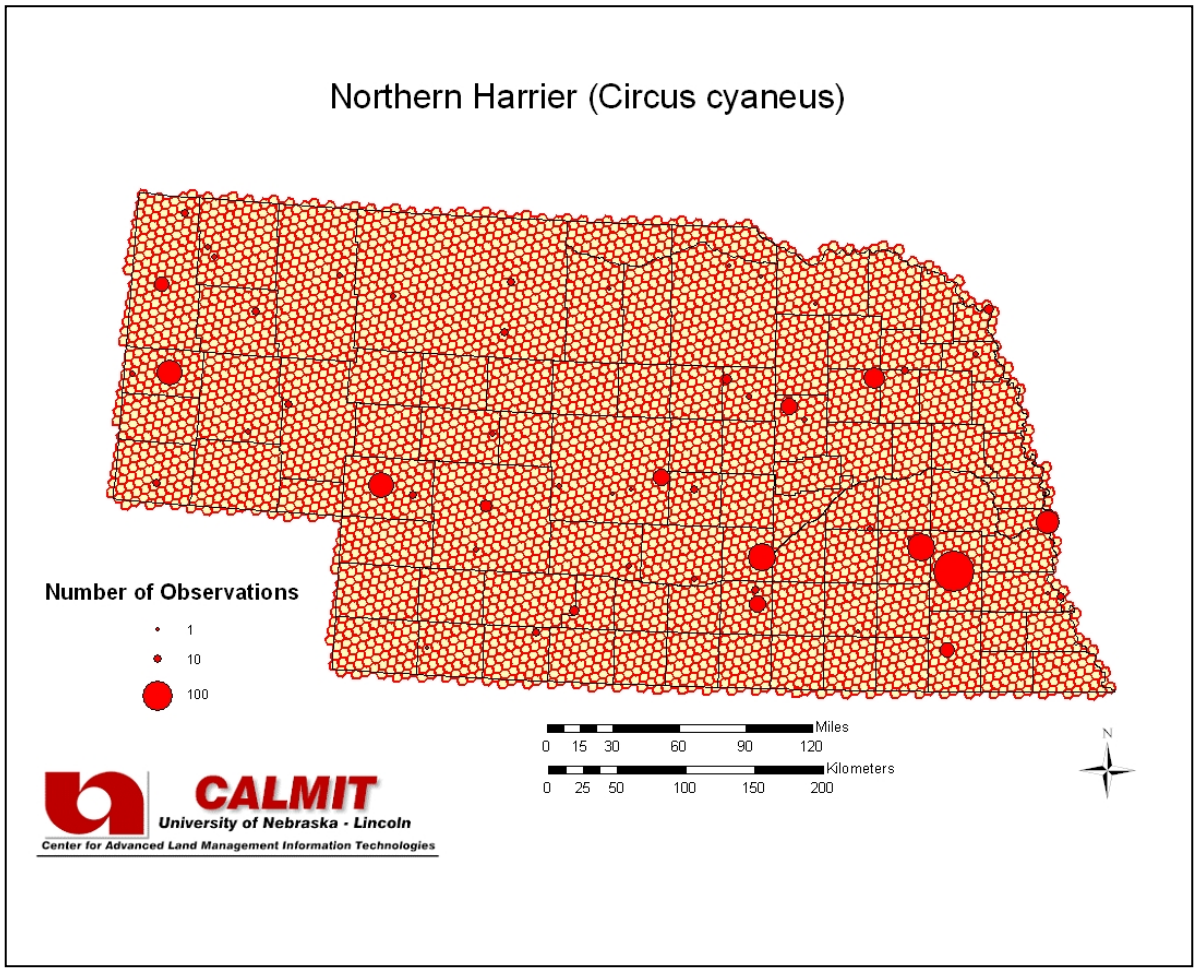
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Northern Harrier**	TNC Global Status:	G5
Scientific Name:	***Circus cyaneus***	Federal Status:	--
TNC Element Code:	ABNKC11010	State (NE) Status:	S3
AOU Code:	03310		

Habitat Description:
Occurs in open habitats, such as native grasslands, prairie marshes and wet meadows, with nesting in grassy or woody vegetation (Johnsgard 1997, Mollhoff 2001). Scattered habitat throughout the state – old fields, grasslands, moist meadows, and weedy ditches (Sharpe et al. 2001). Nesting associated with marshes, as well as ditches with tall grass.

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Habitat descriptions from literature were broad and general, resulting in no available variables for modeling.



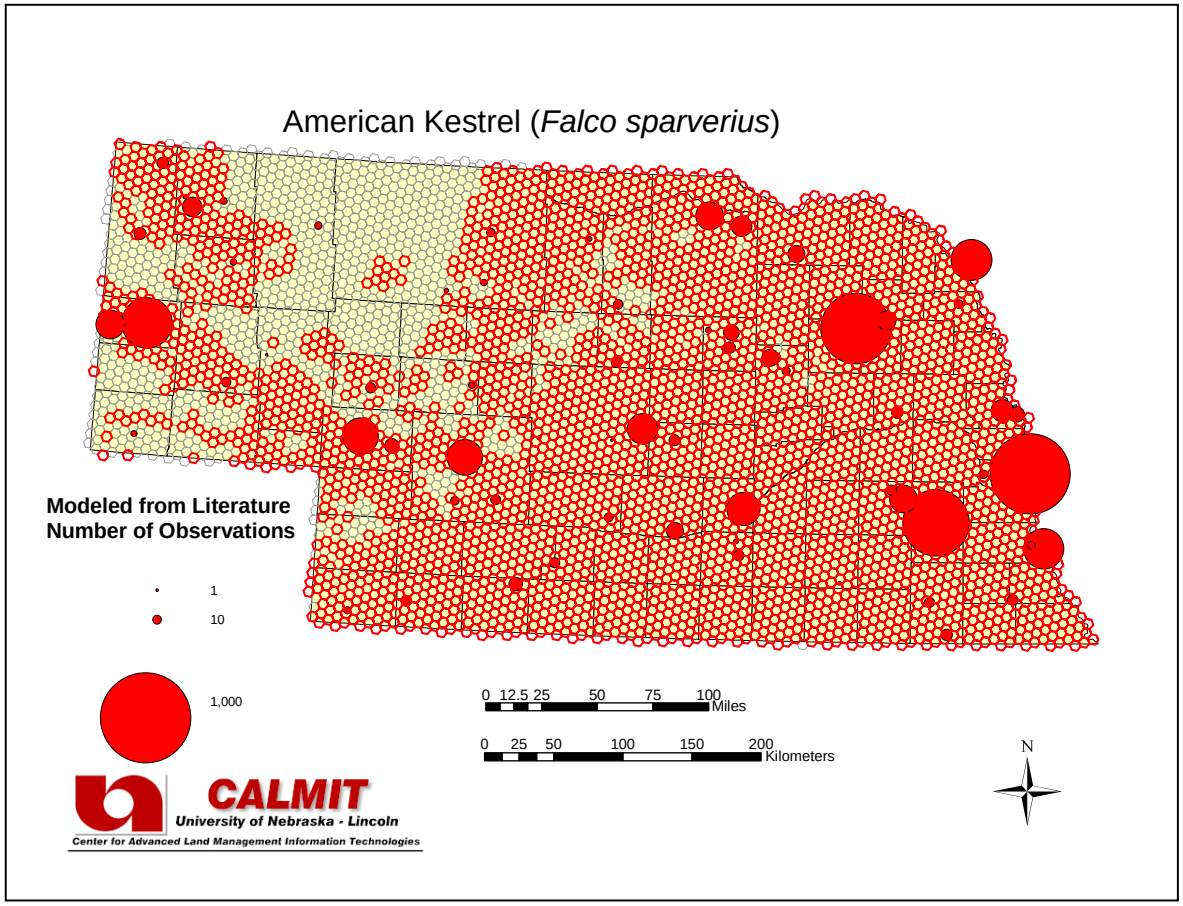
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**American Kestrel**	TNC Global Status:	G5
Scientific Name:	***Falco sparverius***	Federal Status:	--
TNC Element Code:	ABNKD06020	State (NE) Status:	S4
AOU Code:	03600		

Habitat Description
Nests in scattered trees or groves near large areas of grasslands, croplands or badlands (Johnsgard 1997). Found in areas of woodland-grassland edge where the cavity nests in large trees are bordered by open country; often along streams or homestead-era cottonwood groves (Mollhoff 2001). Occur statewide in summer in a variety of open habitats; extensive open habitats, as in the Sandhills or Panhandle, are not favored (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.57×10^7

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Deciduous Forests and Woodlands is present'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

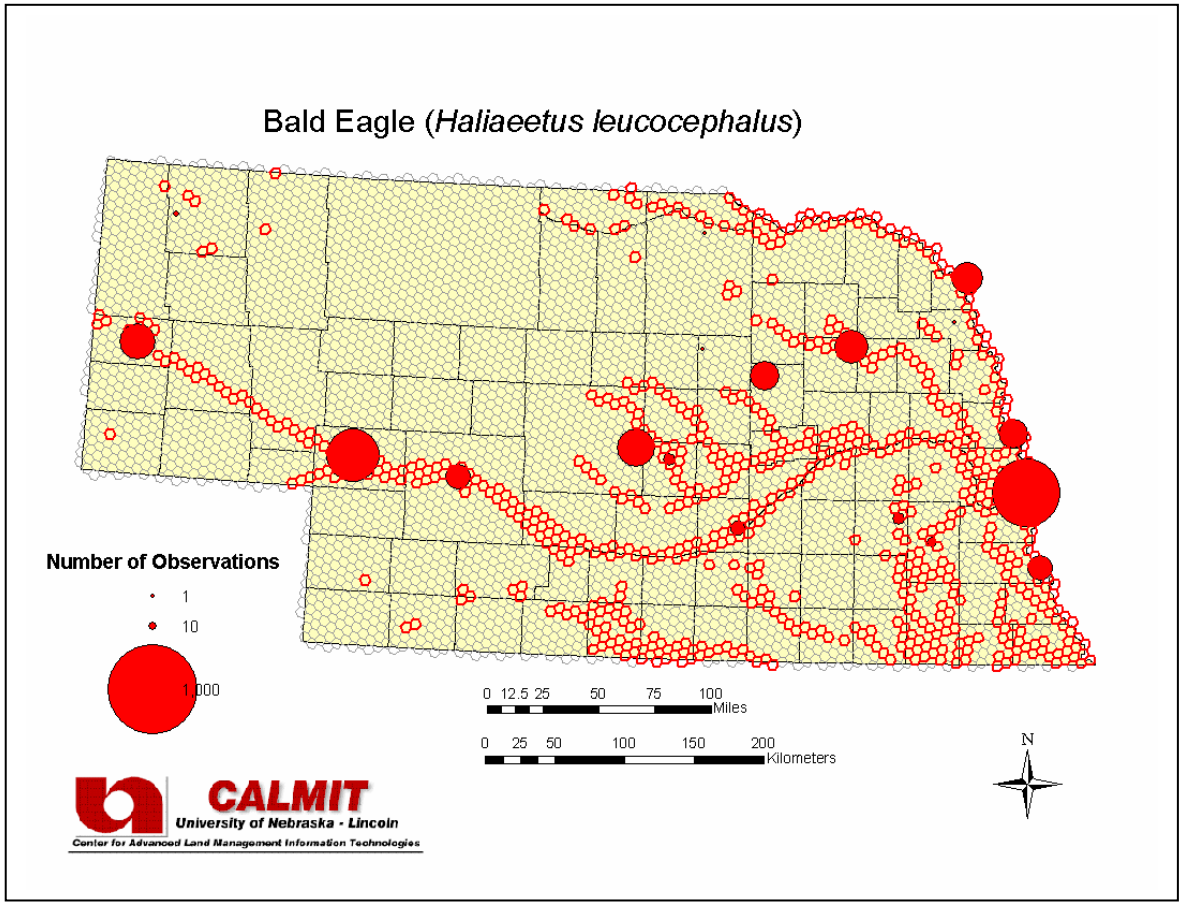
Common Name:	**Bald Eagle**	TNC Global Status:	G4
Scientific Name:	***Haliaeetus leucocephalus***	Federal Status:	LELTLN
TNC Element Code:	ABNKC10010	State (NE) Status:	S1
AOU Code:	03520		

Habitat Description:
Utilize ice-free areas of large tree-lined rivers and reservoirs during winter (Johnsgard 1997). Breeding sites are widely scattered across the state, but are associated with lakes, rivers and reservoirs (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 2,886,885

Model Description:
Modeled distribution using the set of variables 'Land Cover class Open Water > 0.5%' AND 'Land Cover class Sandhills Upland Prairie $\leq$ 21%'.

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



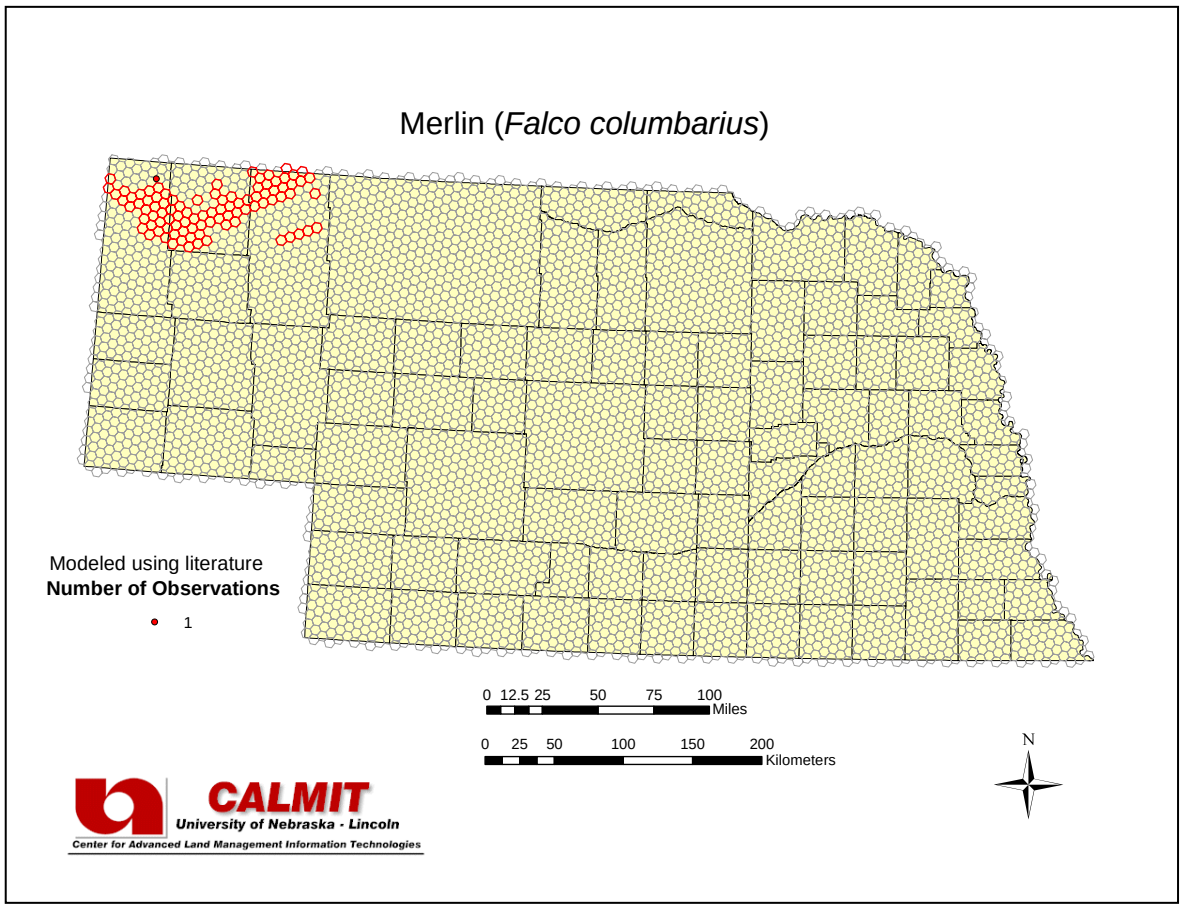
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Merlin**	TNC Global Status:	G5
Scientific Name:	***Falco columbarius***	Federal Status:	--
TNC Element Code:	ABNKD06030	State (NE) Status:	S1
AOU Code:	03570		

Habitat Description:
Nebraska lies at the extreme southern border of breeding range for this species, with nesting reported only in the Pine Ridge. The few breeding reports were from ponderosa pine forest habitat (DeGraff and Rappole 1995; Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001). Nesting typically occurs in scattered trees or groves near large areas of grassland or croplands (Johnsgard 1997). Elsewhere in its range, it is a bird of patchy coniferous boreal forest, of even urban areas (Mollhoff 2001). The species is found in Nebraska year-round.

Total Area of Modeled Habitat (ha): 377,087

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Ponderosa Pine Forests and Woodlands > 1%'. Extent was clipped to match area of known breeding records (Sharpe et al. 2001).



Nebraska GAP Analysis 2004
Bird Species Atlas

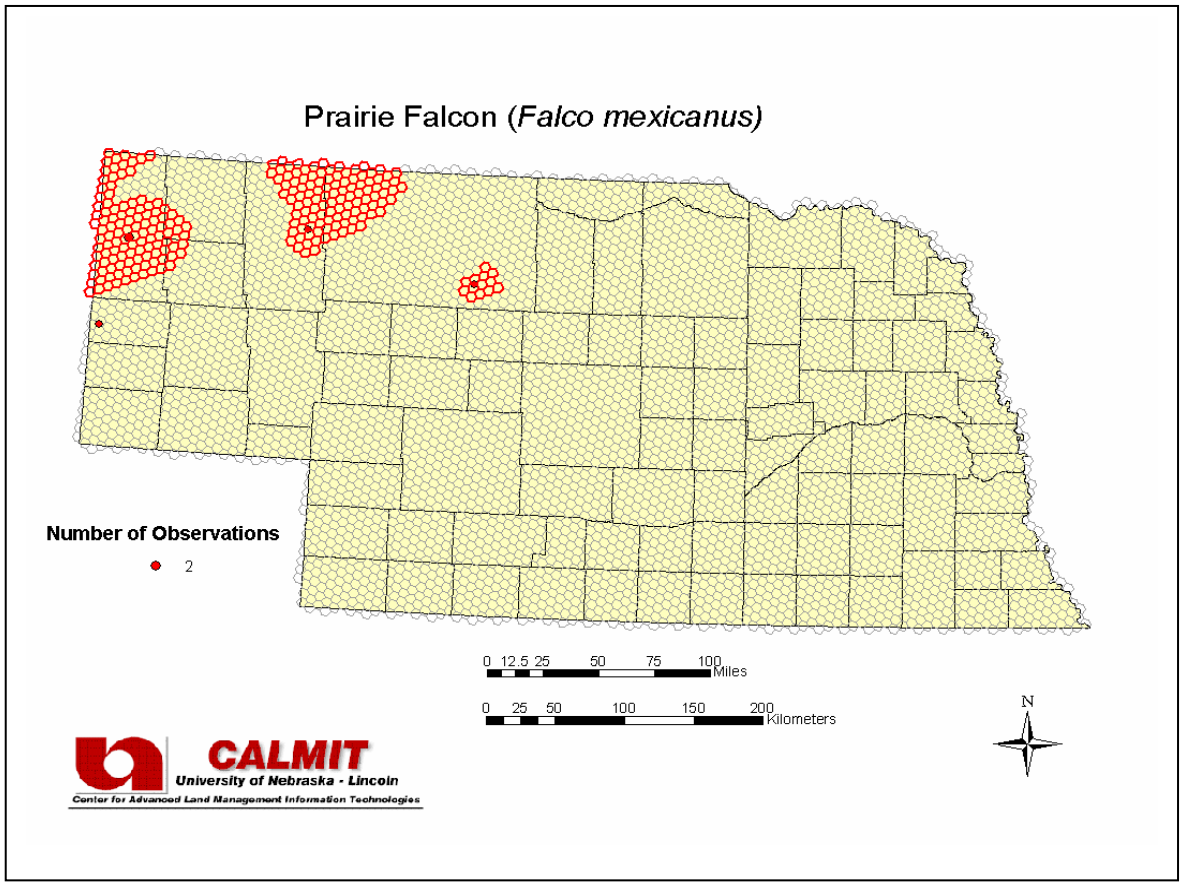
Common Name:	**Prairie Falcon**	TNC Global Status:	G5
Scientific Name:	***Falco mexicanus***	Federal Status:	--
TNC Element Code:	ABNKD06090	State (NE) Status:	S2
AOU Code:	06370		

Habitat Description:
Species is associated with large expanses of open grasslands or sagebrush scrub, with nearby cliffs, bluffs, or rocky outcrops for nesting (Johnsgard 1997). Breeding occurs on cliffs and rocky outcrops in the Panhandle, occasionally farther east (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 965,004

Model Description:
Modeled distribution using the variable 'Average 30-year Minimum Temperature Coefficient of Variation for September > 7.1%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

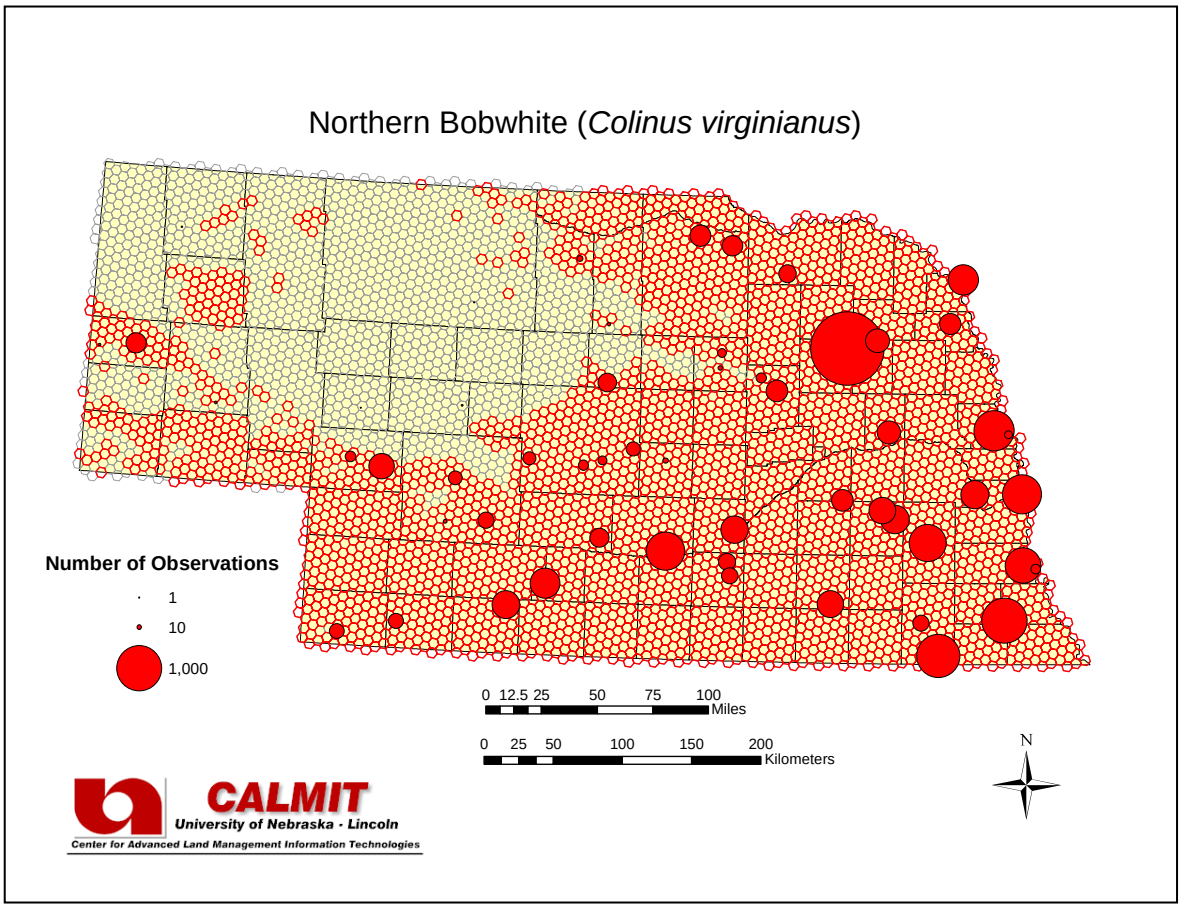
Common Name:	**Northern Bobwhite**	TNC Global Status:	G5
Scientific Name:	***Colinus virginianus***	Federal Status:	--
TNC Element Code:	ABNLC21020	State (NE) Status:	S4
AOU Code:	02890		

Habitat Description:
Most commonly found in brushy areas with adjacent or interspersed grassland or cropland. Nesting requirements include woody cover and weedy areas typically in open herbaceous cover consisting of rather short vegetation that doesn't obstruct easy entry and exit, but sufficient to provide concealment from above. Extensive patches of brush and weeds (e.g. giant ragweed, wild hemp, kochia, and sunflower) are necessary for food and shelter in the winter. It is a regular breed in the southeastern two-thirds of the state (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.4×10^7

Model Description:
Modeled distribution using the set of variables 'Land Cover class Western Wheatgrass Mixedgrass Prairie $\leq$ 0.05%' AND 'Land Cover class Sandhills Upland Prairie $\leq$ 50%' AND 'Land Cover class Western Shortgrass Prairie $\leq$ 41%'.

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



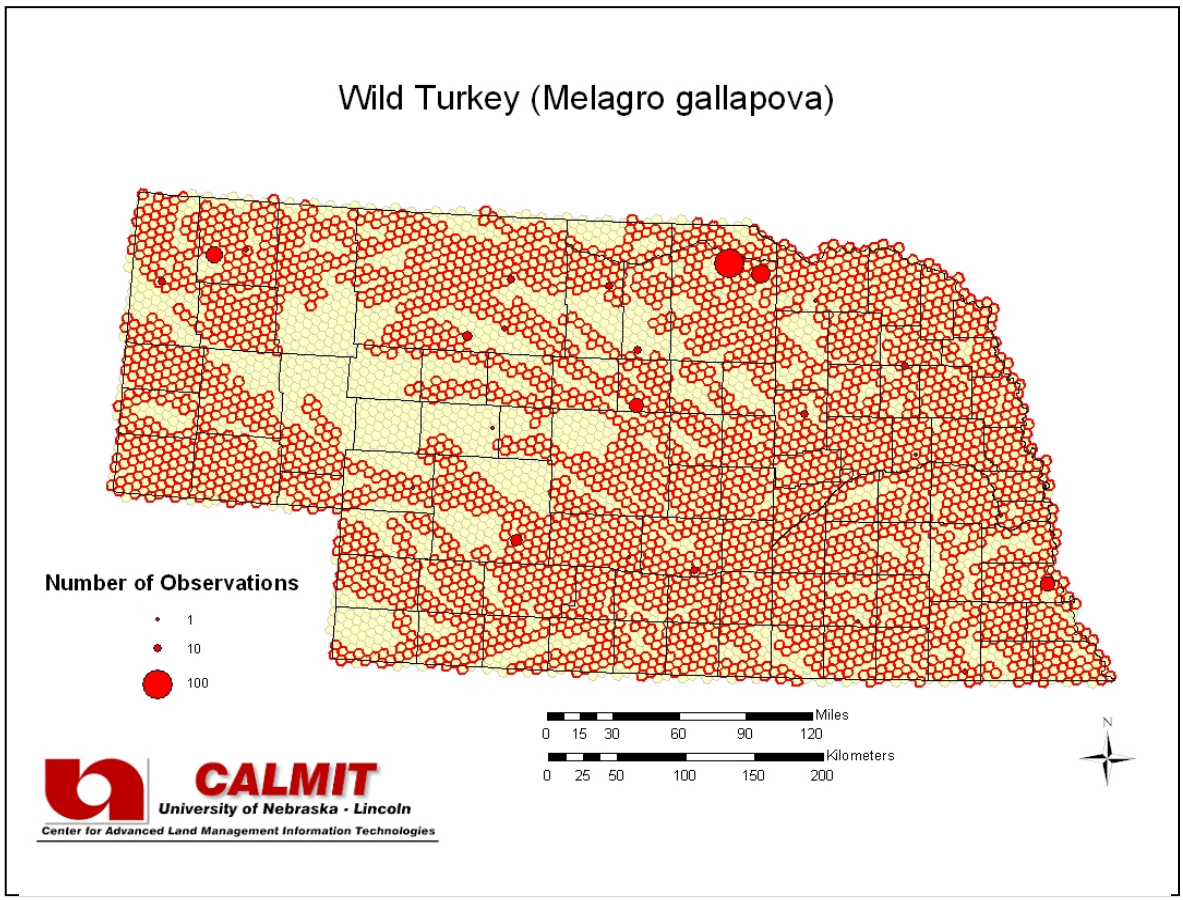
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Wild Turkey**	TNC Global Status:	G5
Scientific Name:	***Meleagris gallopavo***	Federal Status:	--
TNC Element Code:	ABNLC14010	State (NE) Status:	S4
AOU Code:	03100		

Habitat Description:
Occur in riparian woodland, shelterbelts and cottonwood groves having a variety of hardwood trees and in the Pine Ridge area are associated with pines, cedars, running water and a fairly rugged topography (Johnsgard 1997, Mollhoff 2001). Birds currently occur statewide along river and stream valleys and are probably most numerous in the extensive woodlands of the Missouri River Valley and the Pine Ridge (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 2,615,227

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Stream Class is present'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

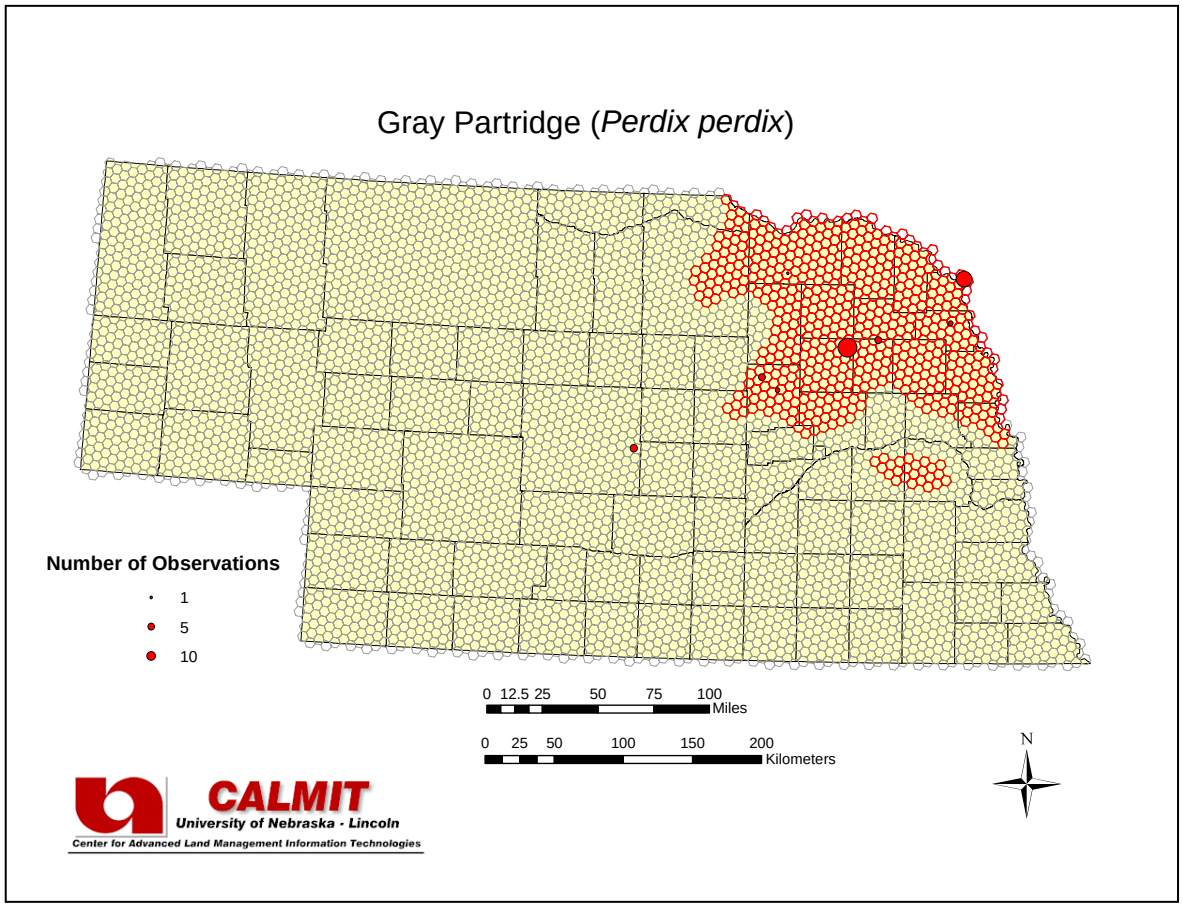
Common Name:	**Gray Partridge**	TNC Global Status:	G5
Scientific Name:	***Perdix perdix***	Federal Status:	--
TNC Element Code:	ABNLC01010	State (NE) Status:	SE
AOU Code:	02881		

Habitat Description:
Current range is restricted to northeastern Nebraska (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001). In Nebraska it appears to prefer agricultural fields rather than pure grasslands, although edge cover is necessary. Nests are located in hay fields and grainfields, with a preference for alfalfa (Mollhoff 2001, Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 2,542,220

Model Description:
Modeled distribution using the variable 'Average 30-year Maximum Temperature Coefficient of Variation for March > 13.5%'.

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



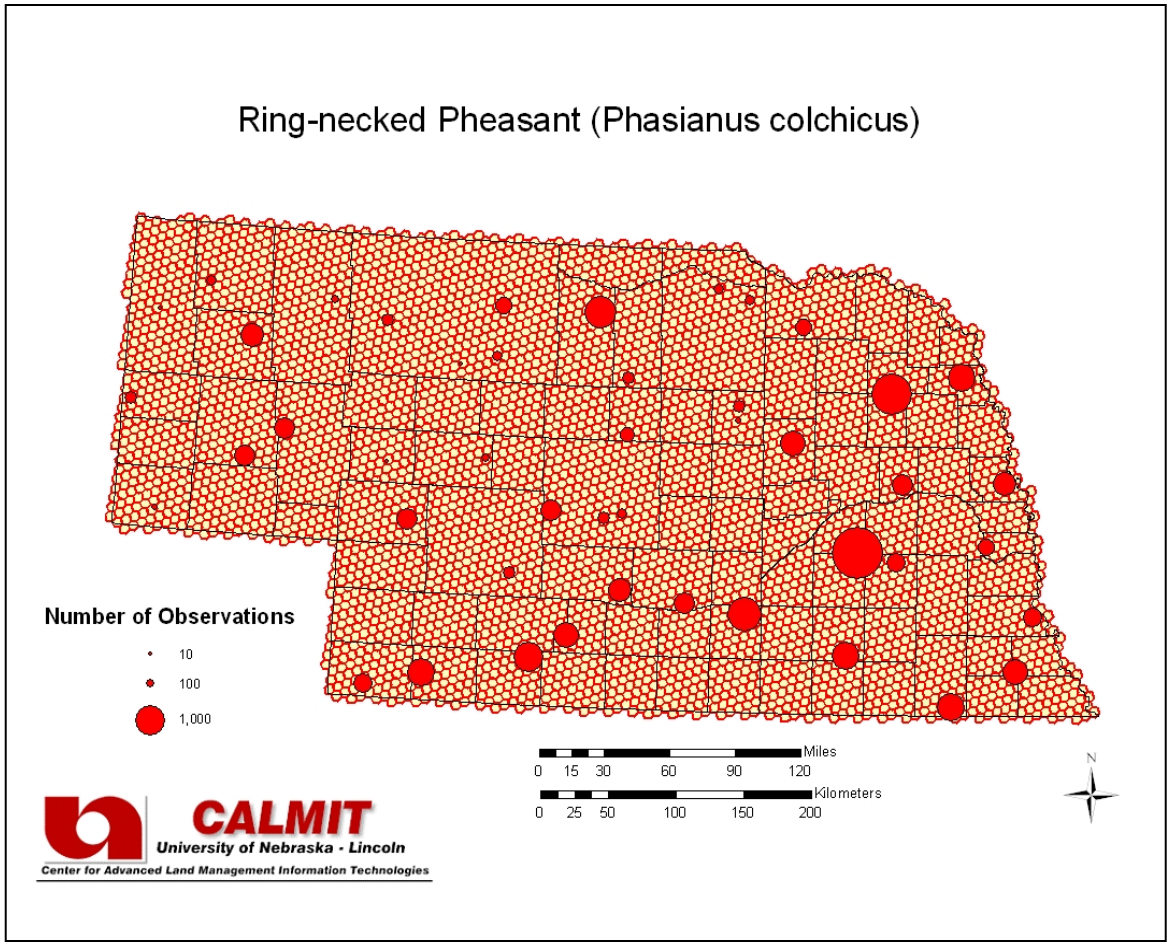
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Ring-necked Pheasant**	TNC Global Status:	G5
Scientific Name:	***Phasianus colchicus***	Federal Status:	--
TNC Element Code:	ABNLC07010	State (NE) Status:	SE
AOU Code:	03091		

Habitat Description:
Nests in roadside ditches, alfalfa or sweetclover fields, or in heavy grass cover statewide (Johnsgard 1997, Mollhoff 2001). Occur statewide in varying densities depending on the presence of cover for protection and nesting; densities highest in the east and south, with significant populations in the Panhandle, but lower in the Sandhills (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Habitat descriptions from literature were broad and general, resulting in no available variables for modeling.



Nebraska GAP Analysis 2004
Bird Species Atlas

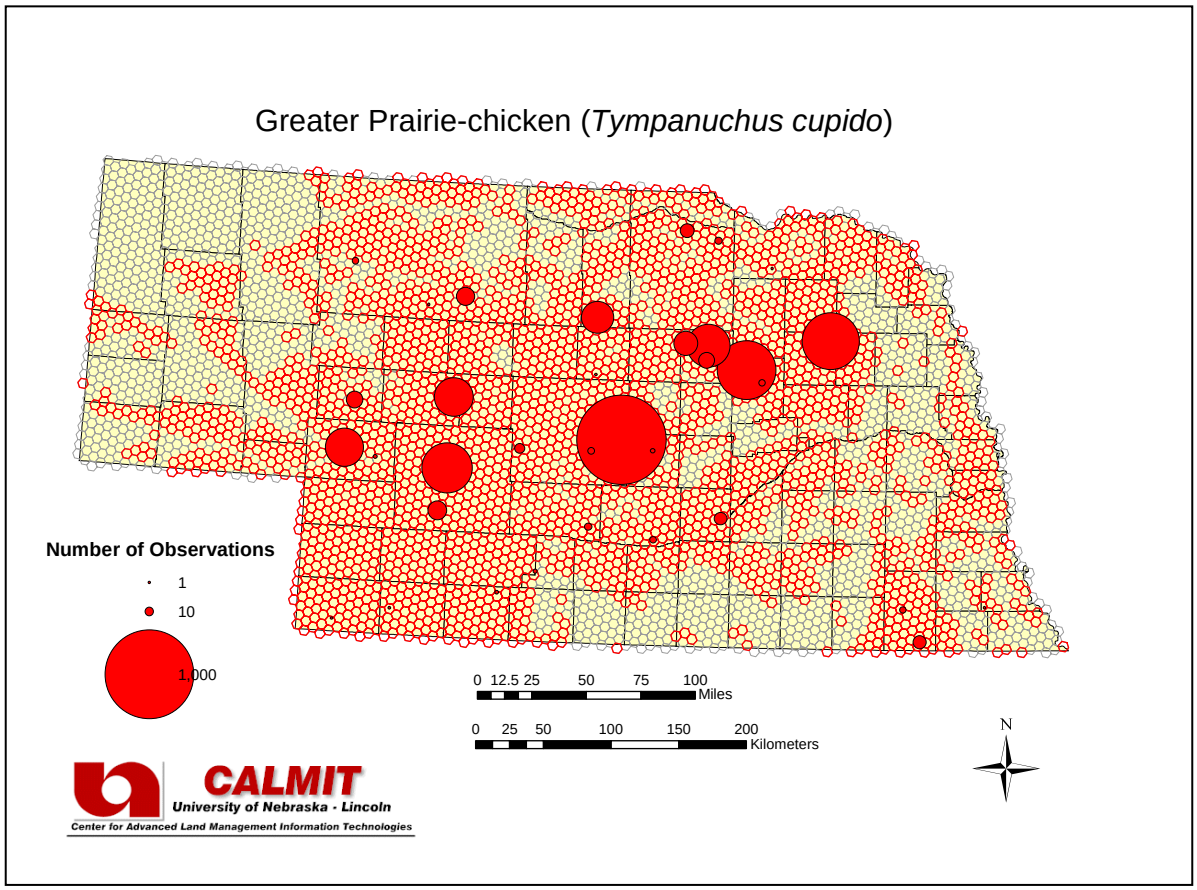
Common Name:	**Greater Prairie-Chicken**	TNC Global Status:	G4
Scientific Name:	***Tympanuchus cupido***	Federal Status:	--
TNC Element Code:	ABNLC13010	State (NE) Status:	--
AOU Code:	03050		

Habitat Description:
The most extensive area occupied by this species is in the grasslands of north-central Nebraska, between the Platte River and the South Dakota border. This species can be found in relatively undisturbed grassland especially little bluestem, reaching greatest numbers where such grassland becomes interspersed with grain croplands in the eastern Sandhills (Johnsgard 1997, Sharpe et al. 2001). They also breed in the sandsage prairie in the southwest corner of the state, and a few relic populations survive in isolated patches of native prairie elsewhere (Mollhoff 2001, Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.19×10^7

Model Description:
Modeled distribution using the set of variables ('Percentage of Fine-textured Soil $\leq$ 0.15%' AND 'Land Cover class Ponderosa Pine Forests and Woodlands $\leq$ 0.3%' AND 'Land Cover class Western Wheatgrass Mixedgrass Prairie $\leq$ 0.05% and 'Land Cover class Western Shortgrass Prairie $\leq$ 30%' AND 'Land Cover class Aquatic Bed Wetland $\leq$ 0.15%') OR ('Percentage of Fine-textured Soil > 0.15%' AND ' Percentage of Hydric Soils $\leq$ 5%' AND 'Land Cover class Western Shortgrass Prairie $\leq$ 29%').

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

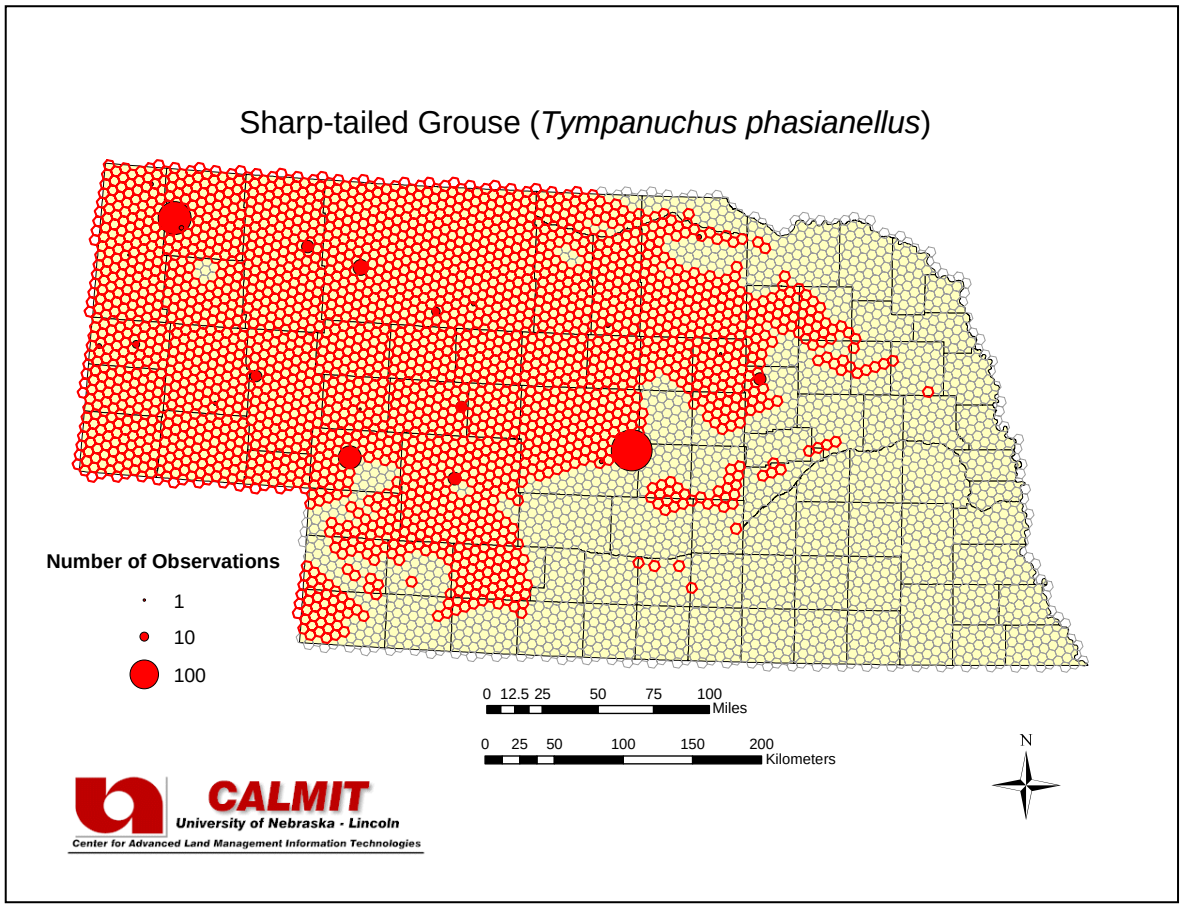
Common Name:	**Sharp-tailed Grouse**	TNC Global Status:	G4
Scientific Name:	***Tympanuchus phasianellus***	Federal Status:	--
TNC Element Code:	ABNLC13030	State (NE) Status:	S4
AOU Code:	03080		

Habitat Description:
This species is found throughout the Sandhills, becoming more numerous to the west. Their habitat is most commonly from blocks of dry, upland Sandhills prairie grasslands where trees are non-existent or widely scattered. In the western part of the Panhandle they were found in shortgrass prairie with some scattered trees (Mollhoff 2001, Sharpe et al. 2001). Their distribution lies primarily north of the Platte River, with the eastern limits approximating those of the Sandhills (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 1.10×10^7

Model Description:
Modeled distribution using the set of variables 'Average 30-year Minimum Temperature for November $\leq$ -5°C' OR 'Average 30-year Minimum Temperature for November > -5°C' AND 'Percentage of Coarse-textured Soils > 45%'.

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

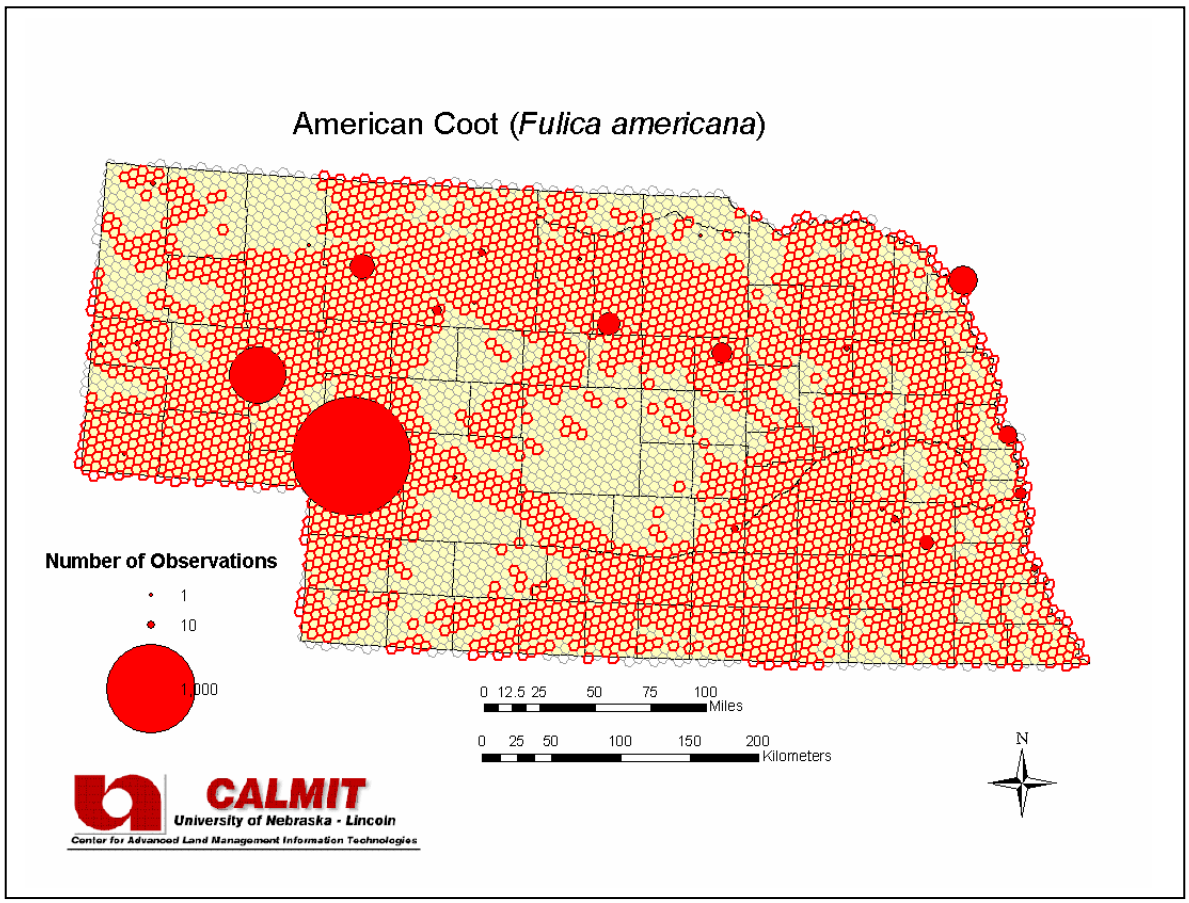
Common Name:	**American Coot**	TNC Global Status:	G5
Scientific Name:	***Fulica americana***	Federal Status:	--
TNC Element Code:	ABNME14020	State (NE) Status:	S?N
AOU Code:	02210		

Habitat Description:
Wide variety of wetlands, ranging from small ponds to large lakes and reservoirs; favoring areas that are fairly shallow and rich in submerged aquatic plants (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 1.26×10^7

Model Description:
Modeled distribution using the set of variables 'Land Cover class Ponderosa Pine Forests and Woodlands $\leq$ 0.8%' AND 'Land Cover class Emergent Wetland is present'.

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

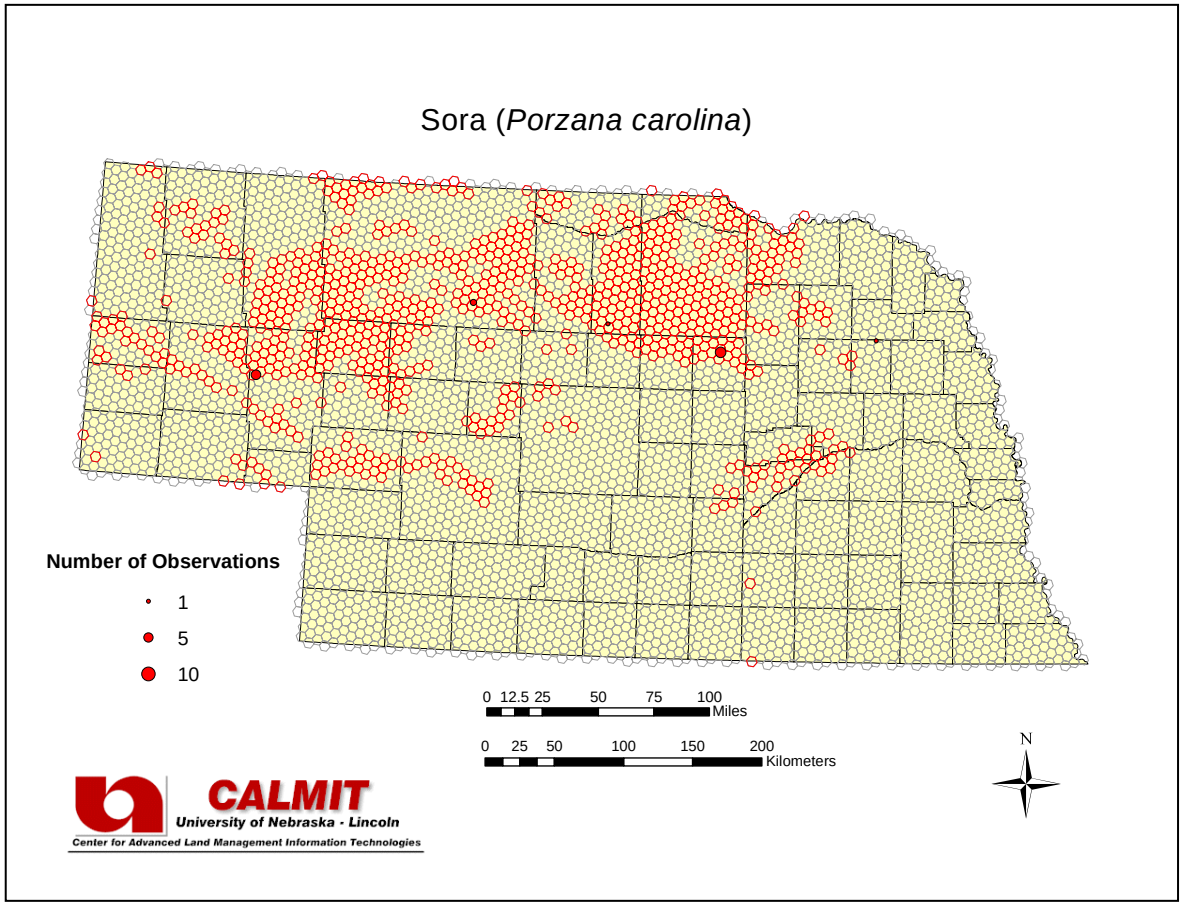
Common Name:	**Sora**	TNC Global Status:	G5
Scientific Name:	***Porzana carolina***	Federal Status:	--
TNC Element Code:	ABNME08020	State (NE) Status:	S4
AOU Code:	02140		

Habitat Description:
This species is found in marshlands with shallow water, especially in areas interspersed with dense emergent vegetation, such as sedges, bulrushes, and brush (Johnsgard 1997, Mollhoff 2001). This species may breed statewide, although densities are low in marginal habitat. The highest breeding densities are in the Sandhills (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 3,653,202

Model Description:
Modeled distribution using the variable 'Land Cover class Lowland Tallgrass Prairie > 5%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



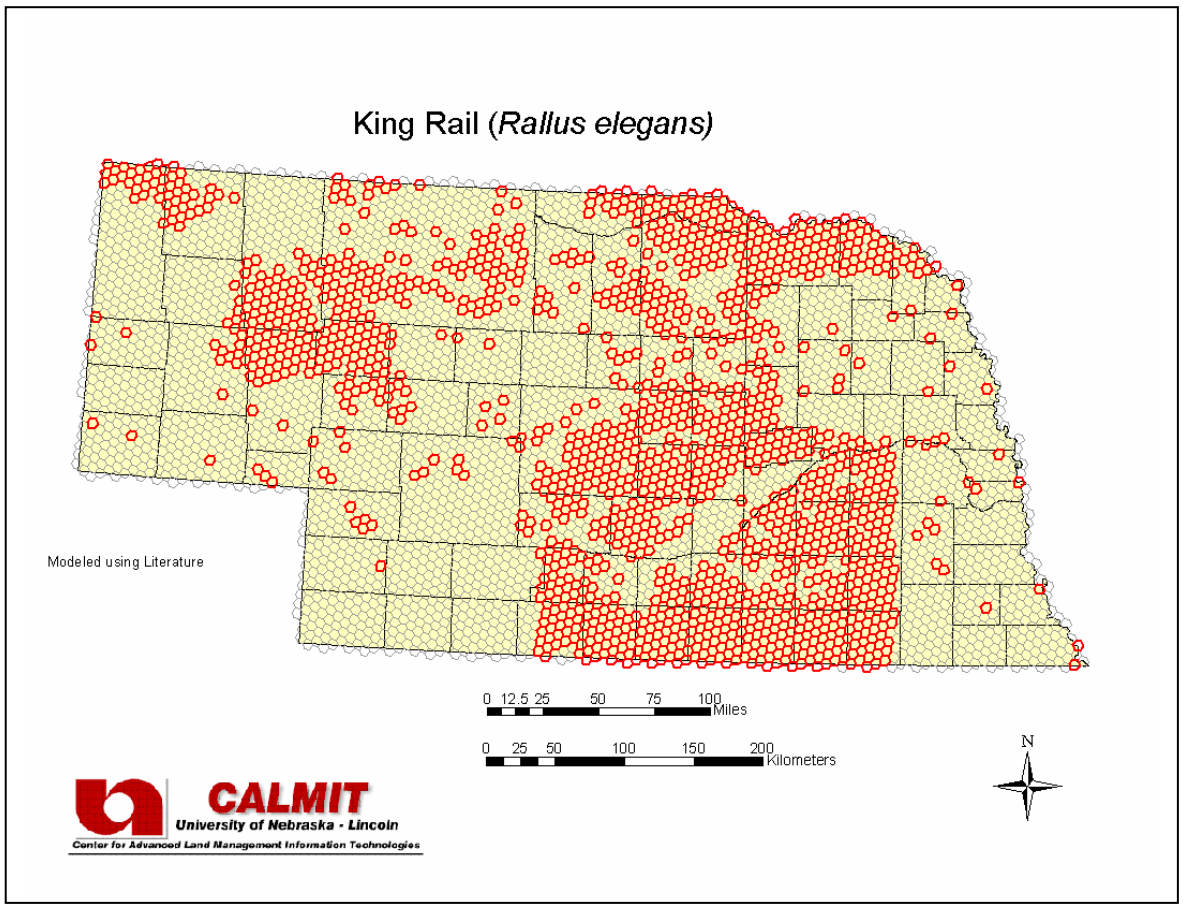
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**King Rail**	TNC Global Status:	G4G5
Scientific Name:	***Rallus elegans***	Federal Status:	--
TNC Element Code:	ABNME05020	State (NE) Status:	S1
AOU Code:	02080		

Habitat Description:
Associated with freshwater marshes with abundant shoreline and emergent vegetation (Johnsgard 1997), as well as fairly stable water levels during the breeding season (DeGraff and Rappole 1995). Bird of the marshes with relatively deep water, where it has a propensity for ditches and waterway edges (Sharpe et al. 2001). Rare casual breeder east, hypothetical elsewhere. Best locations are cattail marshes with interspersed grassy waterways or ditches.

Total Area of Modeled Habitat (ha): 6,321,166

Model Description:
No observational data were available for this species. Modeled from literature using the variable 'Land Cover class Aquatic Bed Wetland > 0.05%'.



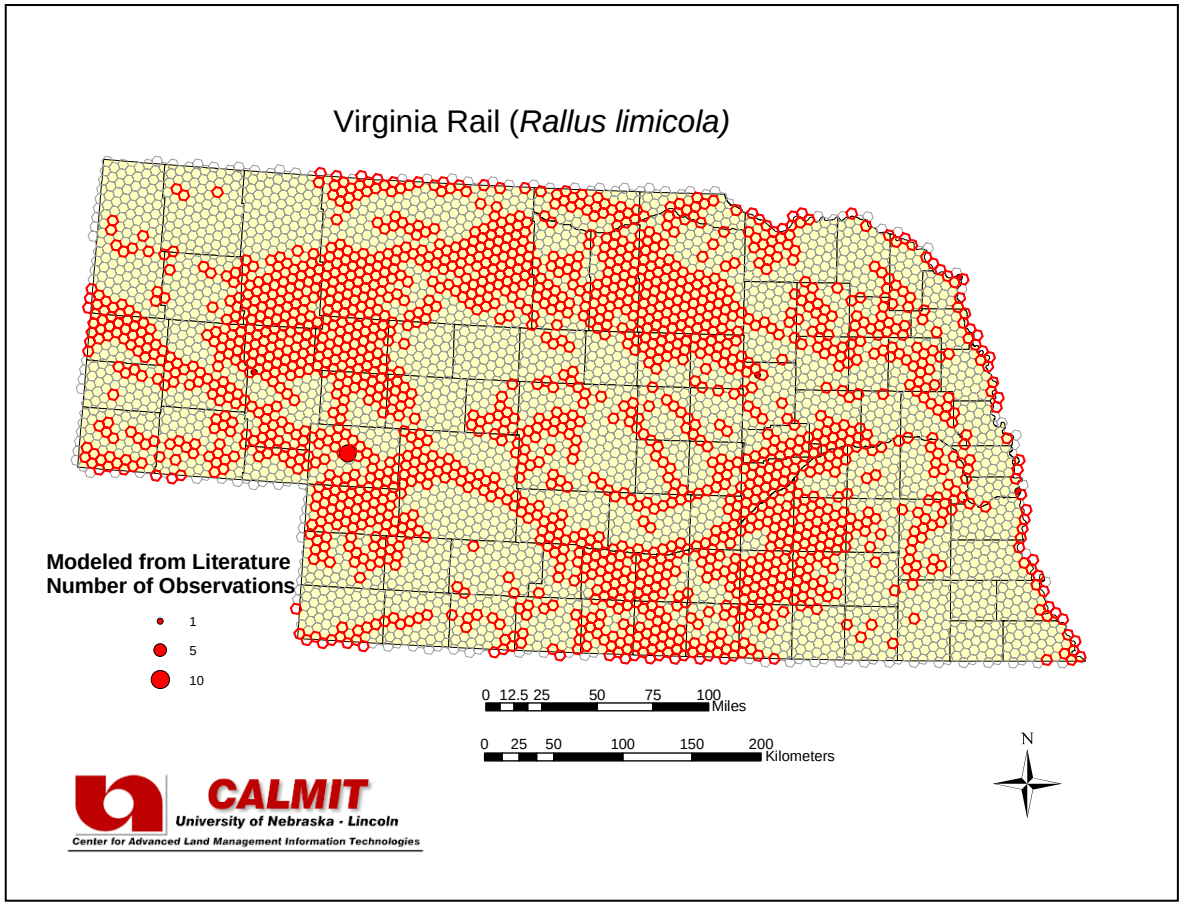
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Virginia Rail**	TNC Global Status:	G5
Scientific Name:	***Rallus limicola***	Federal Status:	--
TNC Element Code:	ABNME05030	State (NE) Status:	S4
AOU Code:	02120		

Habitat Description:
Species' primary habitat consists of marshes with extensive stands of emergent vegetation such as tallgrass, bulrushes, and sedges (Johnsgard 1997). Prefers areas with shallow water and abundant emergent vegetation (DeGraff and Rappole 1995), as well as mudflats (Sharpe et al. 2001). Probably breeds statewide, although lack of habitat limits occurrence in the east, southwest, and southern Panhandle to a few locations; breeding numbers are highest in the Sandhills

Total Area of Modeled Habitat (ha): 3,142,330

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Emergent Wetland > 0.5%'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



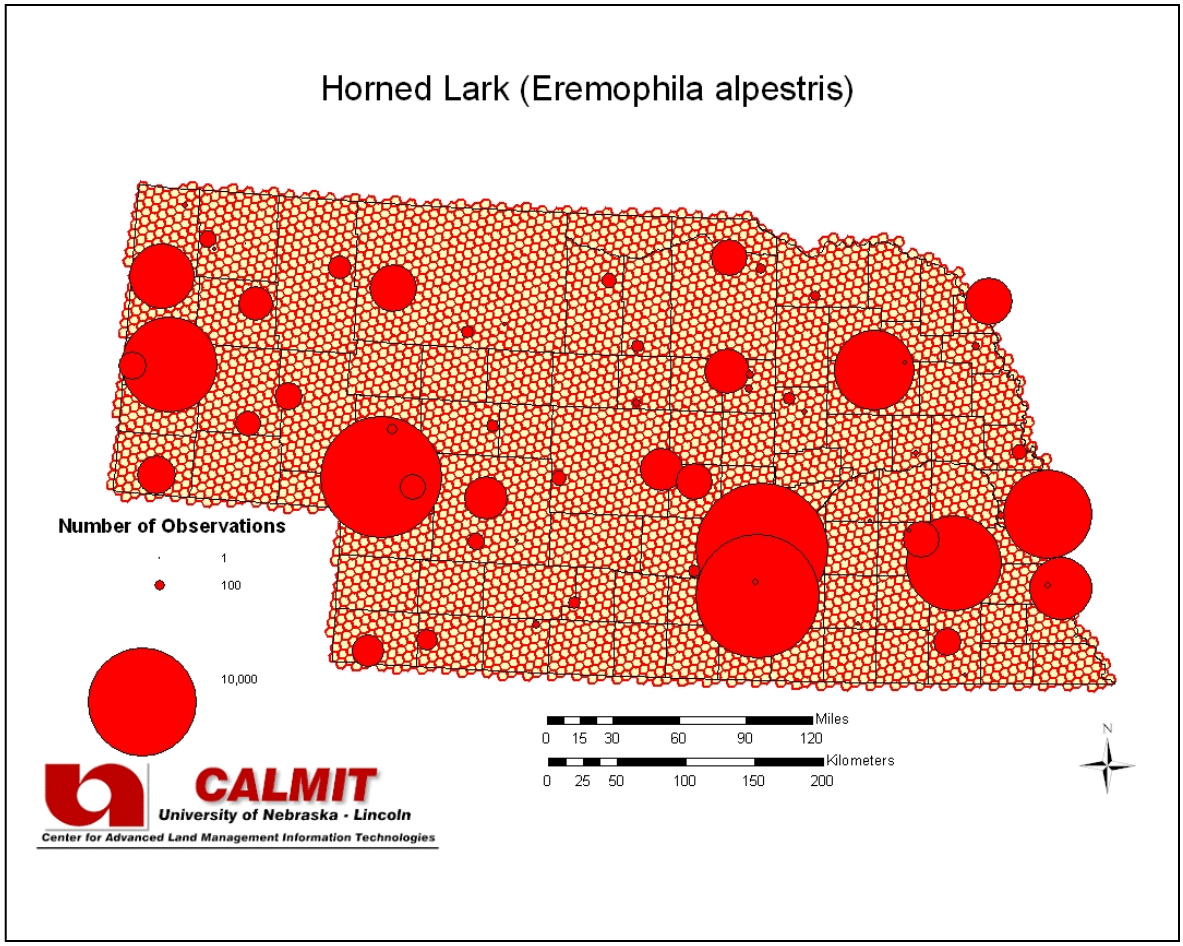
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Horned Lark**	TNC Global Status:	G5
Scientific Name:	***Eremophila alpestris***	Federal Status:	--
TNC Element Code:	ABPAT02010	State (NE) Status:	S5
AOU Code:	04740		

Habitat Description:
A variety of low-stature open habitats; the sparse grasslands of the Sandhills are probably a nearly optimum habitat (Johnsgard 1997). Reported most often in the grasslands and winter wheat country; nests on plowed fallow fields and stubble (Mollhoff 2001). Breeding birds occur statewide in open, sparsely vegetated areas, especially grasslands, where bare soil is present (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

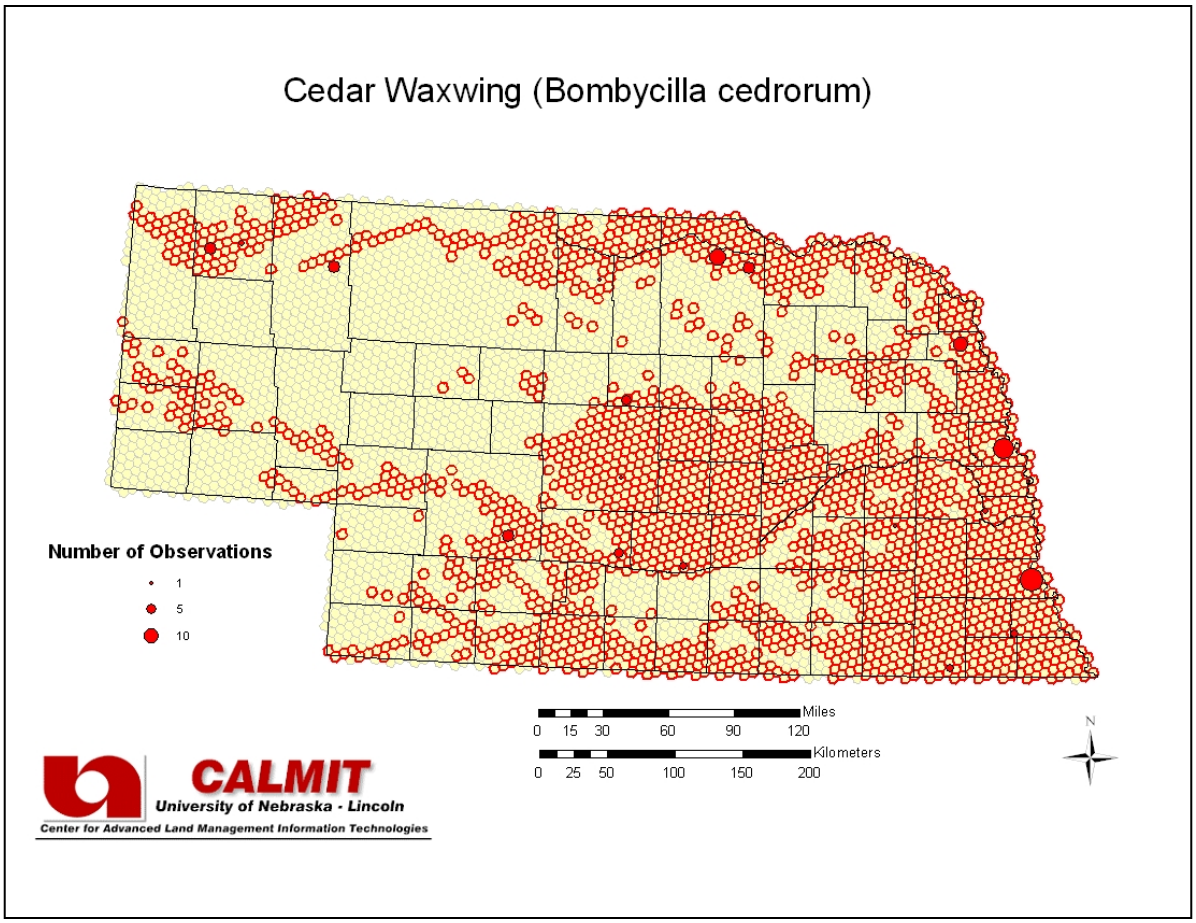
Common Name:	**Cedar Waxwing**	TNC Global Status:	G5
Scientific Name:	***Bombycilla cedrorum***	Federal Status:	--
TNC Element Code:	ABPBN01020	State (NE) Status:	S?N
AOU Code:	06190		

Habitat Description:
Breeding usually occurs in semi-open deciduous woodlands, including floodplain forests, upland woodlands, and sometimes parks, farmsteads or residential areas (Johnsgard 1997). Nesting birds prefer open deciduous woodlands, even in the Pine Ridge (Sharpe et al. 2001). Reported most often in the eastern half of the state, but may breed anywhere (Mollhoff 2001).

Total Area of Modeled Habitat (ha): 7,687,565

Model Description:
Modeled distribution using the set of variables 'Land Cover class Ponderosa Pine Forests and Woodlands > 1% ' OR 'Land Cover class Deciduous Forests and Woodlands > 1%'.

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

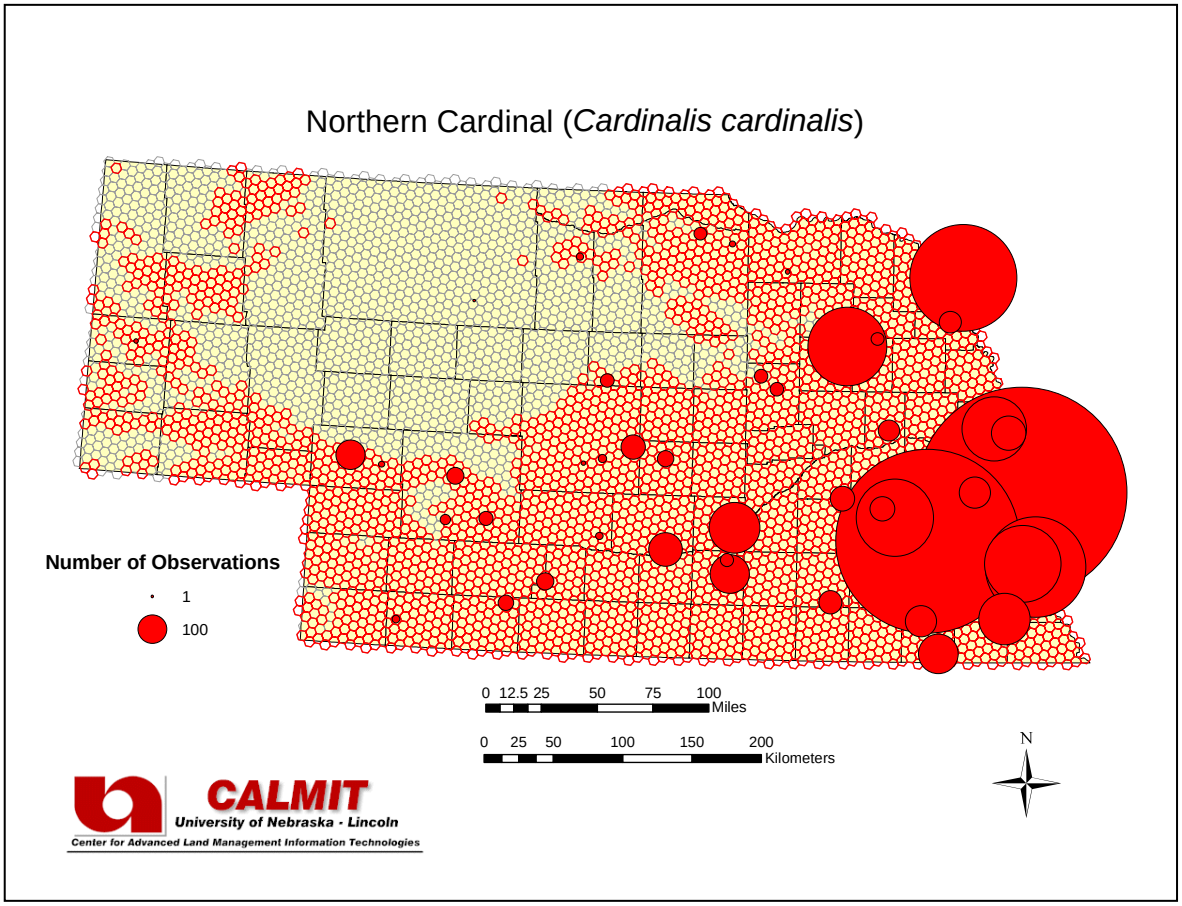
Common Name:	**Northern Cardinal**	TNC Global Status:	G5
Scientific Name:	***Cardinalis cardinalis***	Federal Status:	--
TNC Element Code:	ABPBX60010	State (NE) Status:	S5
AOU Code:	05930		

Habitat Description:
This species occurs in brushy habitats both in and at the edge of woodlands, parks and residential areas planted to shrubs and low trees, second-growth woods, and river-bottom gallery forests in grasslands. It is common in the southeastern two-thirds of the state and breeds west at least to Garden County along the North Platte River but is at best local in the Panhandle (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.35×10^7

Model Description:
Modeled distribution using the set of variables 'Land Cover class Western Wheatgrass Mixedgrass Prairie $\leq$ 0.05%' AND 'Land Cover class Sandhills Upland Prairie $\leq$ 5%' OR 'Land Cover class Western Wheatgrass Mixedgrass Prairie $\leq$ 0.05%' AND 'Land Cover class Sandhills Upland Prairie > 5%' AND 'Land Cover class Barren/Sand/Outcrop $\leq$ 0.45%' AND 'Land Cover class Sandhills Upland Prairie $\leq$ 36.5%'

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



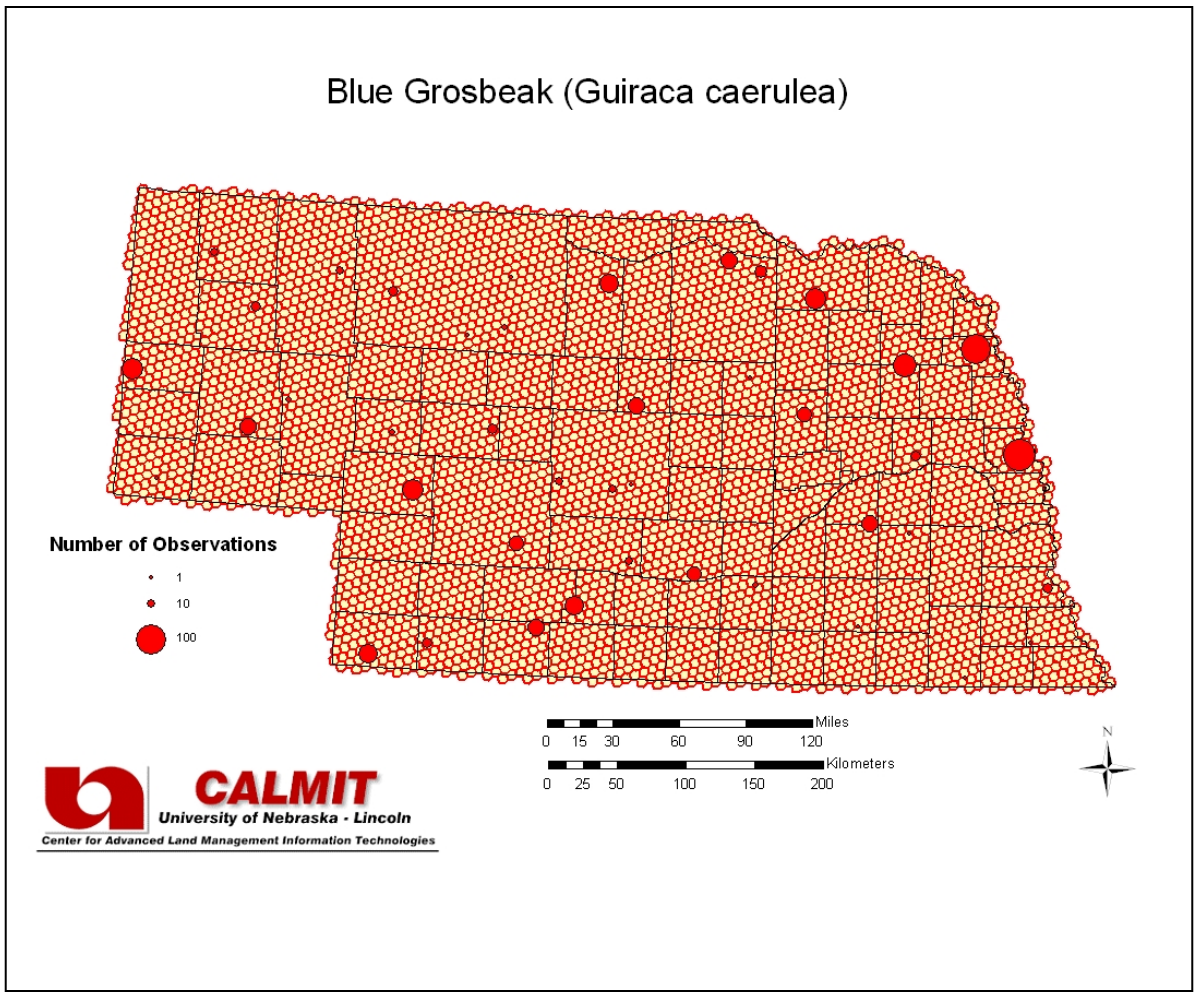
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Blue Grosbeak**	TNC Global Status:	G5
Scientific Name:	***Guiraca caerulea***	Federal Status:	--
TNC Element Code:	ABPBX63010	State (NE) Status:	S5
AOU Code:	05970		

Habitat Description:
Prefers weedy pastures, old fields with scattered saplings, forest edges, streamside thickets, and hedgerows (Johnsgard 1997). Found in open grassy habitat with a sprinkling of trees and brush, and in open, weedy areas adjacent to riparian woods or farmstead windbreaks (Mollhoff 2001). Open country species that utilizes isolated islands of brushy habitat in both riparian and upland locations (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

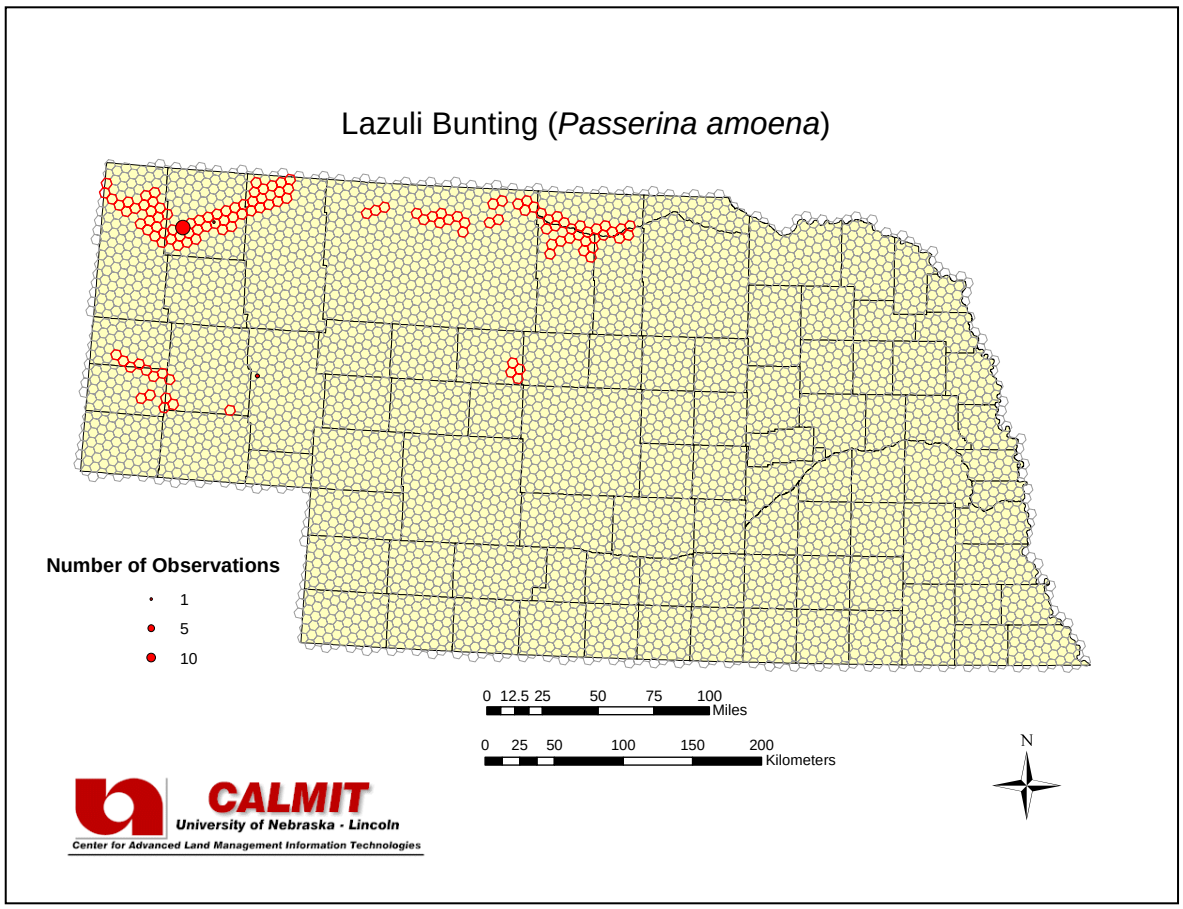
Common Name:	**Lazuli Bunting**	TNC Global Status:	G5
Scientific Name:	***Passerina amoena***	Federal Status:	--
TNC Element Code:	ABPBX64020	State (NE) Status:	S4
AOU Code:	05990		

Habitat Description:
This species occupies woodland edge and open woodland habitats providing successional habitats with a diversity of shrubs, low trees and herbaceous vegetation, as well as riparian areas. Most common in the northern Panhandle and along the Niobrara River east to the Niobrara Valley Preserve. This species hybridizes with Indigo bunting where their summer ranges meet towards eastern Nebraska (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 506,831

Model Description:
Modeled distribution using the variable 'Land Cover class Ponderosa Pine Forests and Woodlands > 5%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

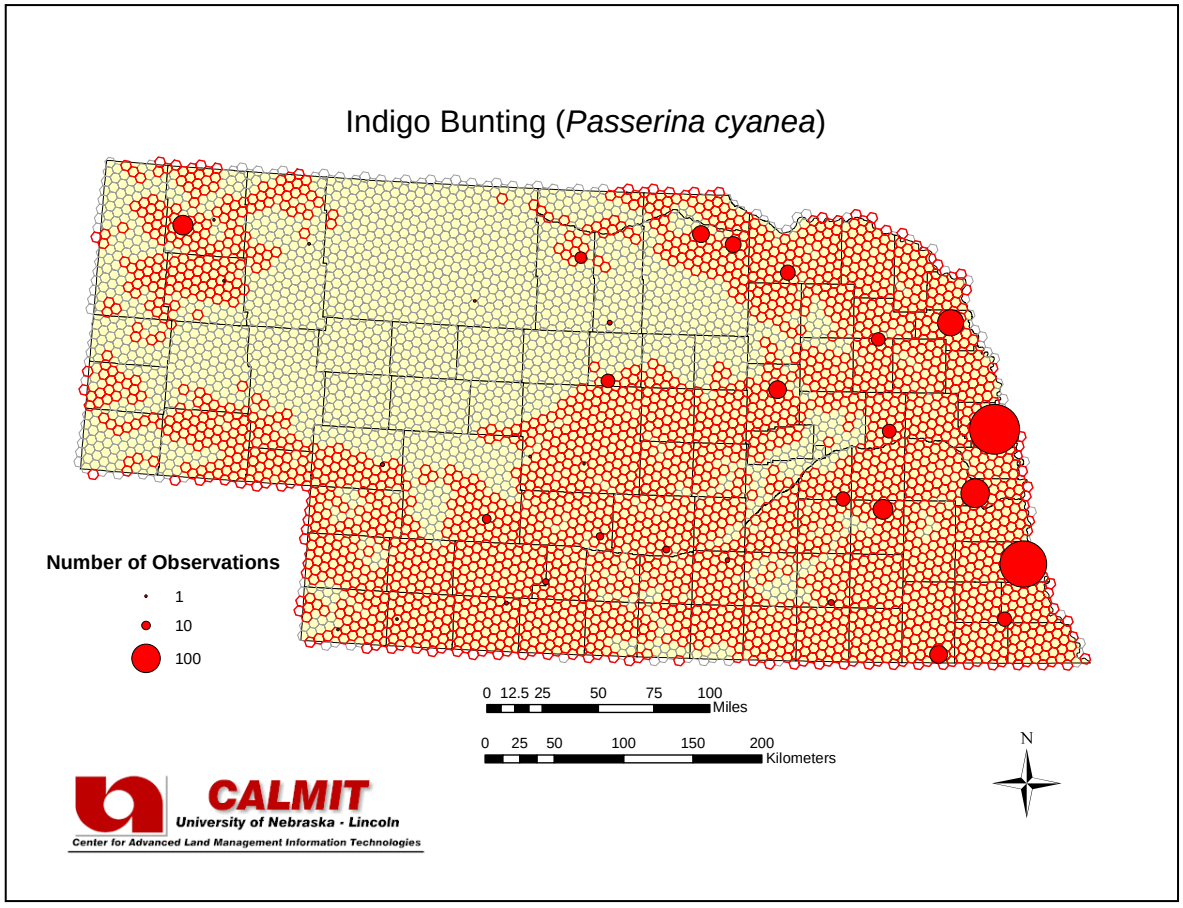
Common Name:	**Indigo Bunting**	TNC Global Status:	G5
Scientific Name:	***Passerina cyanea***	Federal Status:	--
TNC Element Code:	ABPBX64030	State (NE) Status:	S4
AOU Code:	05980		

Habitat Description:
Breeding habitat includes relatively open forests on floodplains or uplands. This species prefers woodland edge where shrub density is high and the forest canopy is open, thus it is often associated with second-growth and disturbed habitats. Indigo bunting breeds statewide, but numbers decline significantly away from the Missouri and Lower Niobrara Valleys (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001). This species hybridizes with Lazuli bunting where their summer ranges meet towards western Nebraska.

Total Area of Modeled Habitat (ha): 1.13×10^7

Model Description:
Modeled distribution using the set of variables 'Land Cover class Emergent Wetland $\leq$ 1.5%' AND 'Land Cover class Barren/Sand/Outcrop $\leq$ 0.5%' AND 'Land Cover class Sandhills Upland Prairie $\leq$ 30%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

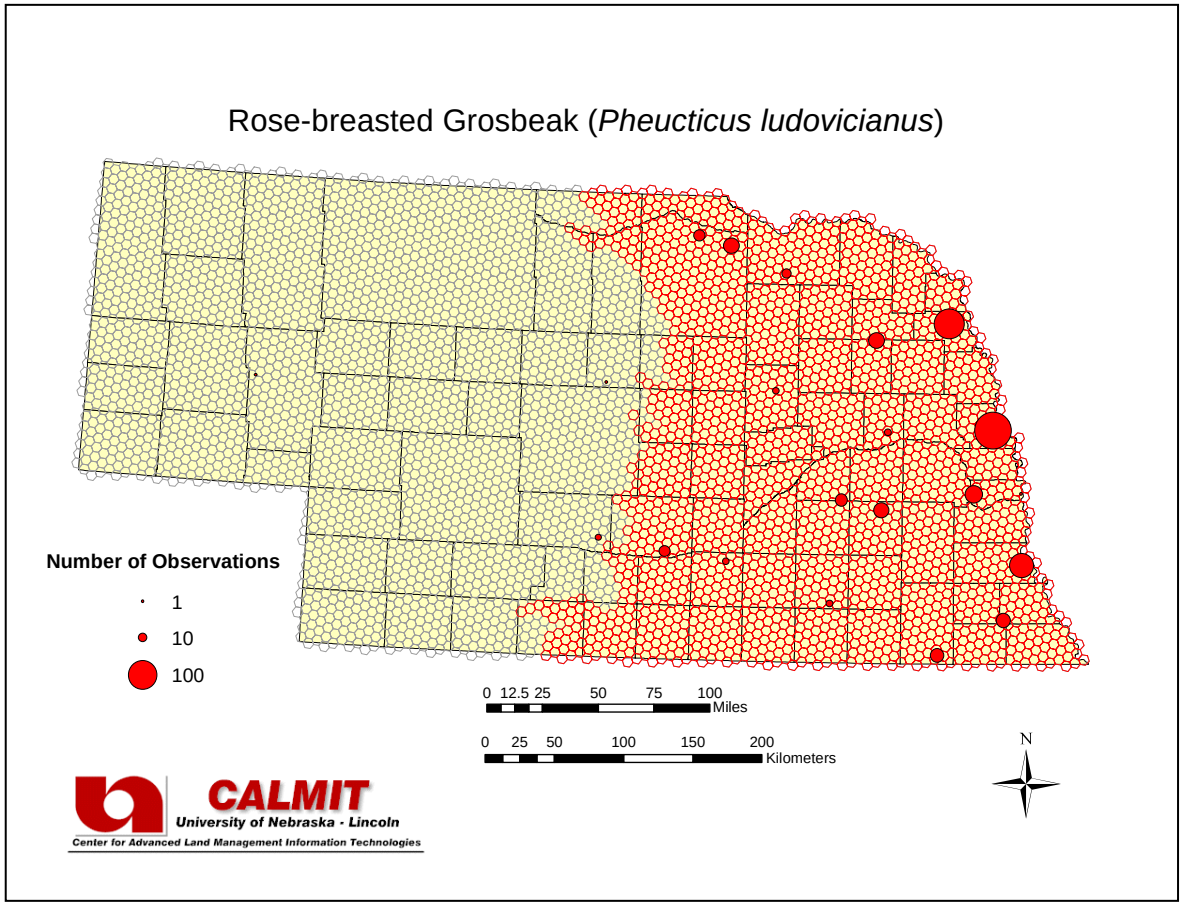
Common Name:	**Rose-breasted Grosbeak**	TNC Global Status:	G5
Scientific Name:	***Pheucticus ludovicianus***	Federal Status:	--
TNC Element Code:	ABPBX61030	State (NE) Status:	S4
AOU Code:	05950		

Habitat Description:
It breeds west to Holt, Garfield, and Phelps counties. Breeding habitat for this species occurs in open deciduous woodlands, both riparian and upland, on floodplains, slopes, and bluffs with a well-developed understory (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 9,220,200

Model Description:
Modeled distribution using the variable 'Elevation ≤ 700 m'.

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

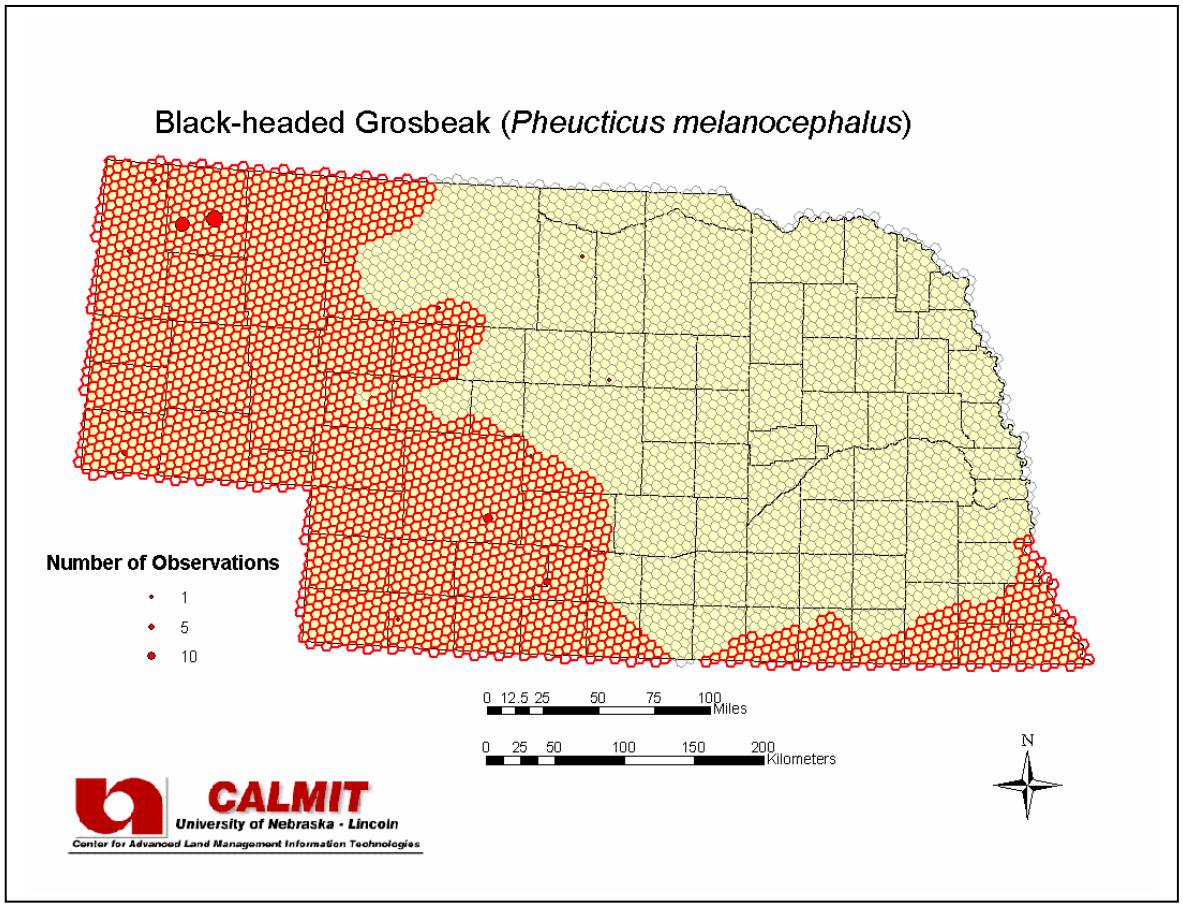
Common Name:	**Black-headed Grosbeak**	TNC Global Status:	G5
Scientific Name:	***Pheucticus melanocephalus***	Federal Status:	--
TNC Element Code:	ABPBX61040	State (NE) Status:	S5
AOU Code:	05960		

Habitat Description:
Occupies relatively open stands of deciduous forest in floodplains or uplands, especially those with well-developed understories; also occurs in orchards, brushy woodlands and urban parks with many trees (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 9,483,749

Model Description:
Modeled distribution using the variable 'Average 30-year Maximum Temperature Coefficient of Variation for March $\leq$ 11.6%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



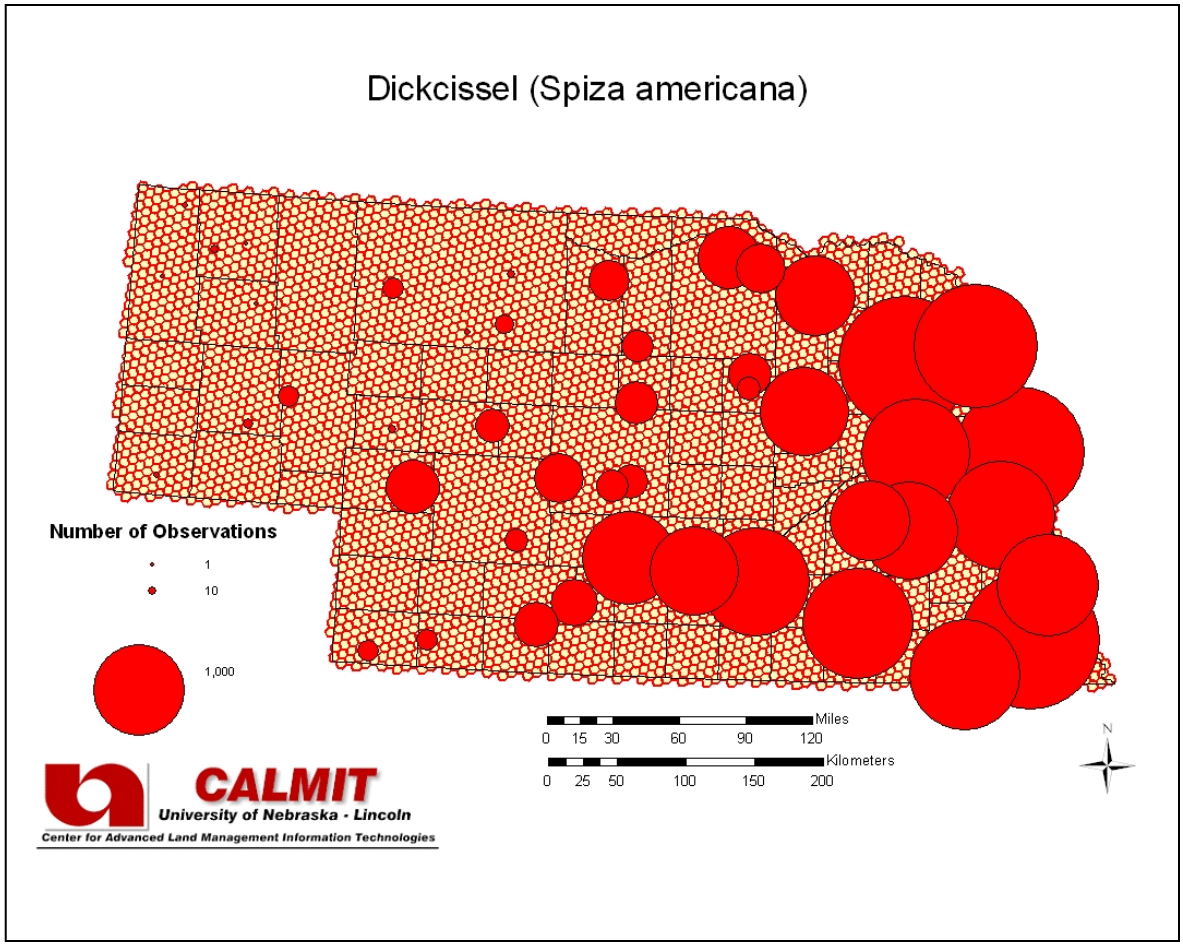
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Dickcissel**	TNC Global Status:	G5
Scientific Name:	***Spiza americana***	Federal Status:	--
TNC Element Code:	ABPBX65010	State (NE) Status:	S5
AOU Code:	06040		

Habitat Description:
Associated with grasslands having a combination of tall grasses, forbs and shrubs, and with various croplands, especially alfalfa, clover, and timothy (Johnsgard 1997). Typical species of agricultural cropland; in the west found associated with alfalfa fields (Mollhoff 2001). Found in midgrass and tallgrass prairies, cultivated fields and old fields and prairies invaded by mixed shrubs (Sharpe et al. 2001). Abundant in the southeast and becoming less numerous westward; absent in the Sandhills, except along roadsides with well-developed fenceline vegetation; rare in the Panhandle.

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



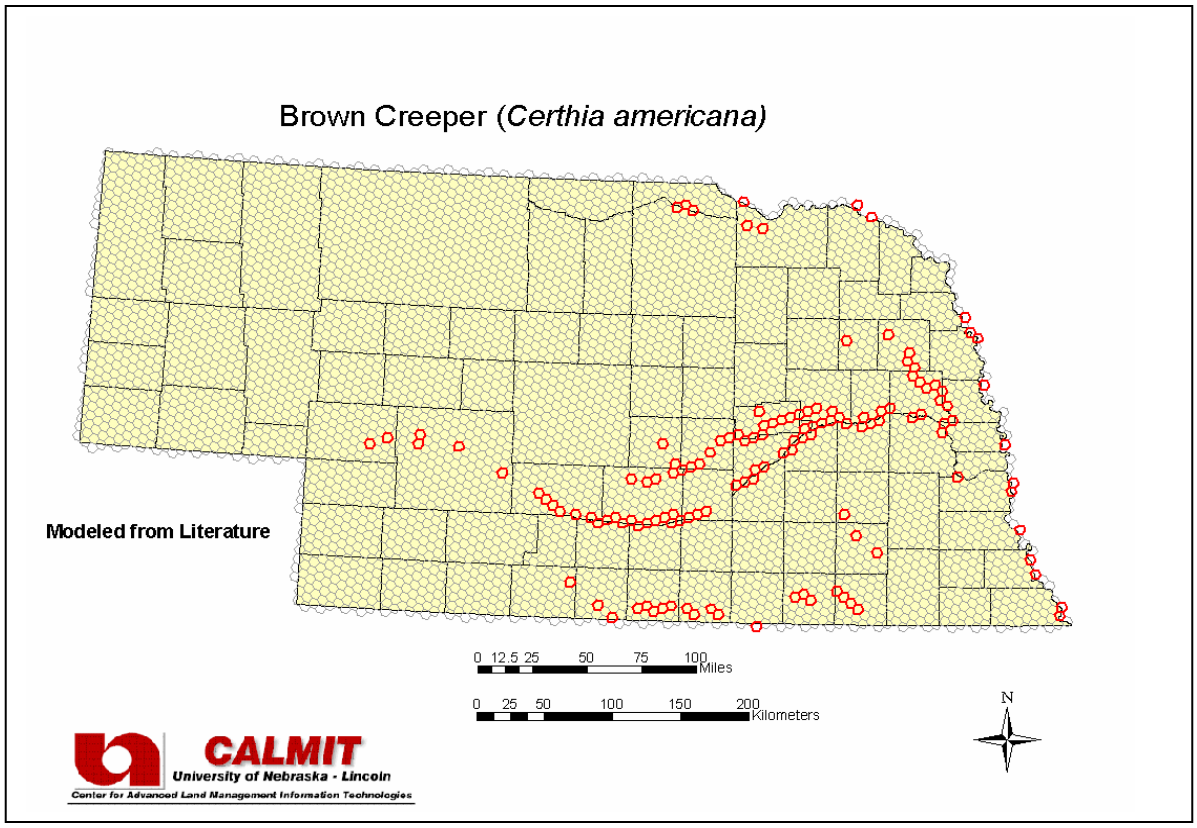
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Brown Creeper**	TNC Global Status:	G5
Scientific Name:	***Certhia americana***	Federal Status:	--
TNC Element Code:	ABPBA01010	State (NE) Status:	S3
AOU Code:	07260		

Habitat Description:
Breeding habitat is described as mature deciduous or coniferous forests (Johnsgard 1997, Versaw 1998). Two races are found in NE – eastern subspecies breeds in the Missouri Valley, Rocky Mountain race presumably breeds in the Pine Ridge (Sharpe et al. 2001). It is unknown which race breeds in the Niobrara Valley. In the Missouri Valley, it occupies swampy woodland with dead elms. Breeding has only been confirmed in Brown and Sarpy Counties, with some evidence of additional breeding in the Missouri and Platte Valley (Adams, Polk, Hamilton, Howard-Hall Counties). Reports suggest a small breeding population in the central Platte Valley, where mature floodplain forest exists. Some contradiction of North American distribution exists. Contrary to documented reports from Nebraska, information from the Ranges of North American Breeding Birds/USGS Northern Prairie Science Center (Price 1995) and the North American Breeding Bird Survey Results and Analysis, 1966-2000 (Sauer et al. 2001) indicates that this species does not breed in Nebraska.

Total Area of Modeled Habitat (ha): 547,373

Model Description:
No observational data were available for this species. Modeled from literature using the variable 'Land Cover class Riparian Woodland > 2%', and then clipped to limit distribution to areas of state where breeding reports have been confirmed (Sharpe et al. 2001).



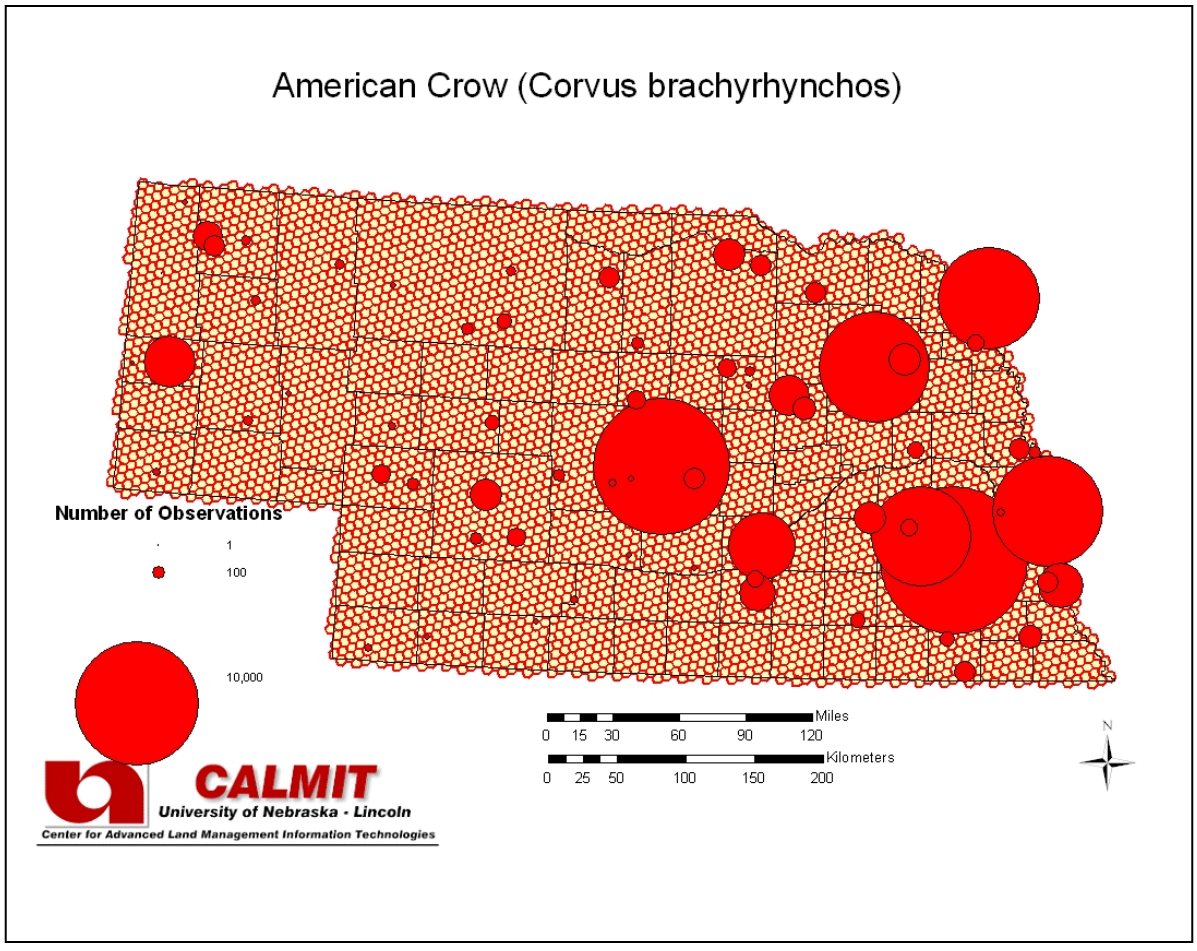
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**American Crow**	TNC Global Status:	G5
Scientific Name:	***Corvus brachyrhynchos***	Federal Status:	--
TNC Element Code:	ABPAV10010	State (NE) Status:	S5
AOU Code:	04880		

Habitat Description:
Species occurs in a wide variety of habitats, ranging from forests and wooded river bottoms, to suburban areas, orchards and parks (Johnsgard 1997). The species seems to adapt readily to any place where a few trees can be found to hold a nest (Mollhoff 2001). In the breeding season, data indicate that birds are most numerous in the east, with smaller numbers distributed rather evenly throughout the rest of the state (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



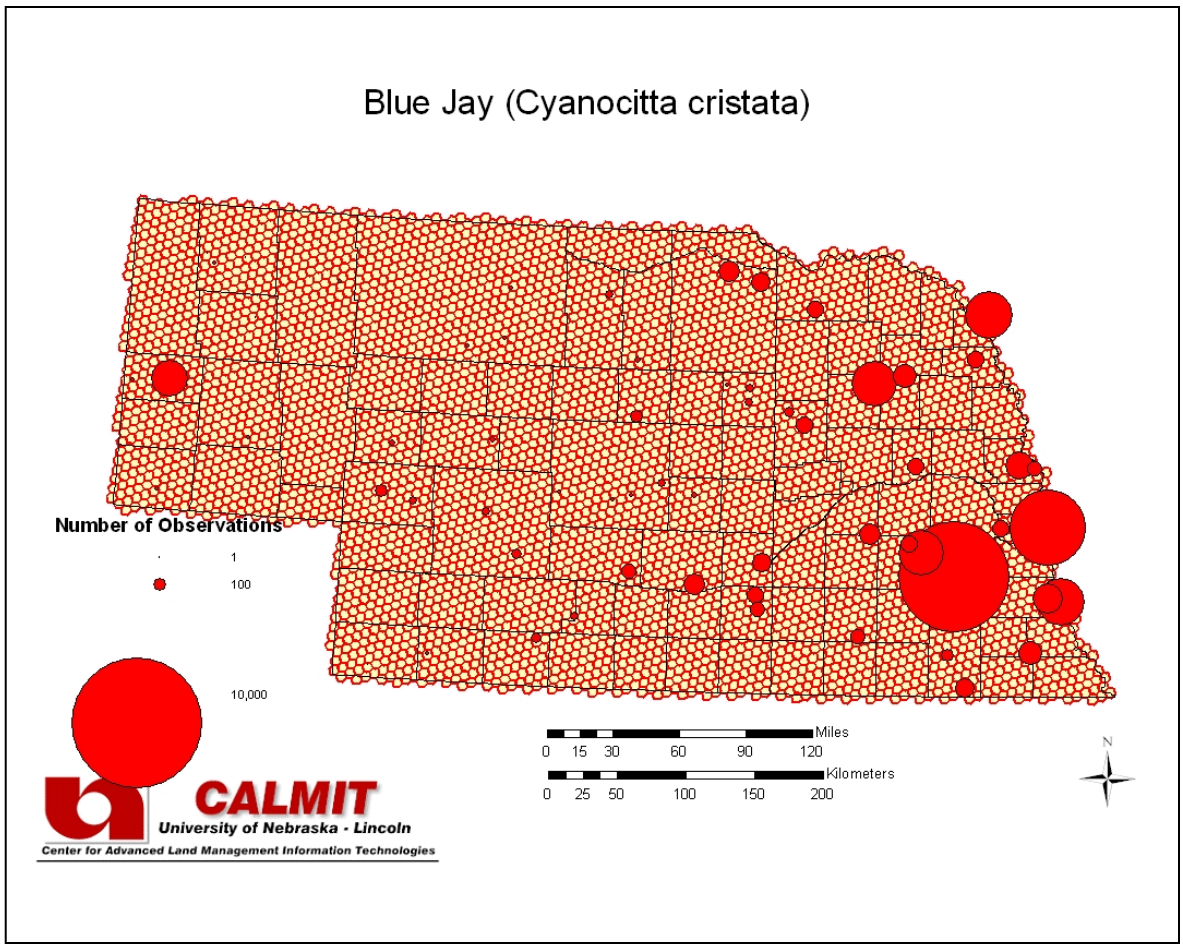
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Blue Jay**	TNC Global Status:	G5
Scientific Name:	***Cyanocitta cristata***	Federal Status:	--
TNC Element Code:	ABPAV02020	State (NE) Status:	S5
AOU Code:	04770		

Habitat Description:
Widely distributed in forests, parks, suburbs, cities, and almost anywhere a combination of trees and grasslands occurs (Johnsgard 1997). Blue Jay is primarily a species of the woodland and woodland edge habitat, being found regularly in most wooded situations on the state; equally at home in oak forest, pine forest, riparian woodland, parks and residential areas (Mollhoff 2001). Breeds statewide, but is least numerous in the Panhandle; requires trees, but apparently avoids coniferous woodland: occur in cities and towns as well as open areas (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

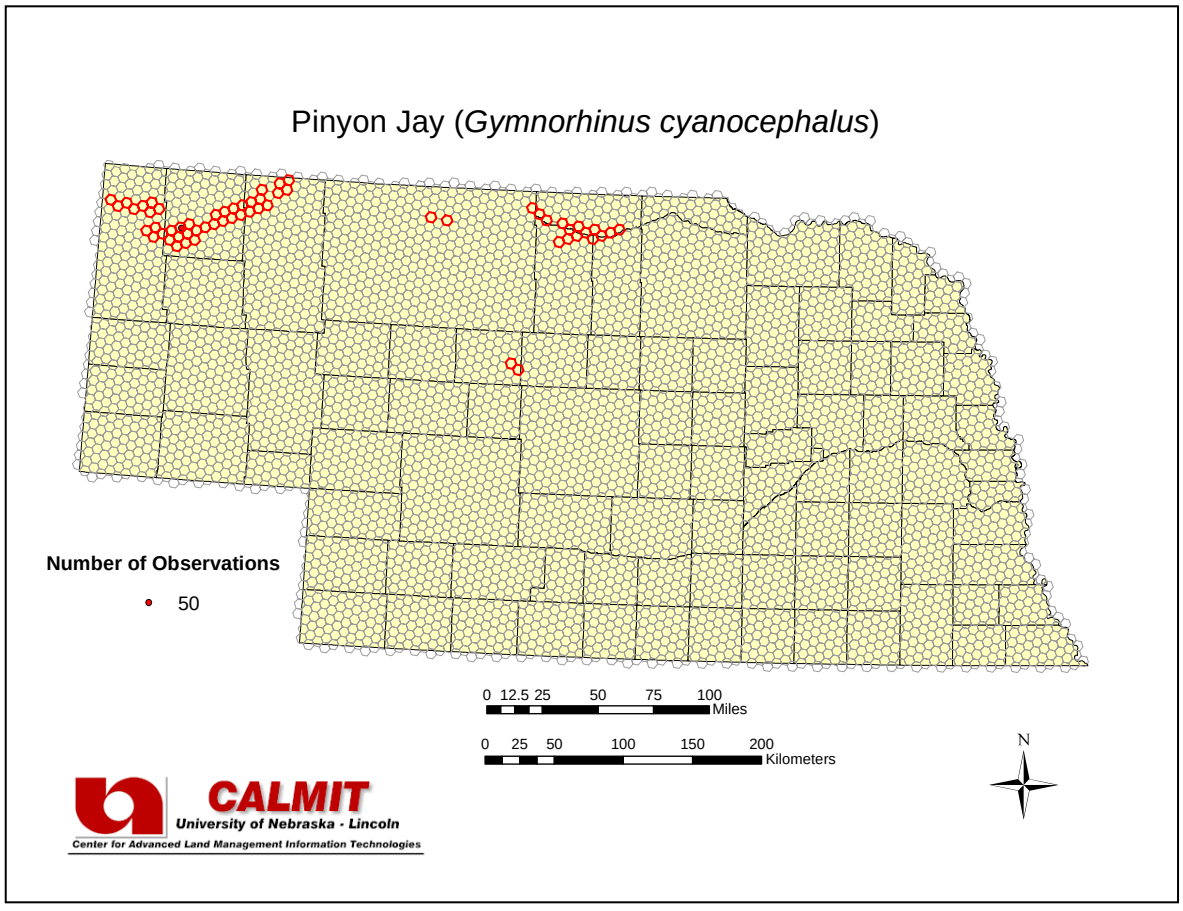
Common Name:	**Pinyon Jay**	TNC Global Status:	G5
Scientific Name:	***Gymnorhinus cyanocephalus***	Federal Status:	--
TNC Element Code:	ABPAV07010	State (NE) Status:	S3
AOU Code:	04920		

Habitat Description:
During the summer this species is found singly or in small groups in open ponderosa pine woodland in the Pine Ridge and similar habitat in Scotts Bluff county or the Wildcat Hills (Mollhoff 2001, Sharpe et al. 2001). Their habitat includes pine forests where the soil is fairly dry and the trees are small and scattered (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 243,281

Model Description:
Modeled distribution using the variable 'Land Cover class Ponderosa Pine Forests and Woodlands $\leq$ 15%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

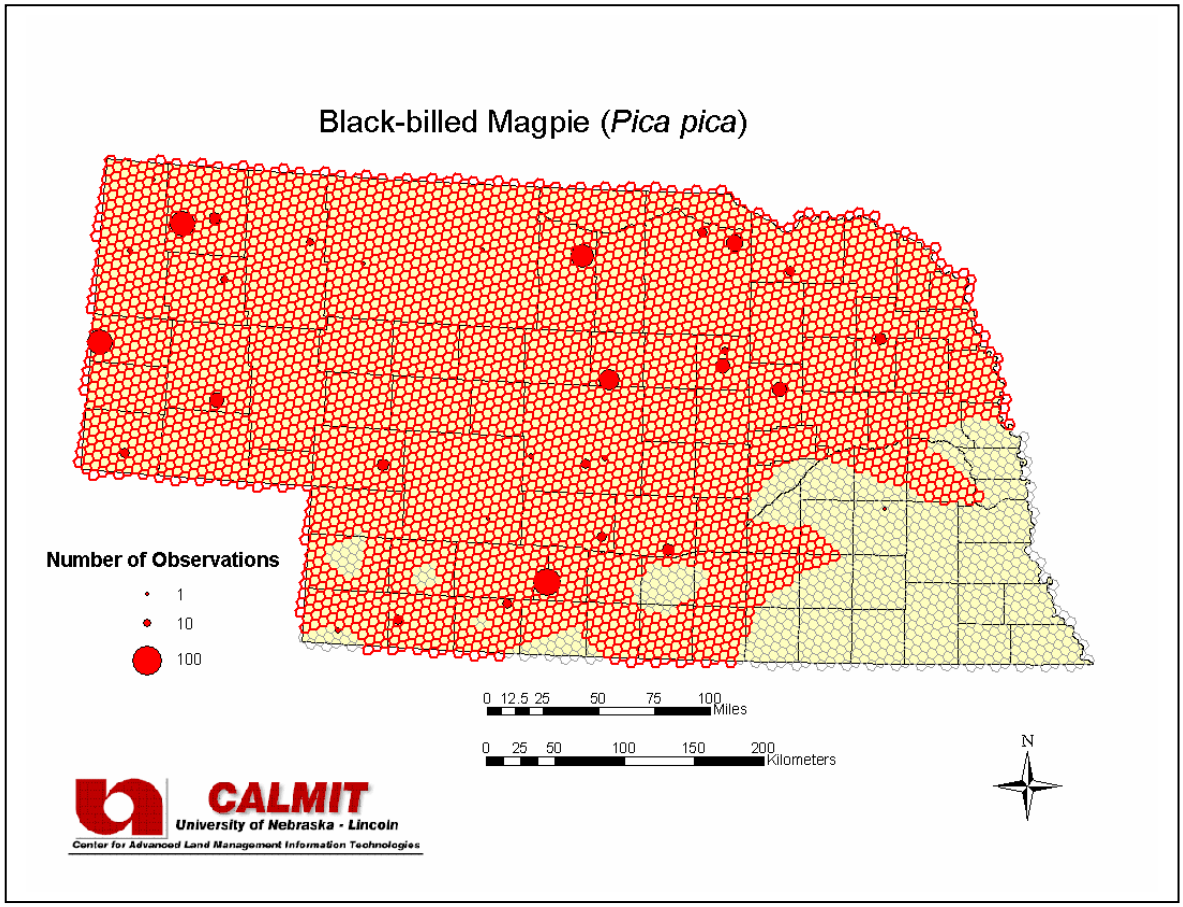
Common Name:	**Black-billed Magpie**	TNC Global Status:	G5
Scientific Name:	***Pica pica***	Federal Status:	--
TNC Element Code:	ABPAV09010	State (NE) Status:	S4
AOU Code:	04750		

Habitat Description:
Species normally frequents wooded canyons and riverbottom forests and forest edges; ranges out into more arid environments into thickets of shrubs or small trees for nesting (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 1.71×10^7

Model Description:
Modeled distribution using the variable 'Average 30-year Minimum Temperature for December $\leq$ -9.5ºC'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

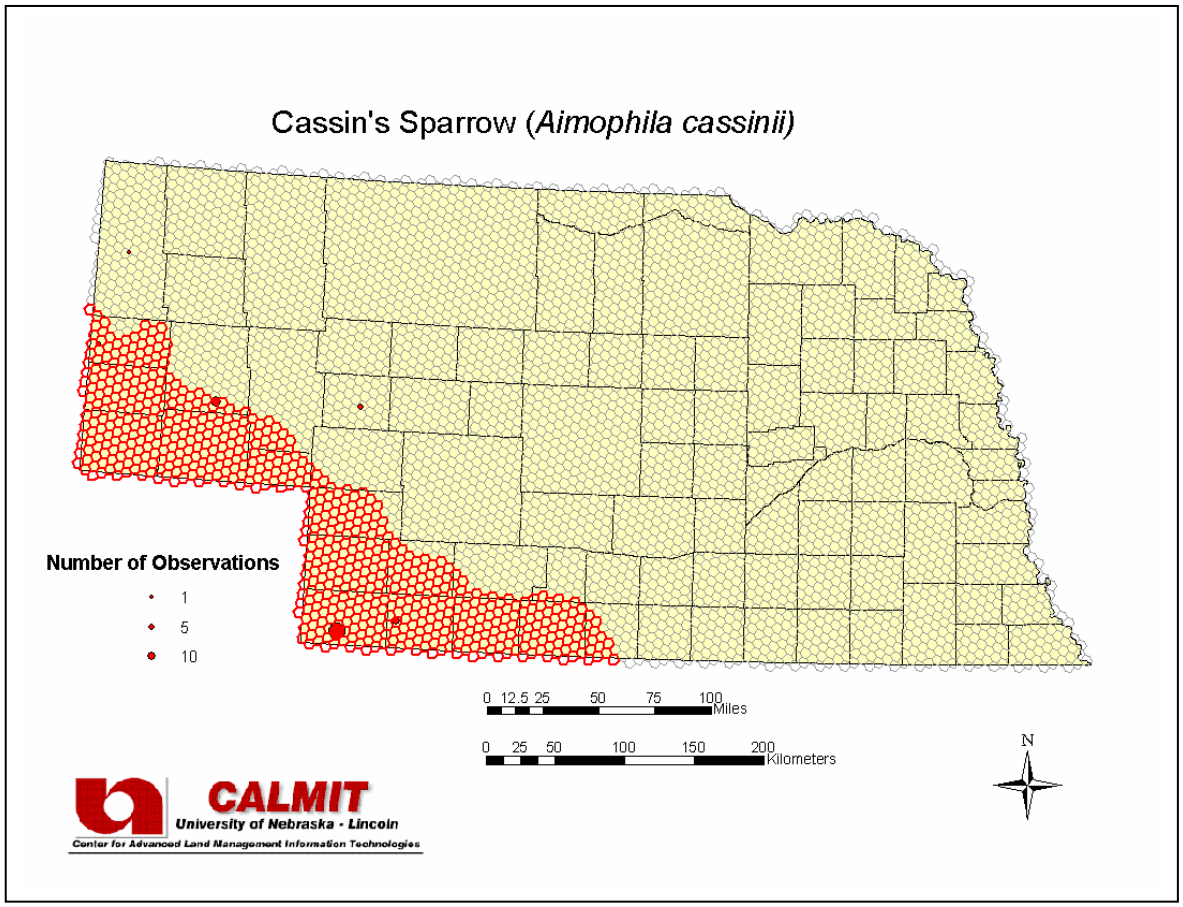
Common Name:	**Cassin's Sparrow**	TNC Global Status:	G5
Scientific Name:	***Aimophila cassinii***	Federal Status:	--
TNC Element Code:	ABPBX91070	State (NE) Status:	S4
AOU Code:	05780		

Habitat Description:
A grassland species that also requires some shrubs (Sharpe et al. 2001). Most Nebraska records are from grasslands containing good stands of sandsage, primarily in the southwest and southern Panhandle.

Total Area of Modeled Habitat (ha): 2,789,569

Model Description:
Modeled distribution using the variable 'April Growing Degree Days Weighted Average Coefficient of Variation $\leq$ 17.5%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



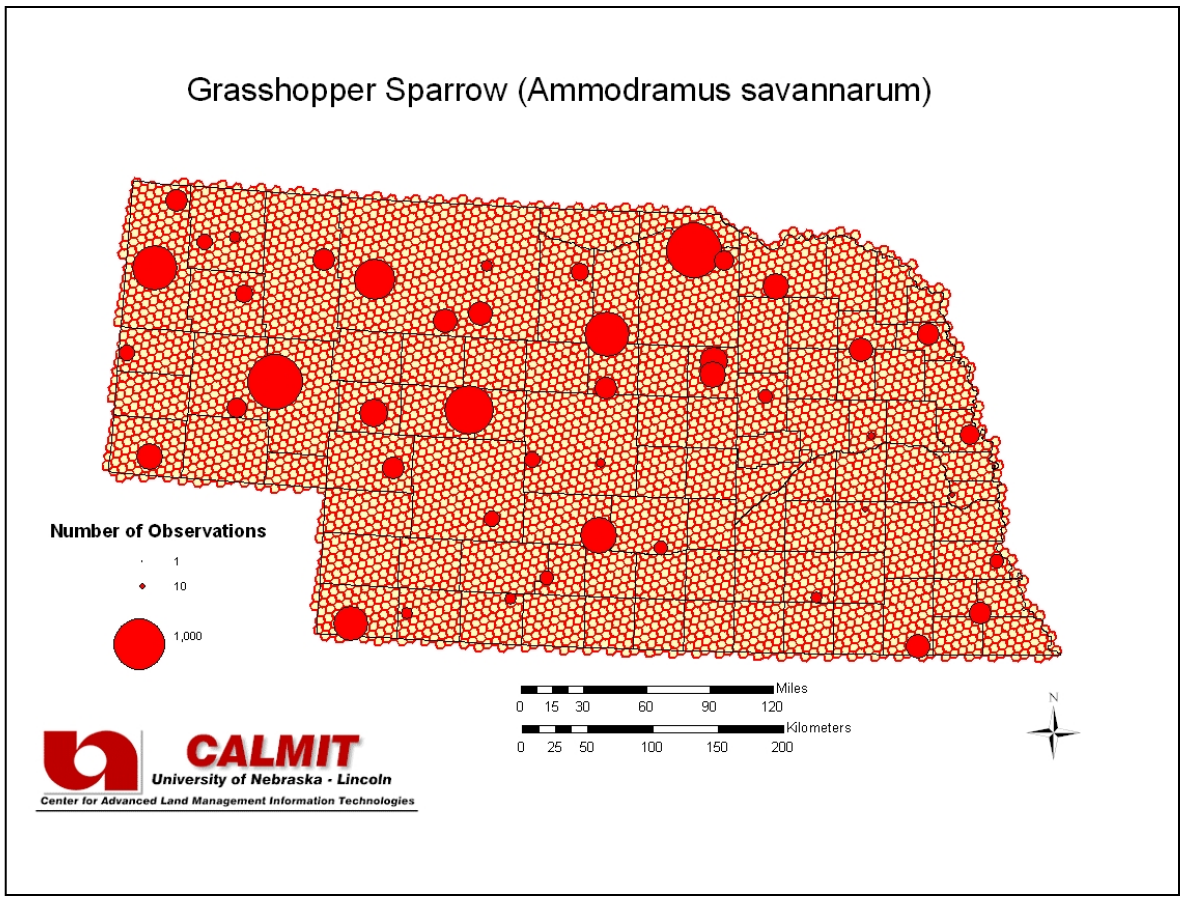
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Grasshopper Sparrow**	TNC Global Status:	G5
Scientific Name:	***Ammodramus savannarum***	Federal Status:	--
TNC Element Code:	ABPBXA0020	State (NE) Status:	S4
AOU Code:	05460		

Habitat Description:
Occur in mixed-grass prairies, pasturelands, shortgrass prairies, sage prairies and to a limited extent, tall-grass prairies (Johnsgard 1997). Species breeds throughout the state, but is most numerous in native shortgrass and mixed or Sandhills prairie, and least numerous in the east and south, where cropping has severely reduced habitat (Mollhoff 2001, Sharpe et al. 2001). Most numerous in the north and west, where native grasslands are extensive. Further east, it is found n native grass pastures and roadsides, and occasionally in introduced grasses, such as smooth brome (Mollhoff 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



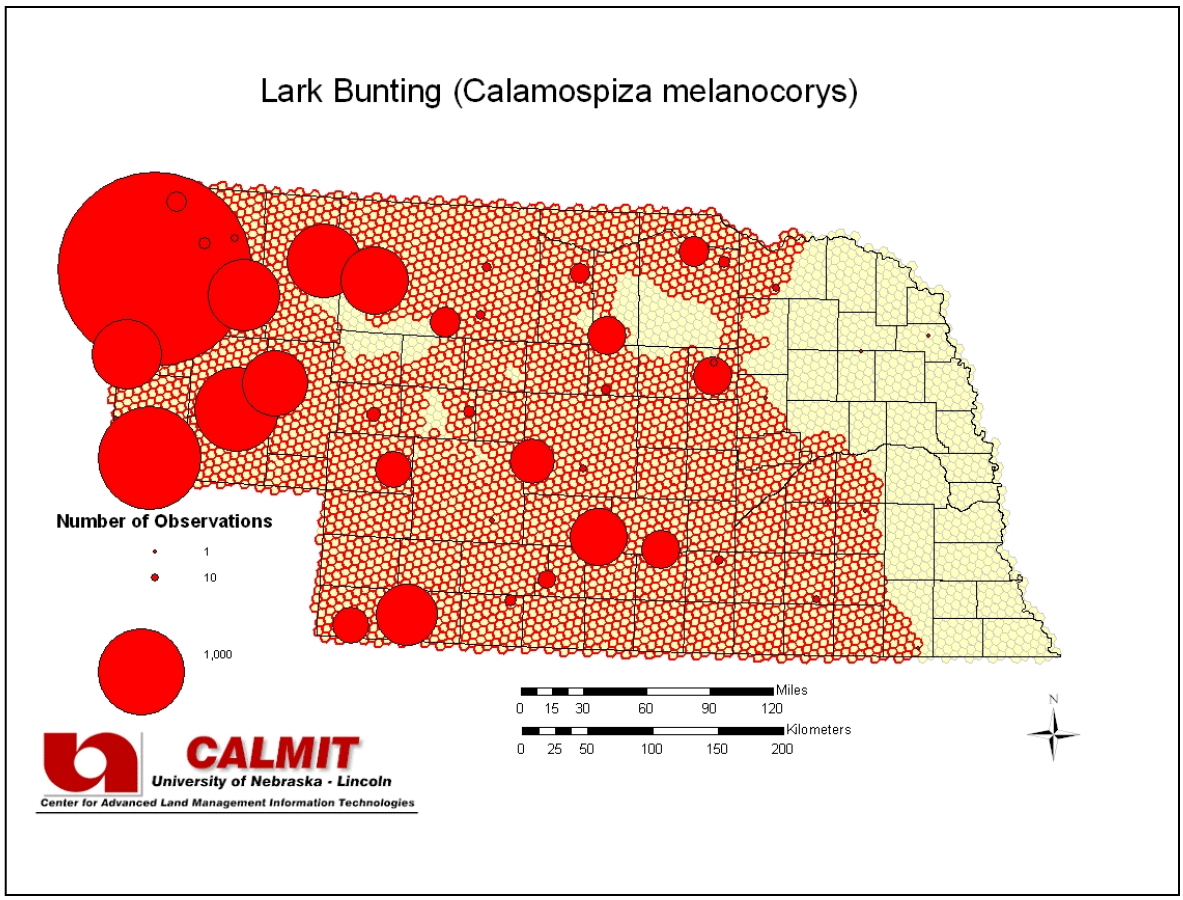
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Lark Bunting**	TNC Global Status:	G5
Scientific Name:	***Calamospiza melanocorys***	Federal Status:	--
TNC Element Code:	ABPBX98010	State (NE) Status:	S5
AOU Code:	06050		

Habitat Description:
Found in mixed shortgrass prairie and sage-dominated areas, but also occurs in areas of taller grasses with scattered shrubs and along weedy roadsides, in retired croplands, and in fields of alfalfa or clover (Johnsgard 1997). A common summer resident in western and central Nebraska, with sporadic breeding farther east. In Nebraska, breeding birds are found primarily in the western two-thirds of the state in shortgrass prairie and becomes rare as one moves east into tallgrass prairie and row-crop agriculture (Mollhoff 2001). The current eastern limit of the breeding range corresponds approximately with the eastern edge of the midgrass prairie region (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.57×10^7

Model Description:
Adequate model could not be resolved using QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the set of variables 'Land Cover class Little Bluestem-Gramma Mixedgrass Prairie > 0.5%' OR 'Land Cover class Western Shortgrass Prairie > 0.5%'. Distribution was supported by Breeding Bird Survey observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

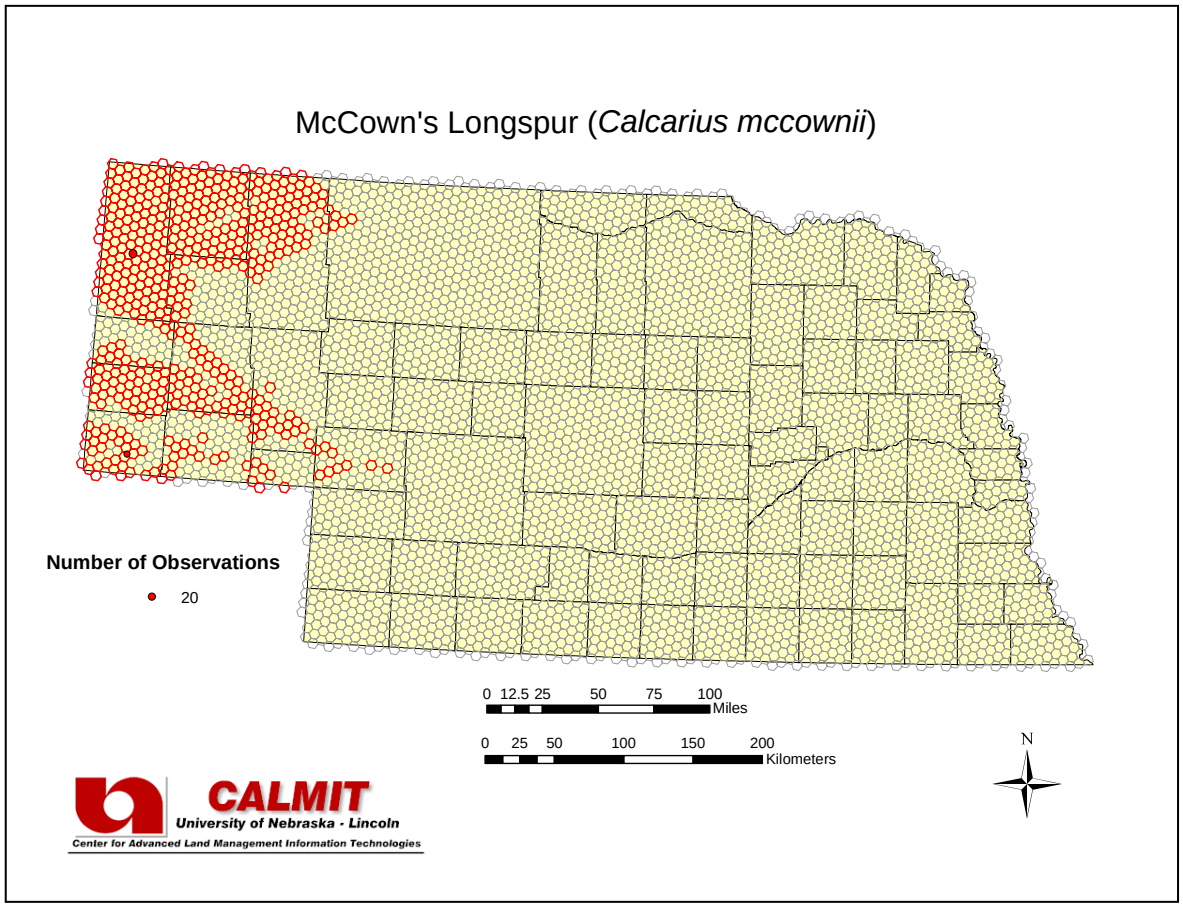
Common Name:	**McCown's Longspur**	TNC Global Status:	G5
Scientific Name:	***Calcarius mccownii***	Federal Status:	--
TNC Element Code:	ABPBXA6010	State (NE) Status:	S3
AOU Code:	05390		

Habitat Description:
Breeding birds are fairly common in the western Panhandle wherever the preferred habitat of grazed shortgrass prairie with significant bare patches is found, as well as stubble fields and newly sprouted grain fields. Most such sites are at a higher altitude than surrounding grasslands. Grazed shortgrass prairie is most extensive in Sioux county and breeding numbers are highest in this area. Breeding also occurs in western Scotts Bluff, Banner, and Kimball counties where suitable habitat exists (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 2,055,685

Model Description:
Modeled distribution using the variable 'Land Cover class Western Shortgrass Prairie > 40%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

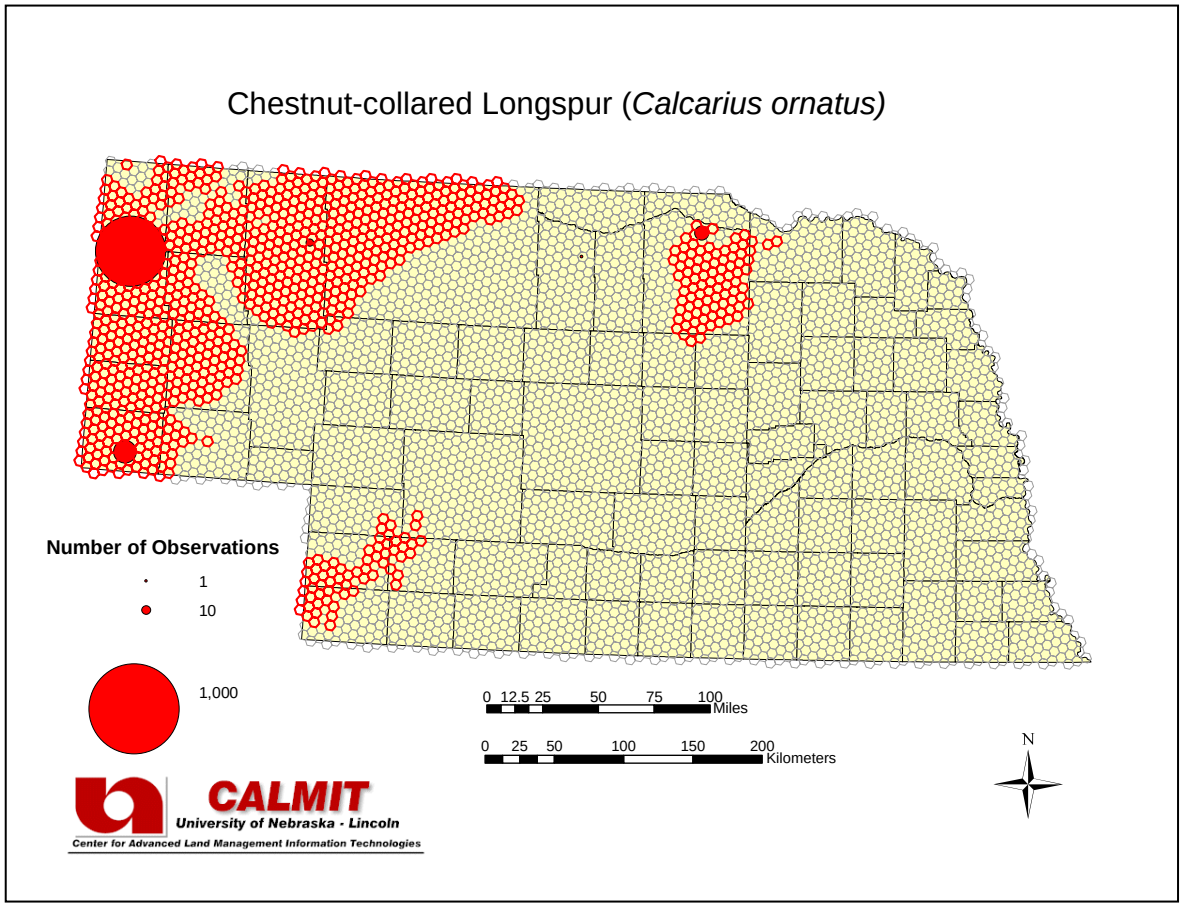
Common Name:	**Chestnut-collared Longspur**	TNC Global Status:	G5
Scientific Name:	***Calcarius ornatus***	Federal Status:	--
TNC Element Code:	ABPBXA6040	State (NE) Status:	S2
AOU Code:	05380		

Habitat Description:
A summer resident in the northwestern corner of the state, from Sioux and Box Butte counties northeastwardly to Sheridan County and perhaps northern Cherry County (Johnsgard 1997). Breeding usually occurs on shortgrass or cut mixedgrass prairies, and less frequently in the low meadow zones around ponds and disturbed grasslands, such as grazed pasturelands. Species breeds in native grasslands (Sharpe et al. 2001). It is most numerous in the Panhandle, but also occurs in small numbers eastward along the South Dakota border, possibly as far as the Missouri Valley. In Nebraska, breeding occurred more frequently on idle shortgrass and mowed mixed-grass prairie than in low meadow zones or pasture (Johnsgard 1980).

Total Area of Modeled Habitat (ha): 4,005,956

Model Description:
Modeled distribution using the set of variables 'Average 30-year Precipitation for May $\leq$ 82.5 mm' AND 'Percentage of Moderately Fine-textured Soils $\leq$ 0.3%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



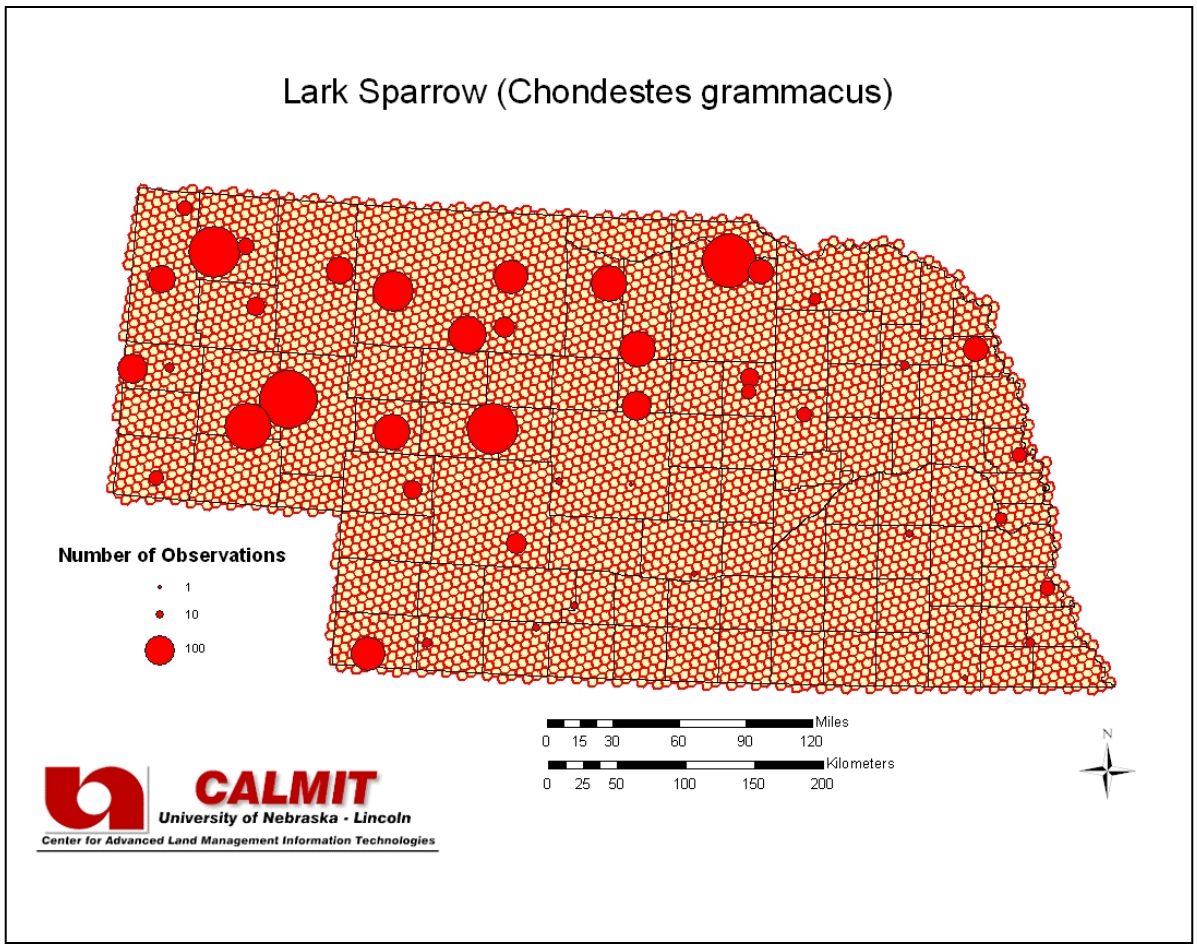
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Lark Sparrow**	TNC Global Status:	G5
Scientific Name:	***Chondestes grammacus***	Federal Status:	--
TNC Element Code:	ABPBX96010	State (NE) Status:	S4
AOU Code:	05520		

Habitat Description:
Occupies natural grasslands or weedy fields that adjoin or include scattered trees, shrubs, and weeds (Johnsgard 1997). Uses a variety of grassland habitats, especially the mid-height mixed grasses of the Sandhills; also seen in nearly all other grassy areas, especially those with native grasses; also found in grassland edge habitat along brushy areas or grassland-woodland margin or in grasslands with scattered trees (Mollhoff 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

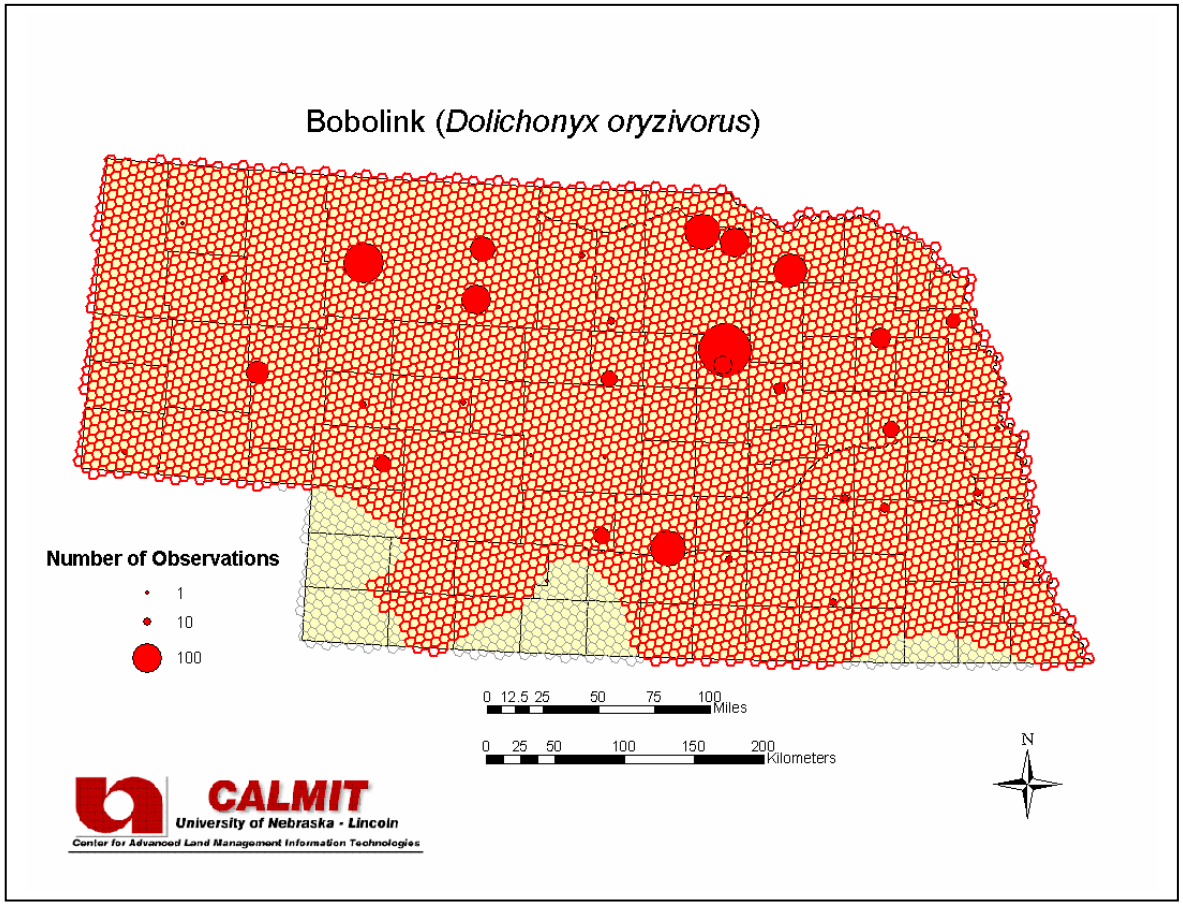
Common Name:	**Bobolink**	TNC Global Status:	G5
Scientific Name:	***Dolichonyx oryzivorus***	Federal Status:	--
TNC Element Code:	ABPBXA9010	State (NE) Status:	S4
AOU Code:	04940		

Habitat Description:
Usually found in ungrazed to lightly grazed medium to tall-grass prairies, wet meadows, retired croplands, and, occasionally, small-grain croplands (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 1.91×10^7

Model Description:
Modeled distribution using the variable 'Total growing degree days at 0ºC through February $\leq$ 0.1'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



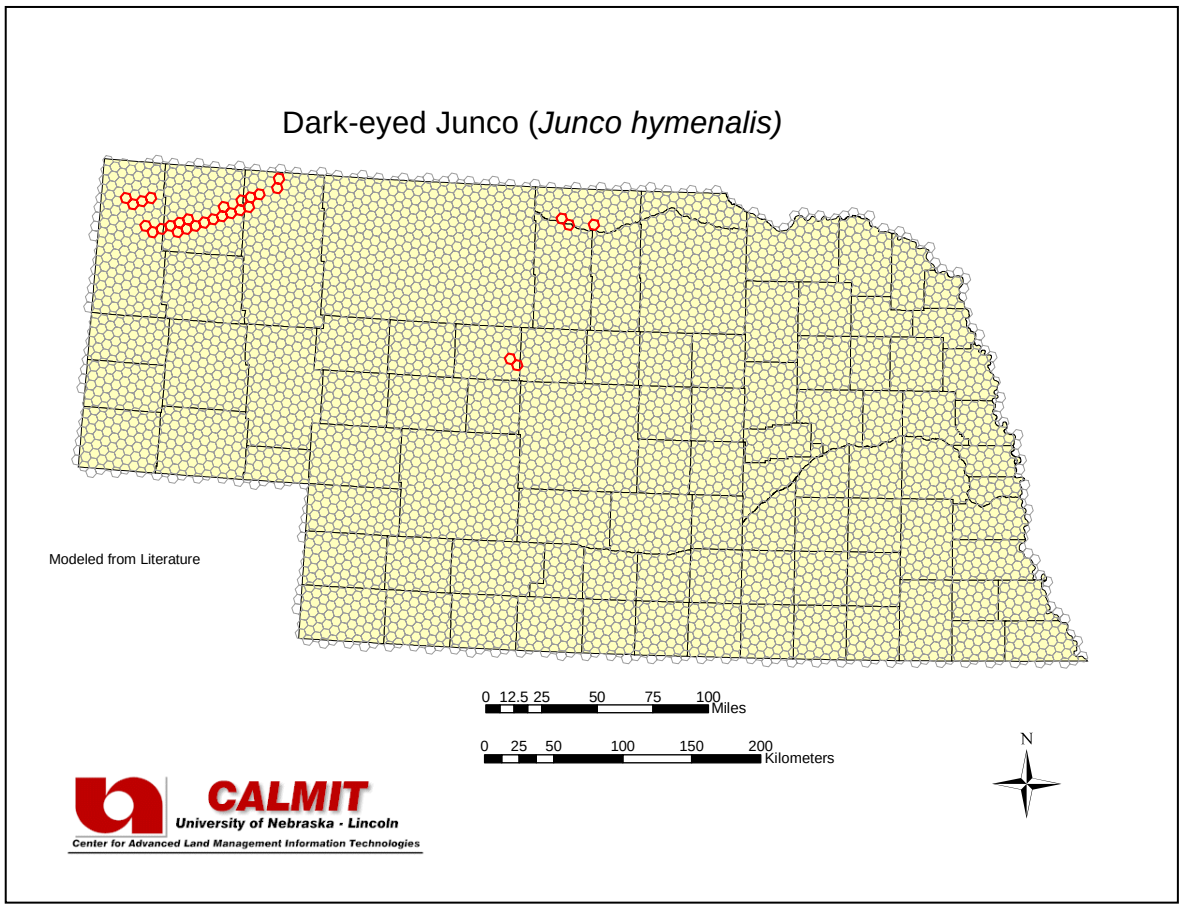
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Dark-eyed Junco**	TNC Global Status:	G5
Scientific Name:	***Junco hyemalis***	Federal Status:	--
TNC Element Code:	ABPBXA5020	State (NE) Status:	S4
AOU Code:	05677		

Habitat Description:
Breeding habitat is restricted to ponderosa pine forests in the Pine Ridge in Sioux and Dawes Counties (Mollhoff 2001, Sharpe et al. 2001). Although probably a regular breeder, it is rare, with a very restricted distribution. Found only in the forested canyons of the Pine Ridge. Reports from the 'Ranges of North American Breeding Birds' (Sauer et al. 2001) show this same limited distribution.

Total Area of Modeled Habitat (ha): 121,641

Model Description:
Adequate model could not be resolved using QUEST (Loh and Shih 1997, Shih 2000). Distribution modeled from literature using variable 'Land Cover class Ponderosa Pine Forests and Woodlands > 25%'. Extent was clipped to match areas of known breeding records (Sharpe et al. 2001).



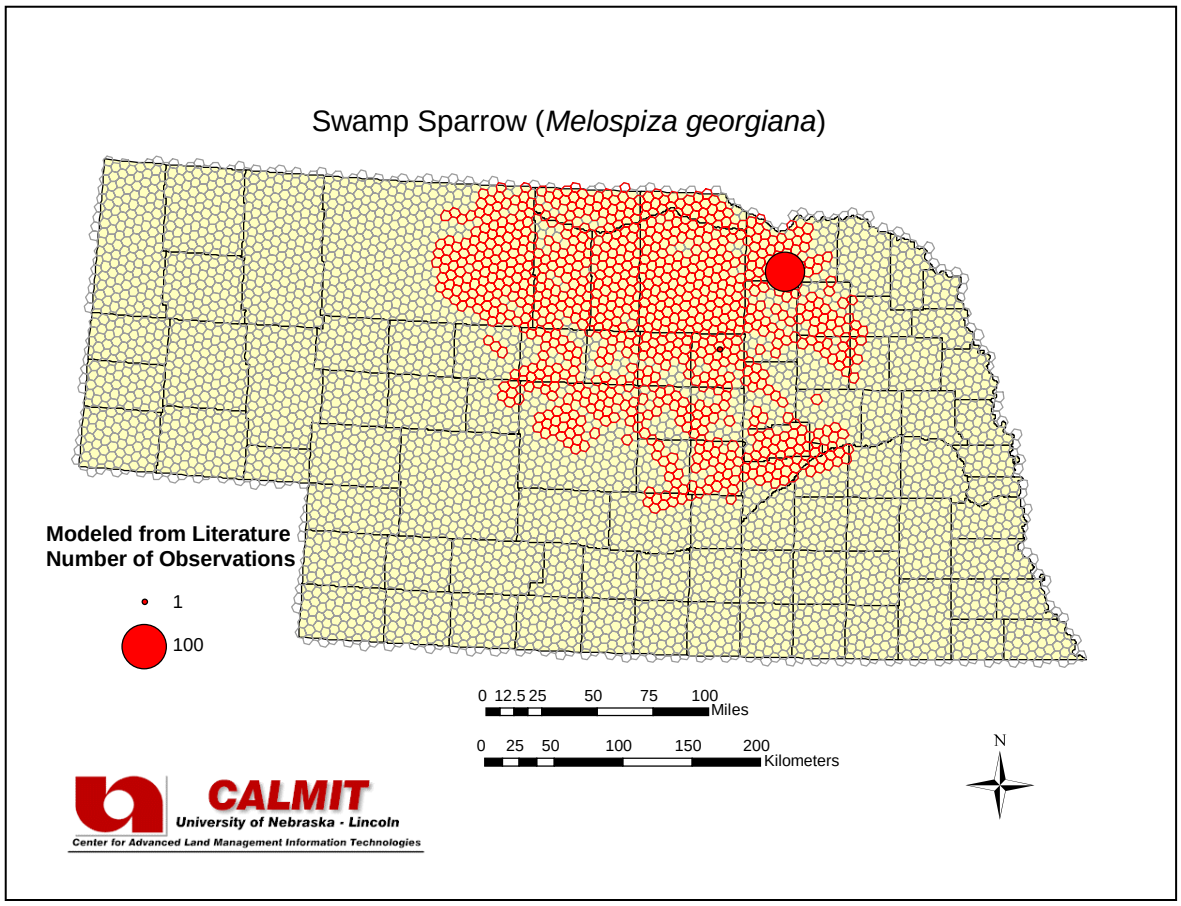
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Swamp Sparrow**	TNC Global Status:	G5
Scientific Name:	***Melospiza georgiana***	Federal Status:	--
TNC Element Code:	ABPBXA3030	State (NE) Status:	S3
AOU Code:	05840		

Habitat Description:
Breeding habitat includes cattail marshes, usually with shrubs or small trees present for singing perches in the Sandhills and Loup drainage (Johnsgard 1997, Sharpe et al. 2001). Sites range from extensive shallow-water areas to narrow strips of swamp beside oxbows, road ditches or streams (Mollhoff 2001). Breeding colonies tend to be locally distributed and birds are often absent from seemingly suitable habitat (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 3,628,877

Model Description:
Adequate model could not be resolved using QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the set of variables 'Land Cover class Sandhills Upland Prairie > 1%' AND 'Land Cover class Lowland Tallgrass Prairie > 0.5%' AND 'Land Cover class Emergent Wetland is present'. Extent clipped to eastern Sandhills, the area of known breeding records (Mollhoff 2001, Sharpe et al. 2001).



Nebraska GAP Analysis 2004
Bird Species Atlas

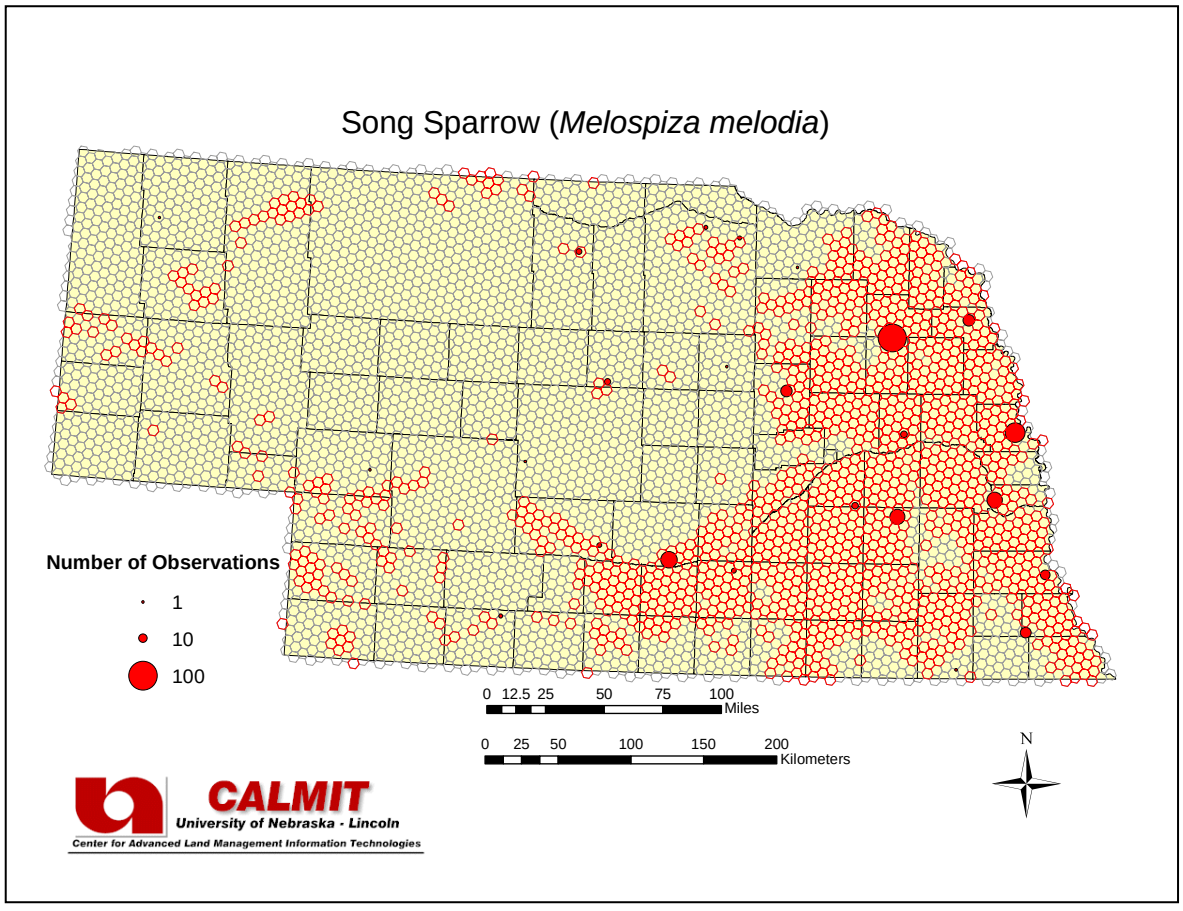
Common Name:	**Song Sparrow**	TNC Global Status:	G5
Scientific Name:	***Melospiza melodia***	Federal Status:	--
TNC Element Code:	ABPBXA3010	State (NE) Status:	S4
AOU Code:	05810		

Habitat Description:
Found in brushy or weedy riparian habitats, along streams, and around ponds or lakes but may frequent wet ditches that support stands of willow or other shrubby vegetation. Breeds regularly in the Missouri Valley and adjacent counties and is expanding westward along the Platte Valley and into adjacent drainages (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 5,761,607

Model Description:
Modeled distribution using the set of variables 'Land Cover class Agricultural Fields > 62.5%' OR 'Land Cover class Agricultural Fields ≤ 62.5%' AND 'Percentage of Moderately Coarse-textured Soils > 42.5%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



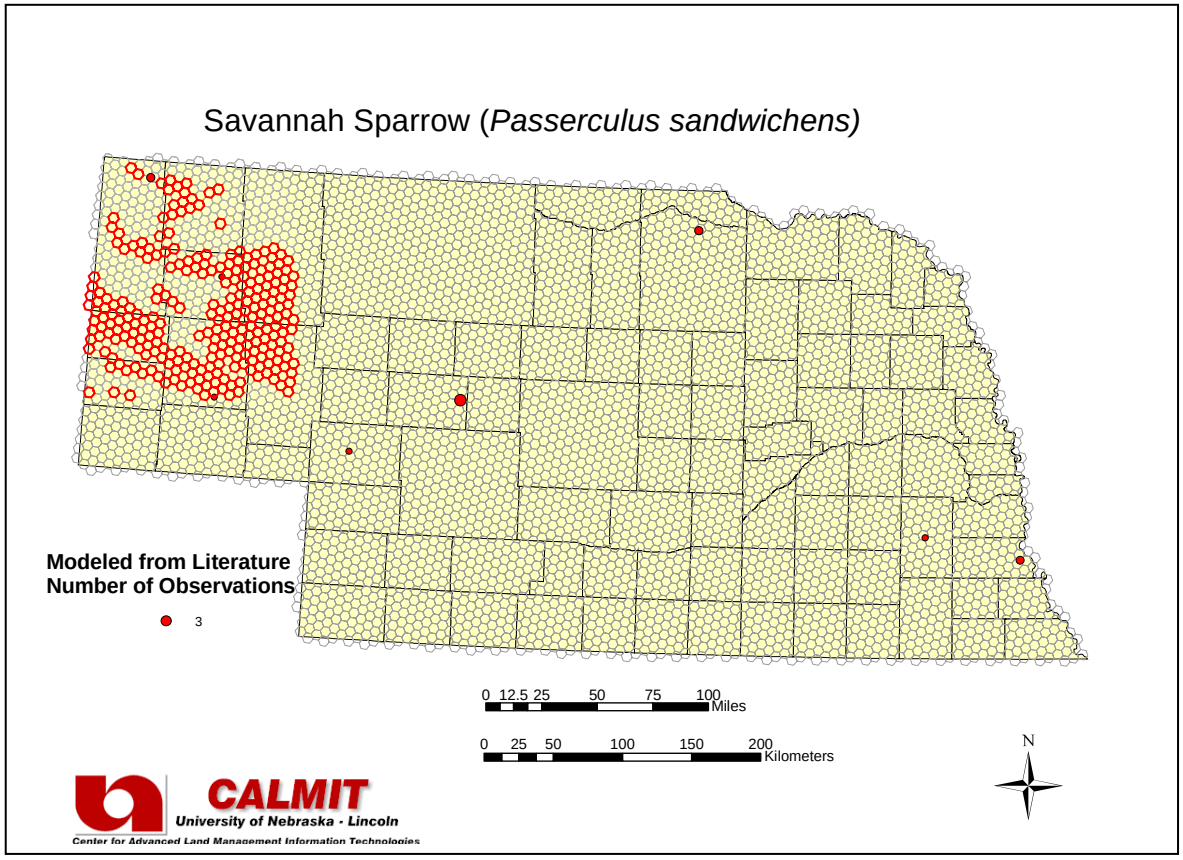
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Savannah Sparrow**	TNC Global Status:	G5
Scientific Name:	***Passerculus sandwichensis***	Federal Status:	--
TNC Element Code:	ABPBX99010	State (NE) Status:	S3
AOU Code:	05420		

Habitat Description:
Breeding occurs in wet-meadow zones of wetlands, and in tall to mid-grass prairies (Johnsgard 1997). Breeding is local and probably limited to the west. The breeding range of this species barely reaches the northern and western edges of NE. Breeding is documented only from a few locations in the Panhandle, although there are scattered summer reports from elsewhere in the state (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1,066,347

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the set of variables 'Land Cover class Lowland Tallgrass Prairie is present' AND 'Land Cover class Emergent Wetland > 0.1%', clipped to areas of the state where breeding reports have been confirmed- in the western Sandhills from Crescent Lake northward and westward (Sharpe et al. 2001).



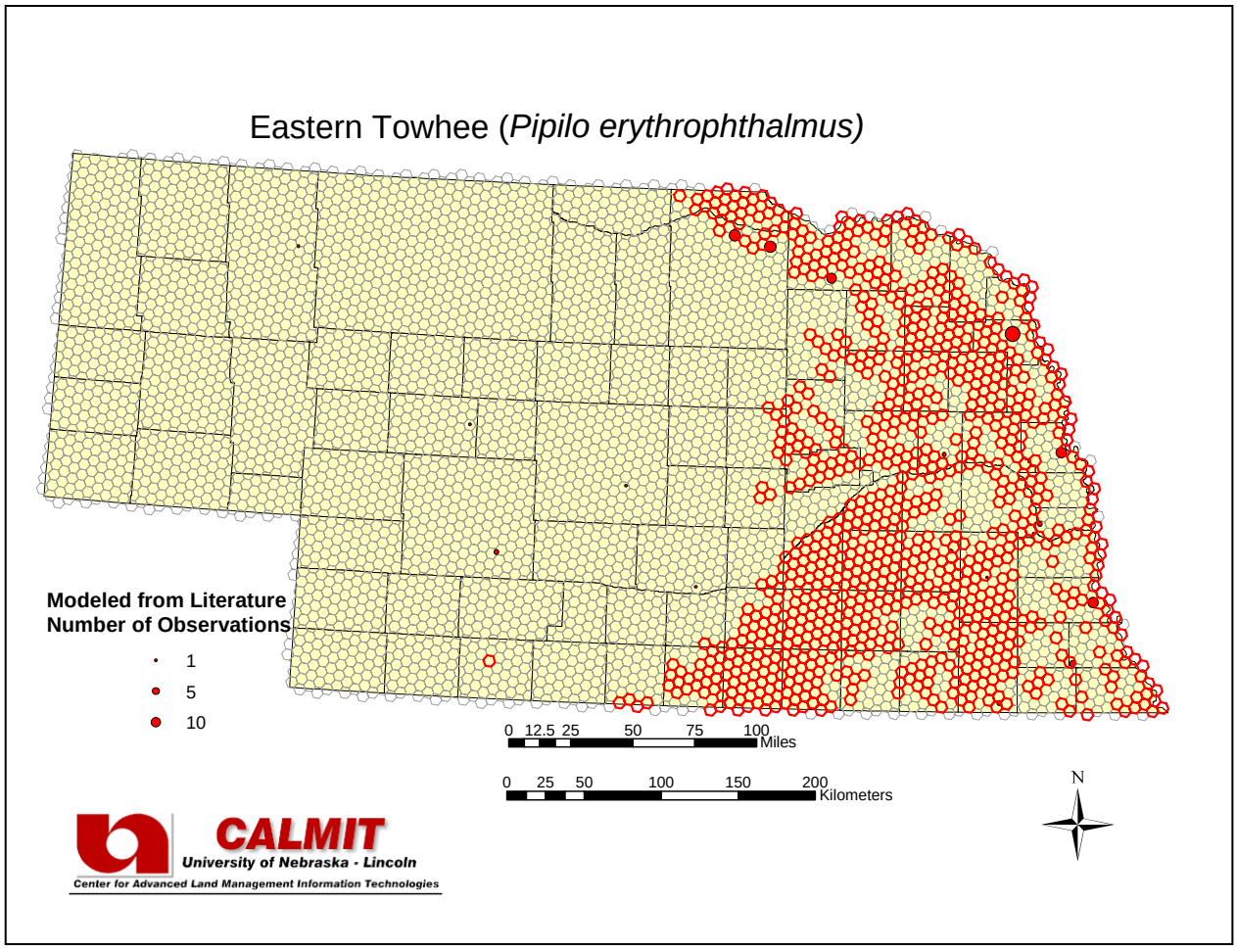
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Eastern Towhee**	TNC Global Status:	G5
Scientific Name:	***Pipilo erythrophthalmus***	Federal Status:	--
TNC Element Code:	ABPBX74030	State (NE) Status:	S4
AOU Code:	05870		

Habitat Description:
At one time, the Spotted Towhee from the western United States and the closely related Eastern Towhee were known collectively as the Rufous-sided Towhee (Cornell Lab of Ornithology 1999). Today, they are considered separate species based on differences that include song and plumage. But where their ranges meet in the northern Great Plains of the United States, hybrids that are intermediate in appearance have been seen. Inhabits forest and swamp edges, regenerating clearcuts, open-canopied forests (including deciduous, pine, pine-hardwood and spruce-fir; particularly those with a well-developed understory), reclaimed strip mines, mid-late successional fields, riparian thickets, overgrown fencerows, shrub/small-tree thickets, and other brushy habitats. Fairly common regular breeder in the southeast, rare in the extreme south or southwest (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 3,770,791

Model Description:
Adequate model could not be resolved using QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the set of variables ('Land Cover class Deciduous Forests and Woodlands > 0.1%' AND 'Land Cover class Emergent Wetland > 0.1%' AND 'Average 30-year Precipitation for August > 62.5 mm') AND NOT 'Percentage of Moderately-textured Soils < 0.25%'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



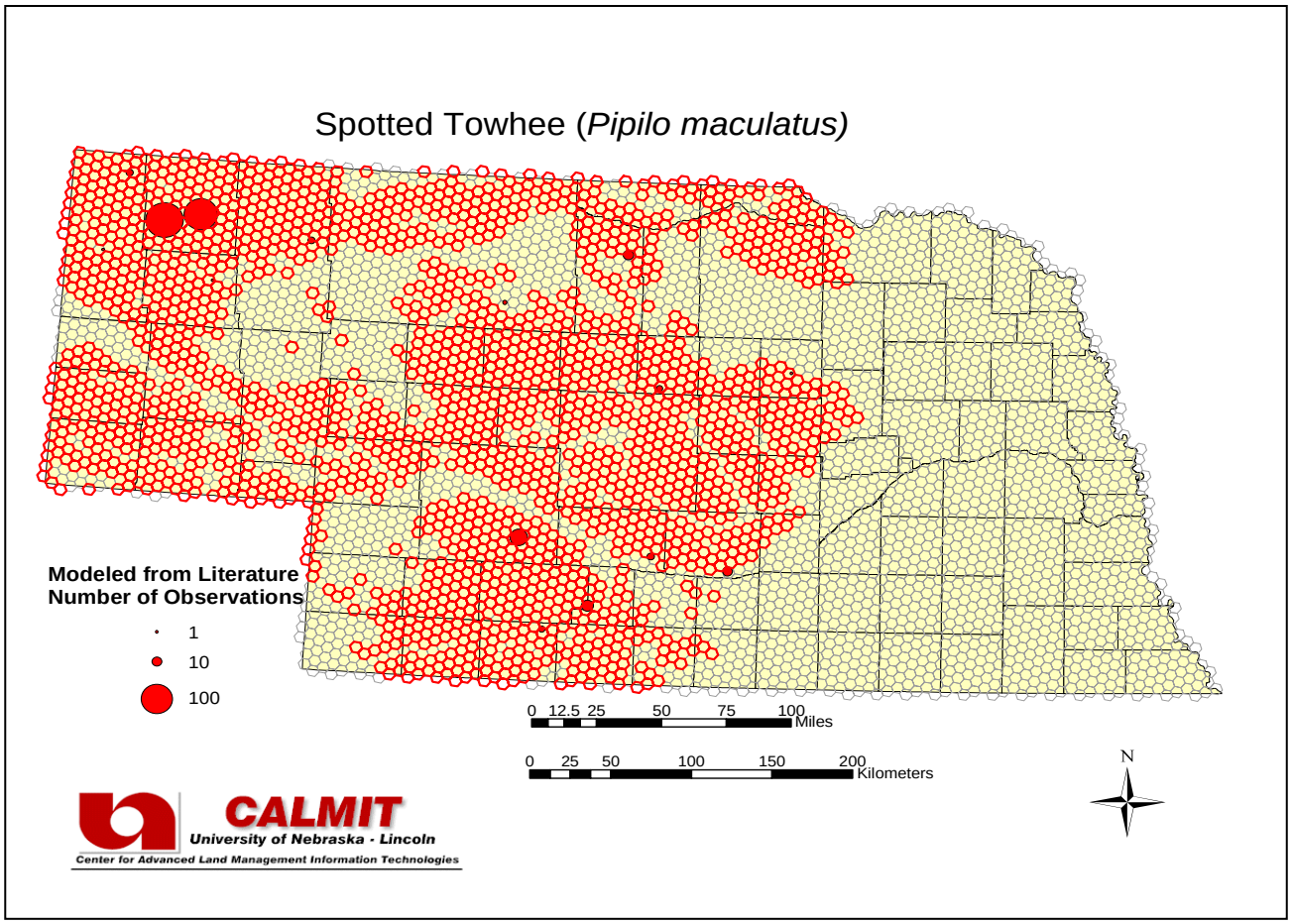
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Spotted Towhee**	TNC Global Status:	G5
Scientific Name:	***Pipilo maculates***	Federal Status:	--
TNC Element Code:	ABPBX74080	State (NE) Status:	S?
AOU Code:	05880		

Habitat Description:
At one time, the Spotted Towhee from the western United States and the closely related Eastern Towhee were known collectively as the Rufous-sided Towhee (Cornell Lab of Ornithology 1999). Today, they are considered separate species based on differences that include song and plumage, but where their ranges meet in the northern Great Plains of the United States, hybrids that are intermediate in appearance have been seen. Breeding Bird Distribution maps indicate range predominately in the western two-thirds of the state (Gough 2002). Inhabits forest and swamp edges, regenerating clearcuts, open-canopied forests (including deciduous, pine, pine-hardwood and spruce-fir; particularly those with a well-developed understory), reclaimed strip mines, mid-late successional fields, riparian thickets, overgrown fencerows, shrub/small-tree thickets, and other brushy habitats (NatureServe 2002). Occurs from the Colorado and Wyoming borders east in the Platte Valley (Johnsgard 1997). Common regular breeder statewide, except in southeast Nebraska (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 8,324,135

Model Description:
Adequate model could not be resolved using QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the set of variables ('Land Cover class Emergent Wetland $\leq$ 0.5%' AND 'Land Cover class Sandsage Shrubland $\leq$ 2.5%' AND 'Average 30-year Precipitation for September < 70 mm') AND NOT 'Land Cover class Upland Tallgrass Prairie > 0.1%'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

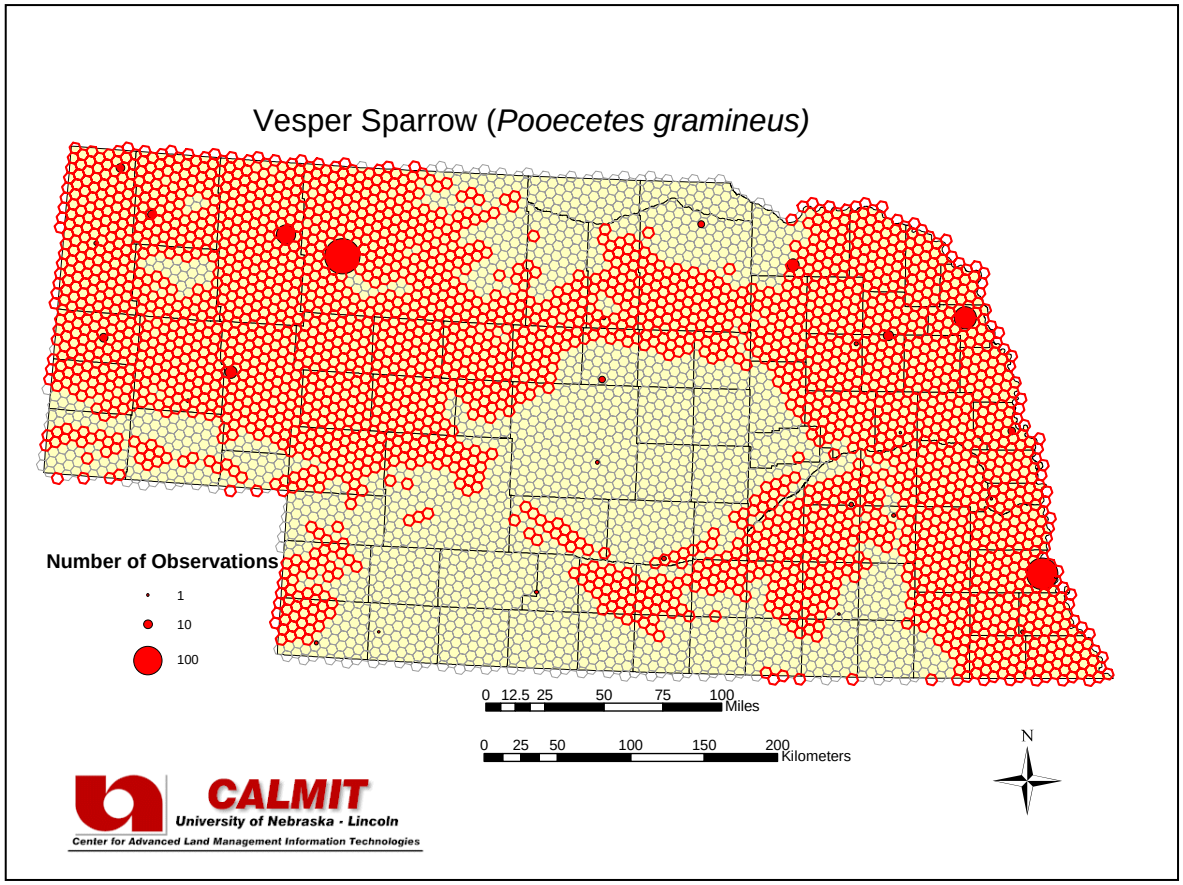
Common Name:	**Vesper Sparrow**	TNC Global Status:	G5
Scientific Name:	***Pooecetes gramineus***	Federal Status:	--
TNC Element Code:	ABPBX95010	State (NE) Status:	S5
AOU Code:	05400		

Habitat Description:
Migrants and breeding birds frequent overgrown fields, prairie edges, and similar habitats where grasslands join or are mixed with shrubs and scattered low trees (Johnsgard 1997). In the Sandhills it was found in dry upland mixedgrass/bunch-grass setting and also noted in shortgrass and mixedgrass prairie (Mollhoff 2001). Most numerous in the northwest and the northern Missouri Valley- highest numbers on breeding bird survey routes are in western Cherry and eastern Sheridan Counties, and good numbers breed in extreme northern Sioux Co (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.20×10^7

Model Description:
Modeled distribution using the set of variables 'Land Cover class Little Bluestem-Gramma Mixedgrass Prairie $\leq$ 10%' AND 'Land Cover class Fallow Agricultural Fields $\leq$ 15%'

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

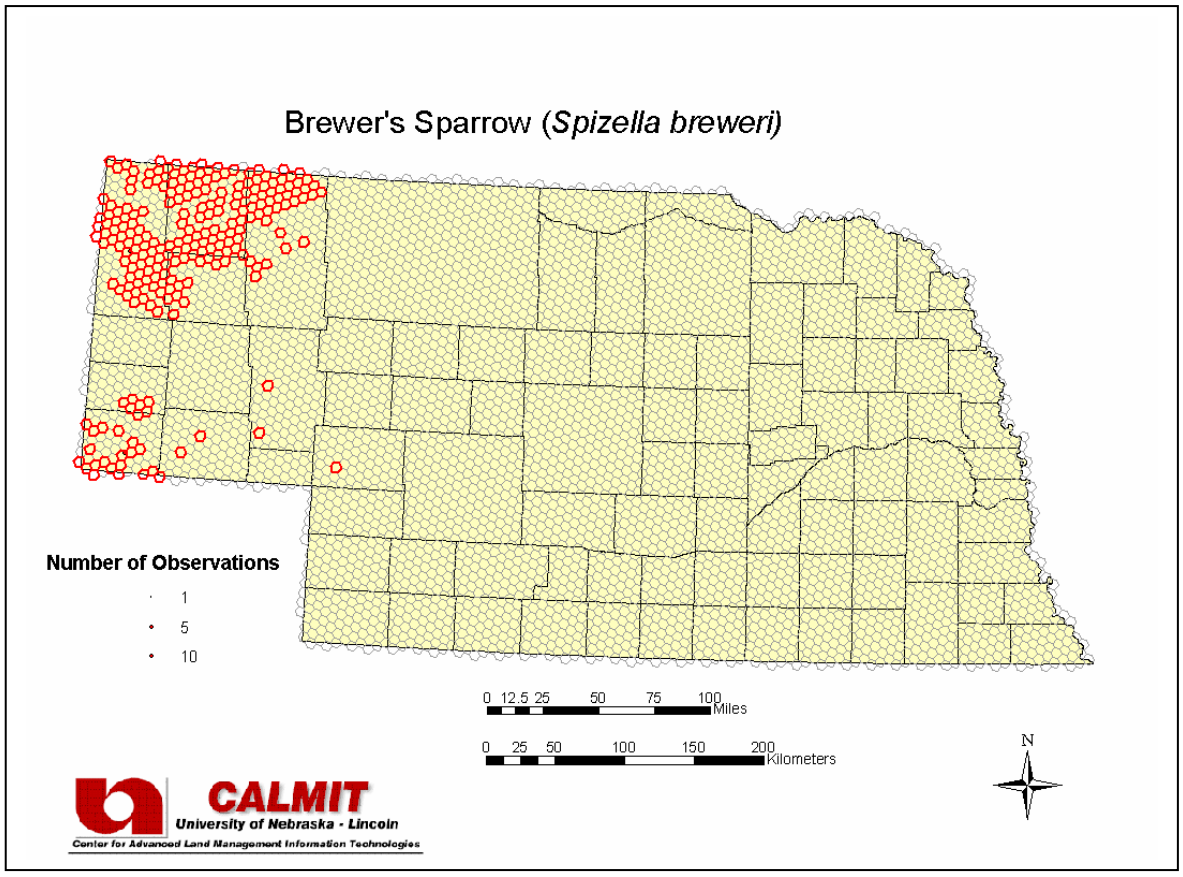
Common Name:	**Brewer's Sparrow**	TNC Global Status:	G5
Scientific Name:	***Spizella breweri***	Federal Status:	--
TNC Element Code:	ABPBX94040	State (NE) Status:	S4
AOU Code:	05620		

Habitat Description:
Associated with open scrublands, especially short-grass plains with sagebrush, rabbitbrush and other semiarid shrubs (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 928,511

Model Description:
Modeled distribution using the set of variables 'Land Cover class Western Shortgrass Prairie > 42.5%' AND 'Percentage of Moderately Coarse-textured Soils $\leq$ 4%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



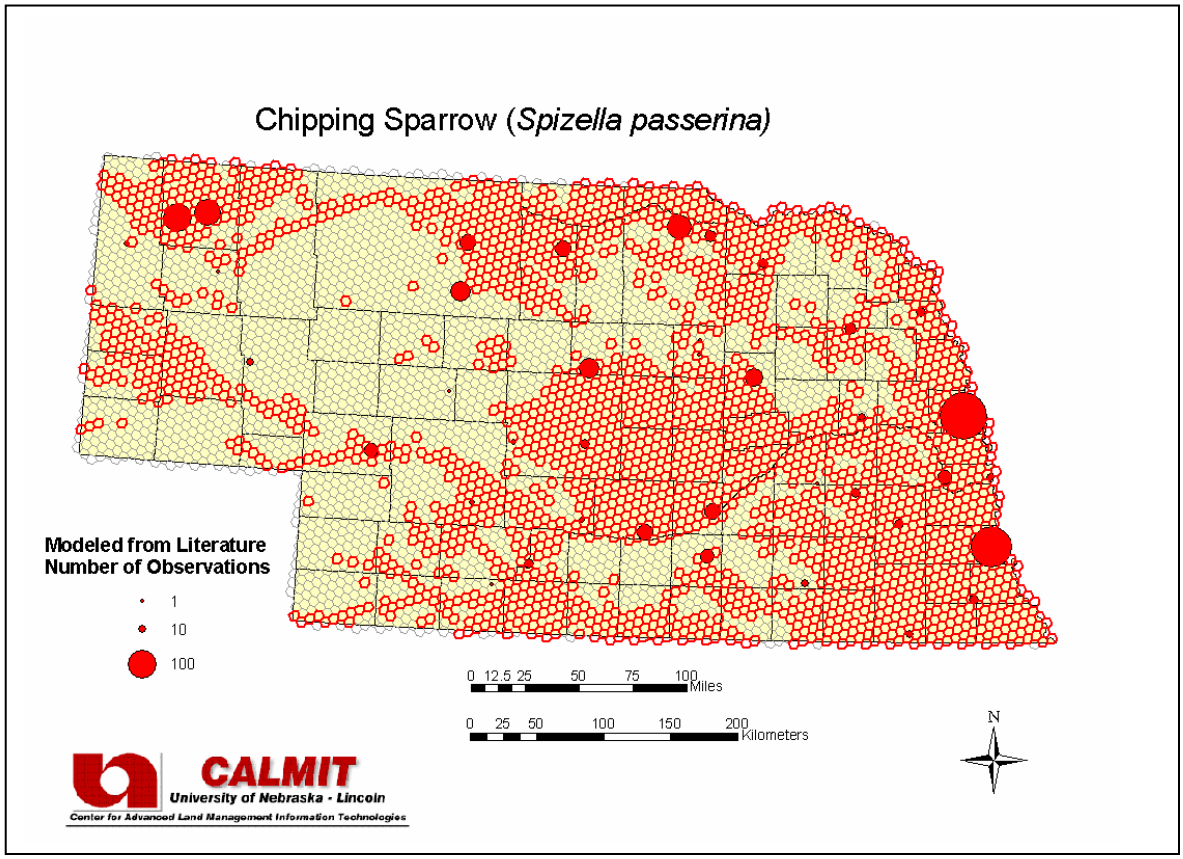
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Chipping Sparrow**	TNC Global Status:	G5
Scientific Name:	***Spizella passerina***	Federal Status:	--
TNC Element Code:	ABPBX94020	State (NE) Status:	S5
AOU Code:	05600		

Habitat Description:
A contradiction between various authorities exists in the type of breeding habitat preferred by this species. According to Johnsgard (1997), in Nebraska this species is associated with the margins of deciduous forests, parks, urban and farm areas, or any open areas with nearby scattered trees and few shrubs. Others state that the preferred habitat appears to be the open coniferous woodland of the Pine Ridge, as well as residential areas with plantings of conifers (Mollhoff 2001, Sharpe et al. 2001). Breeding bird nests are most numerous in the Pine Ridge, Niobrara Valley, Loup drainage, and urban areas (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 9,925,714

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the set of variables 'Land Cover class Ponderosa Pine Forests and Woodlands is present' OR 'Land Cover class Deciduous Forests and Woodlands > 1%'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



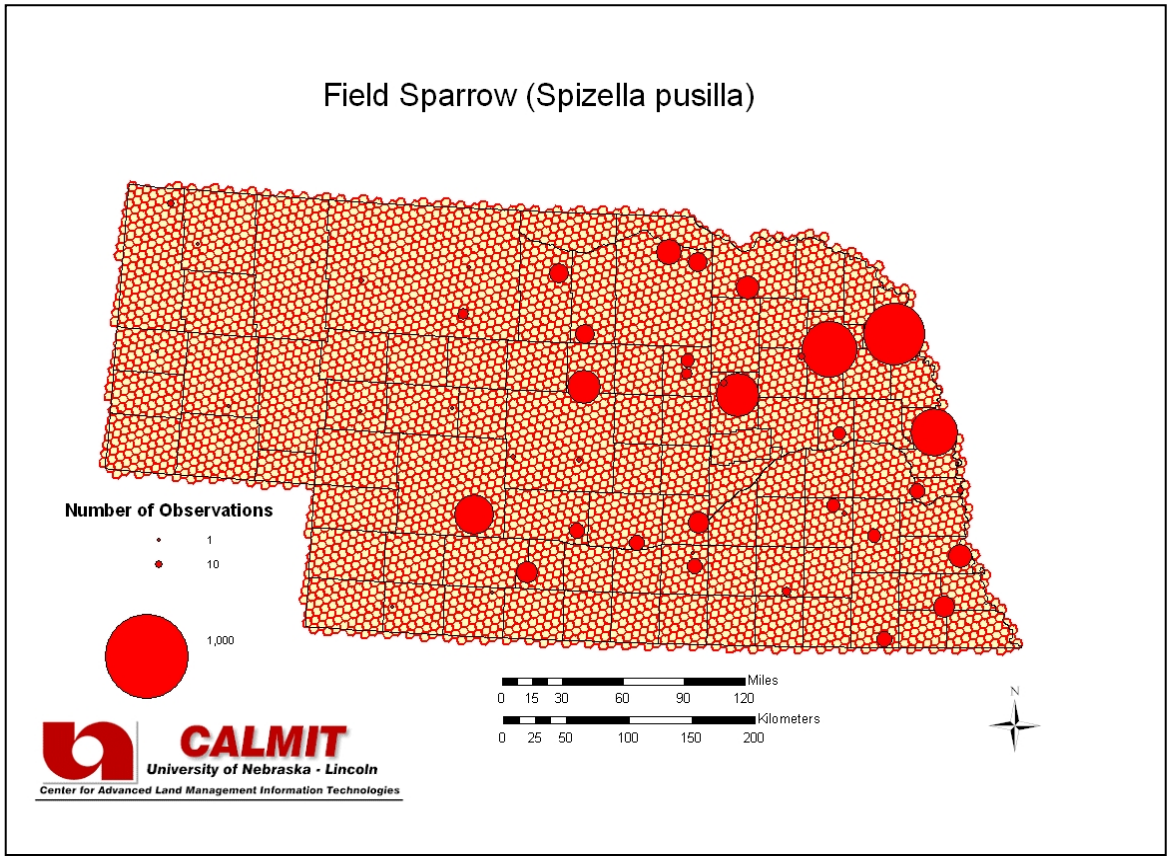
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Field Sparrow**	TNC Global Status:	G5
Scientific Name:	***Spizella pusilla***	Federal Status:	--
TNC Element Code:	ABPBX94050	State (NE) Status:	S5
AOU Code:	05630		

Habitat Description:
Occurs in brushy, open woodland, forest edges, brushy ravines or draws, sagebrush flats, abandoned hayfields, forest clearings, and similar open habitat having scattered shrubs or low trees (Johnsgard 1997). Species exploits the grassland-shrub-woodland 'edge' or ecotone that is prevalent over much of the state (Mollhoff 2001). Breeds in edge habitats and overgrown fields with small to medium-sized shrubs and trees; most numerous in the north and east, rare west of Cherry County (Sharpe et al. 2001).

Total Area of Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

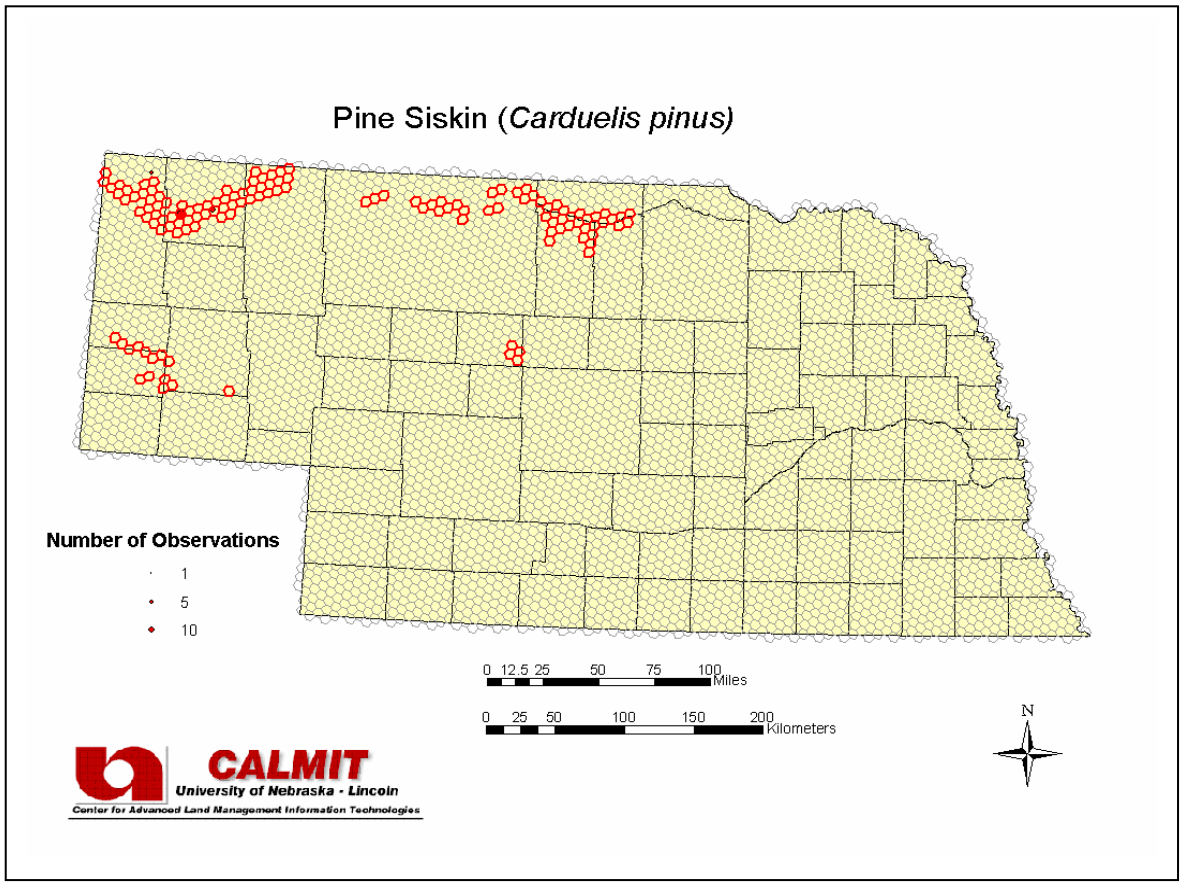
Common Name:	**Pine Siskin**	TNC Global Status:	G5
Scientific Name:	***Carduelis pinus***	Federal Status:	--
TNC Element Code:	ABPBY03010	State (NE) Status:	S5
AOU Code:	05330		

Habitat Description:
Breeding occurs in both conifers and deciduous trees, and may also occur in ornamental shrubs such as lilacs, vines, and other diverse rural and urban locations (Johnsgard 1997, Sharpe et al. 2001). Regular breeder in the ponderosa pine forests of the Pine Ridge; some records of breeding in planted conifers (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 527,104

Model Description:
Modeled distribution using the variable 'Land Cover class Ponderosa Pine Forests and Woodlands > 4.5%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



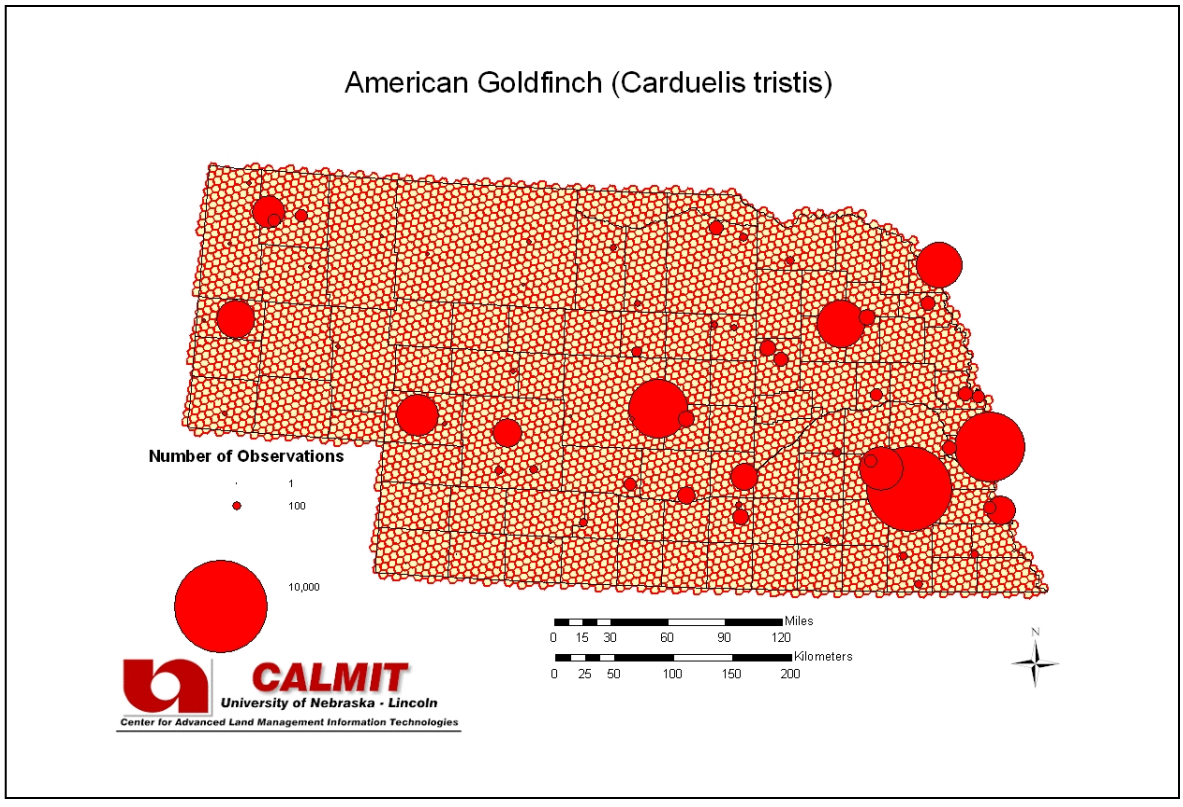
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**American Goldfinch**	TNC Global Status:	G5
Scientific Name:	***Carduelis tristis***	Federal Status:	--
TNC Element Code:	ABPBY06110	State (NE) Status:	S5
AOU Code:	05290		

Habitat Description:
Breeding usually occurs in rather open grazing country, farmyards, swamps, seedy fields and other open habitats (Johnsgard 1997). Species found in a variety of brushy, weedy, old-field edges, open woodland, agricultural field margin and swamp/marsh edge habitats; sometimes found near farmsteads and ranches and edges of small towns (Mollhoff 2001). During the breeding season goldfinches are most often associated with open areas and woodland edge; BBS data show that breeding populations are highest in the east, although they do breed statewide (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

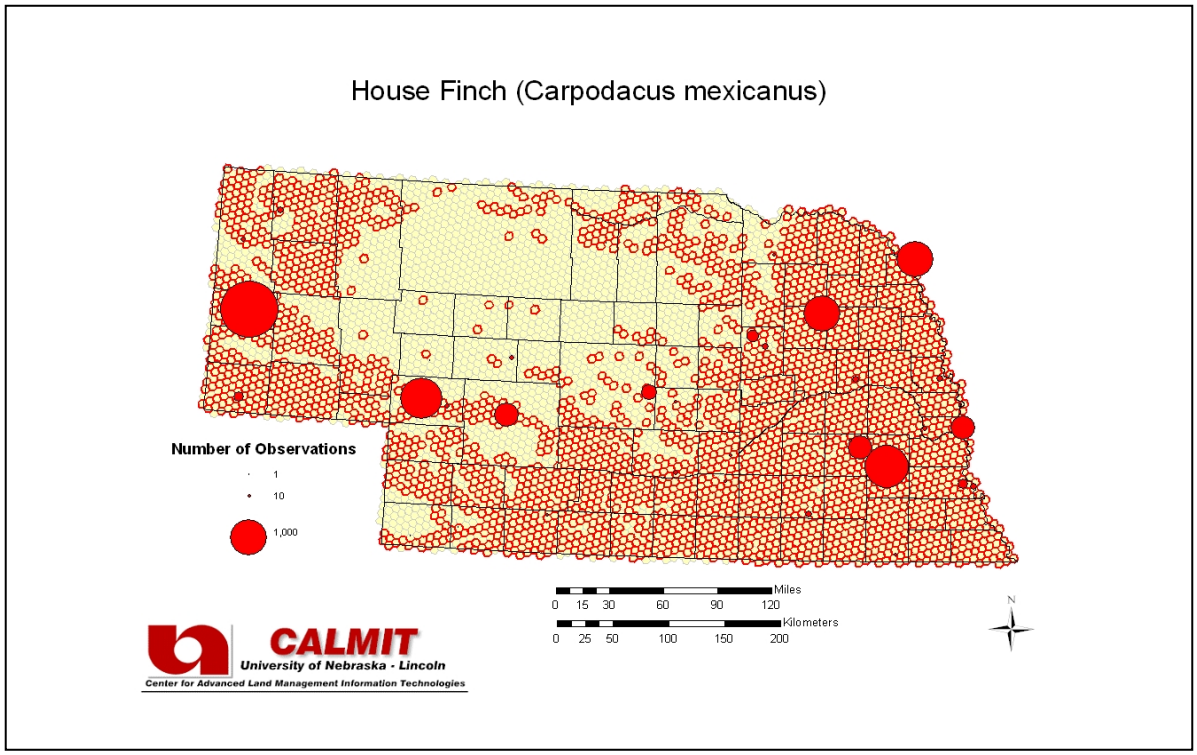
Common Name:	**House Finch**	TNC Global Status:	G5
Scientific Name:	***Carpodacus mexicanus***	Federal Status:	--
TNC Element Code:	ABPBY04040	State (NE) Status:	S3
AOU Code:	05190		

Habitat Description:
This species is virtually restricted in Nebraska to towns and cities across the state. In urban habitats it favors ornamental plantings of conifers, especially blue spruce. In rural areas, it is found in the conifers of windbreaks and occasionally in dry, brushy canyons, scrubby vegetation, ranchlands, or riparian woodlands. Currently summering species are fewest in the Sandhills, central Niobrara Valley, upper Loup drainage, and lower Little Blue drainage. Their eastern spread is apparently accomplished by fall dispersals of birds that visit feeders and the establishment of windbreaks (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 11,612,420

Model Description:
Modeled distribution using the set of variables ('Stream Class is present' AND 'Land Cover class Juniper Woodlands ≤ 2%' AND 'Percentage of Coarse-textured Soils ≤ 80%') OR 'Land Cover class Low Intensity Residential is present'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variables indicated above were determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

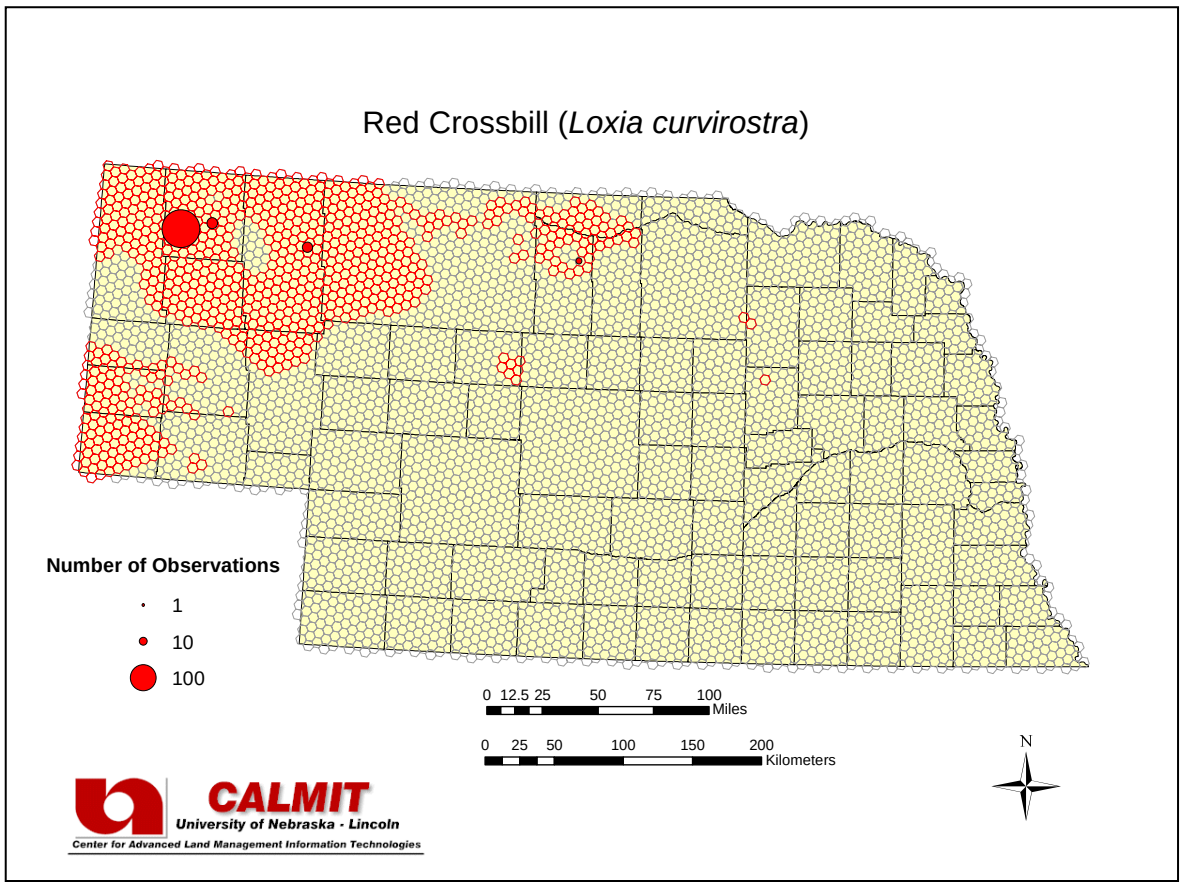
Common Name:	**Red Crossbill**	TNC Global Status:	G5
Scientific Name:	***Loxia curvirostra***	Federal Status:	--
TNC Element Code:	ABPBY05010	State (NE) Status:	S4
AOU Code:	05210		

Habitat Description:
Occur almost exclusively in coniferous woodland, especially ponderosa pine; distribution and abundance are directly related to the status of the pine seed crop (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 3,259,919

Model Description:
Modeled distribution using the set of variables 'Average 30-year Maximum Temperature for April $\leq$ 15.2°C' OR 'Average 30-year Maximum Temperature for April > 15.2°C' AND 'Land Cover class Ponderosa Pine Forests and Woodlands > 1.5%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



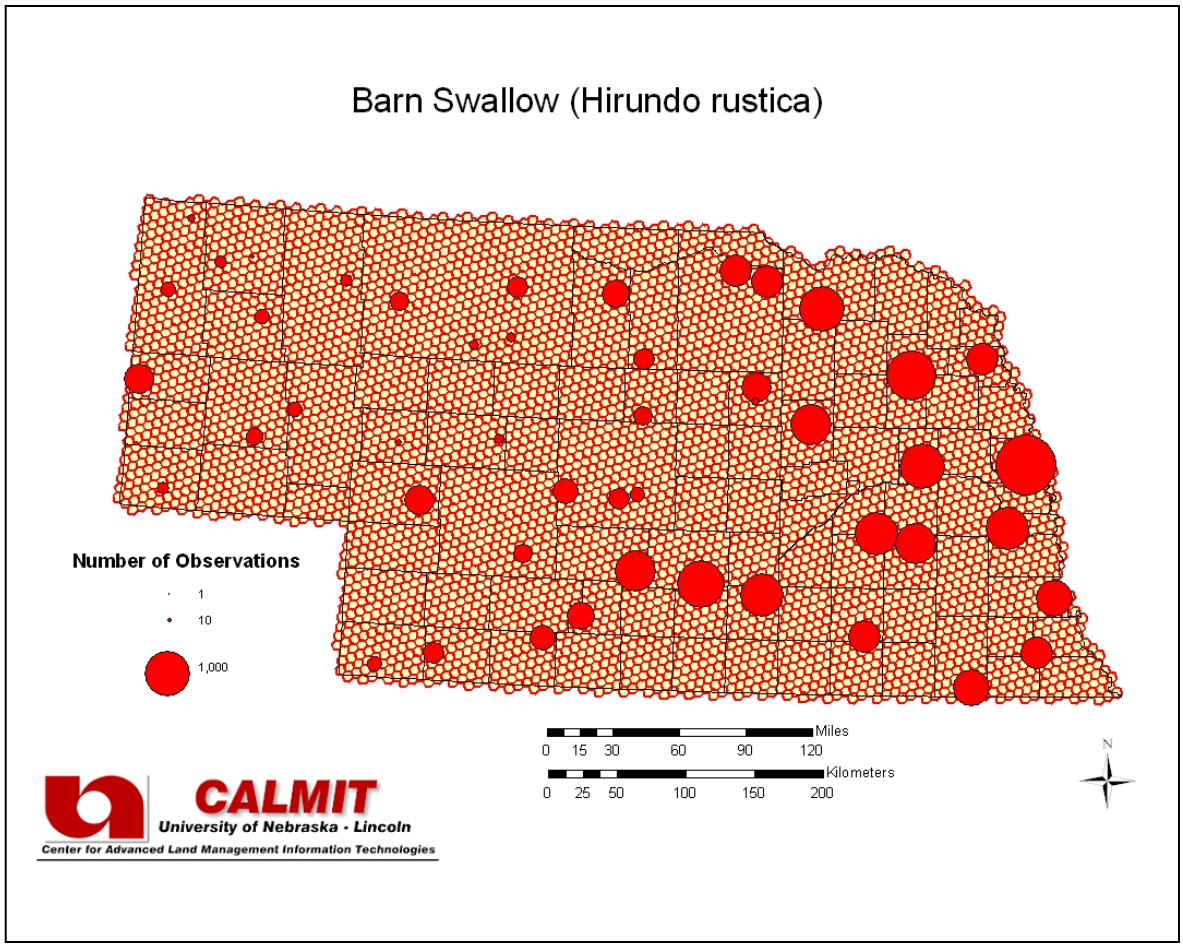
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Barn Swallow**	TNC Global Status:	G5
Scientific Name:	***Hirundo rustica***	Federal Status:	--
TNC Element Code:	ABPAU09030	State (NE) Status:	S5
AOU Code:	06130		

Habitat Description:
Occupies open forests, farmlands, suburbs, and rural areas, usually nesting on or inside buildings (Johnsgard 1997). Found almost everywhere that humans live, work, or build (Mollhoff 2001). Breeds in open areas throughout the state, often placing nests beneath overhangs on buildings (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



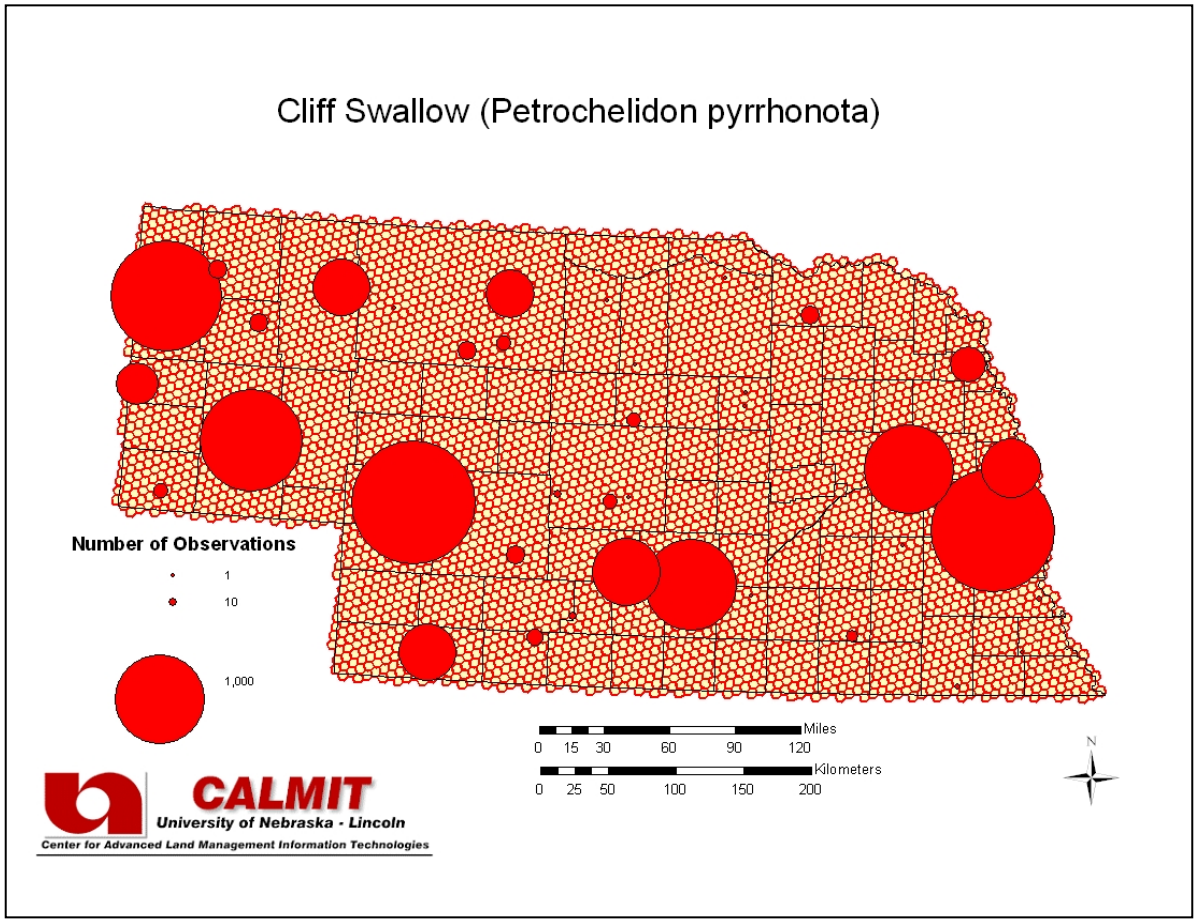
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Cliff Swallow**	TNC Global Status:	G5
Scientific Name:	***Petrochelidon pyrrhonota***	Federal Status:	--
TNC Element Code:	ABPAU09010	State (NE) Status:	S5
AOU Code:	06120		

Habitat Description:
Occur over open areas of farmland, towns, near cliffs, around bridges, and in other areas where mud supplies and potential nest sites exist on vertical and overhanging surfaces (Johnsgard 1997). Breed statewide, and are most commonly found in manmade sites near water, most often on steel and concrete bridges and dams (Mollhoff 2001, Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

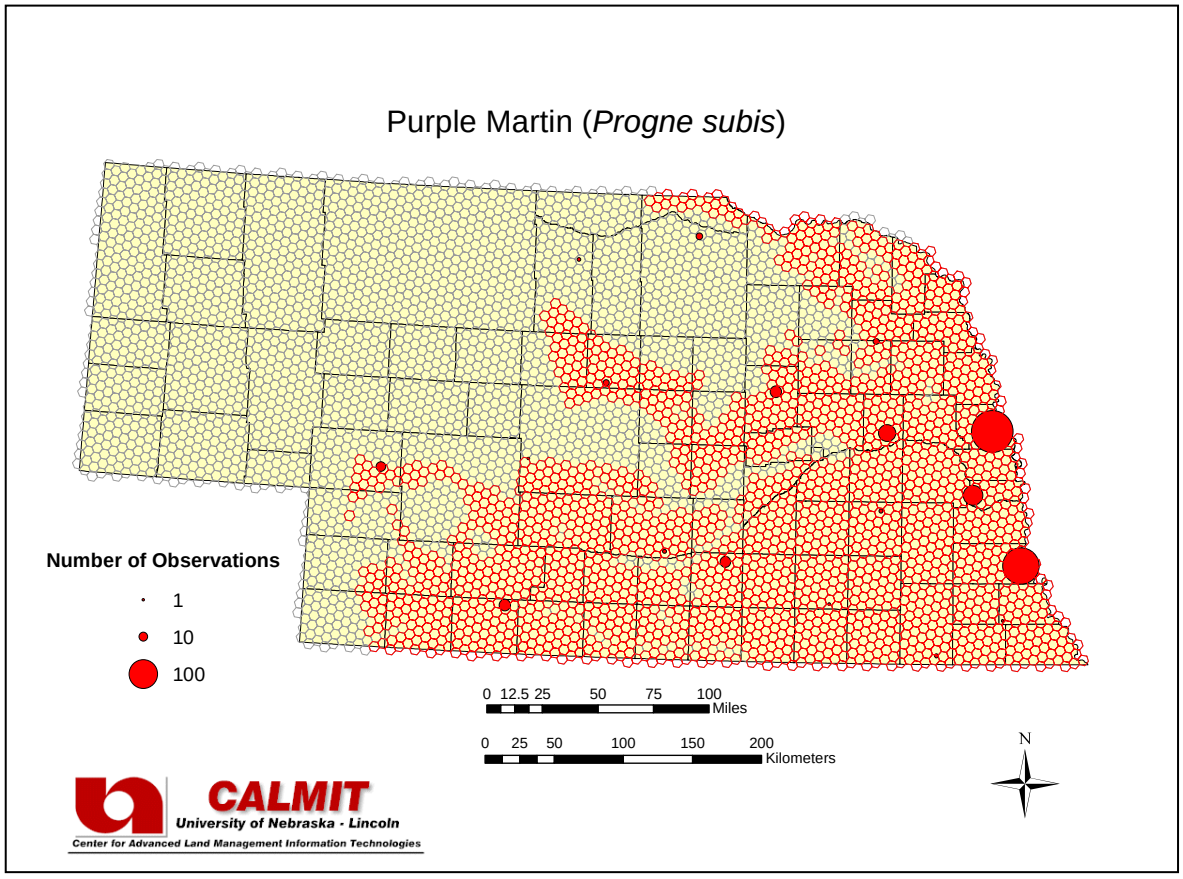
Common Name:	**Purple Martin**	TNC Global Status:	G5
Scientific Name:	***Progne subis***	Federal Status:	--
TNC Element Code:	ABPAU01010	State (NE) Status:	S4
AOU Code:	06110		

Habitat Description:
This species can be found in urban, suburban, and rural habitats, usually near water, where open perches and suitable nesting cavities (usually artificial nest boxes) are available. It is a common breeding bird in the east, becoming less common westward and virtually absent in the Panhandle (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.01×10^7

Model Description:
Modeled distribution using the set of variables 'Average 30-year Minimum Temperature Coefficient of Variation for November $\leq$ 15%' AND 'Percentage of Coarse-textured Soils $\leq$ 12%' OR 'Average 30-year Minimum Temperature Coefficient of Variation for November > 15%' AND 'Average 30-year Precipitation for August > 76.5 mm'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data. Extent was clipped to the eastern two-thirds of the state, excluding the Panhandle region from the model (Sharpe et al. 2001).



Nebraska GAP Analysis 2004
Bird Species Atlas

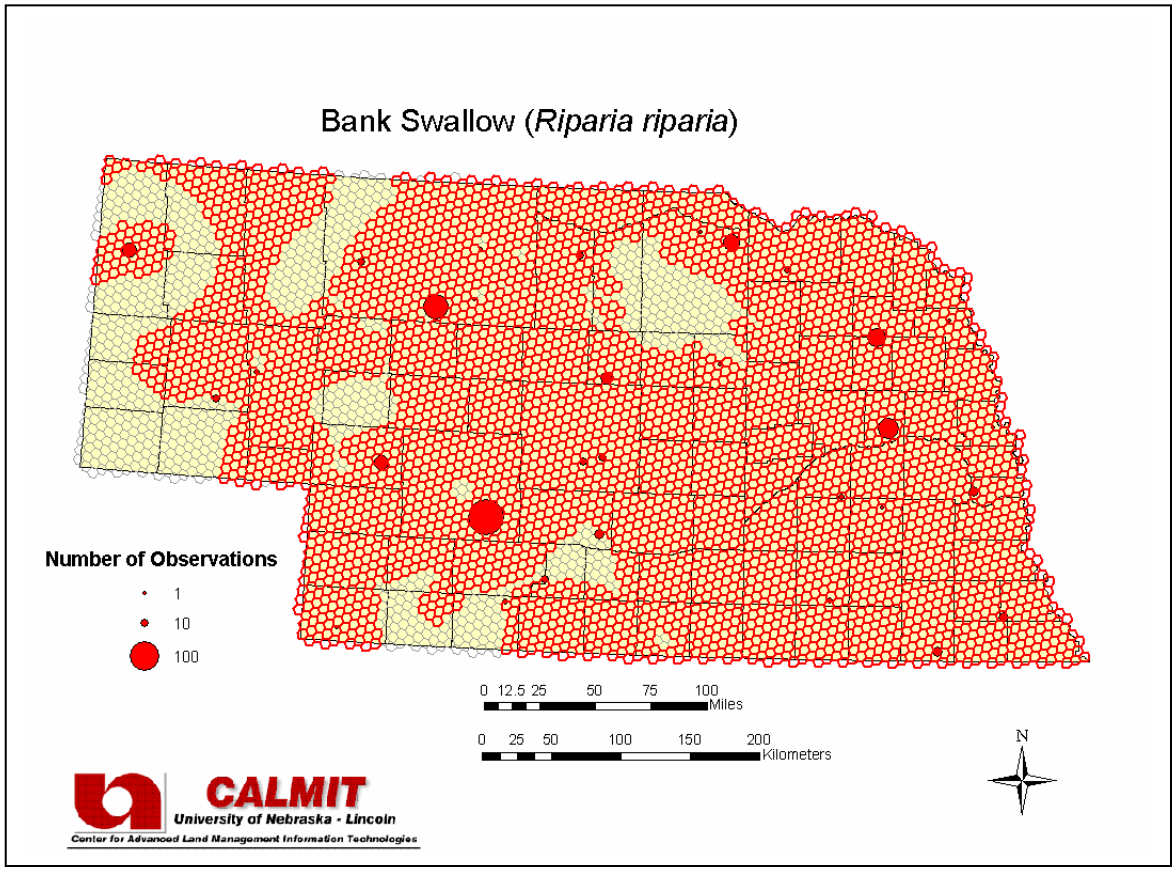
Common Name:	**Bank Swallow**	TNC Global Status:	G5
Scientific Name:	***Riparia riparia***	Federal Status:	--
TNC Element Code:	ABPAU08010	State (NE) Status:	S5
AOU Code:	06160		

Habitat Description:
Species occurs in a variety of open habitats, especially grasslands and croplands, but is typically found near water and is dependent on suitable potential nest sites in the form of vertical banks of clay, sand or gravel (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 1.68×10^7

Model Description:
Modeled distribution using the set of variables 'Land Cover class Lowland Tallgrass Prairie $\leq$ 15%' AND 'Average 30-year Maximum Temperature Coefficient of Variation for May $\leq$ 5.3%'.

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



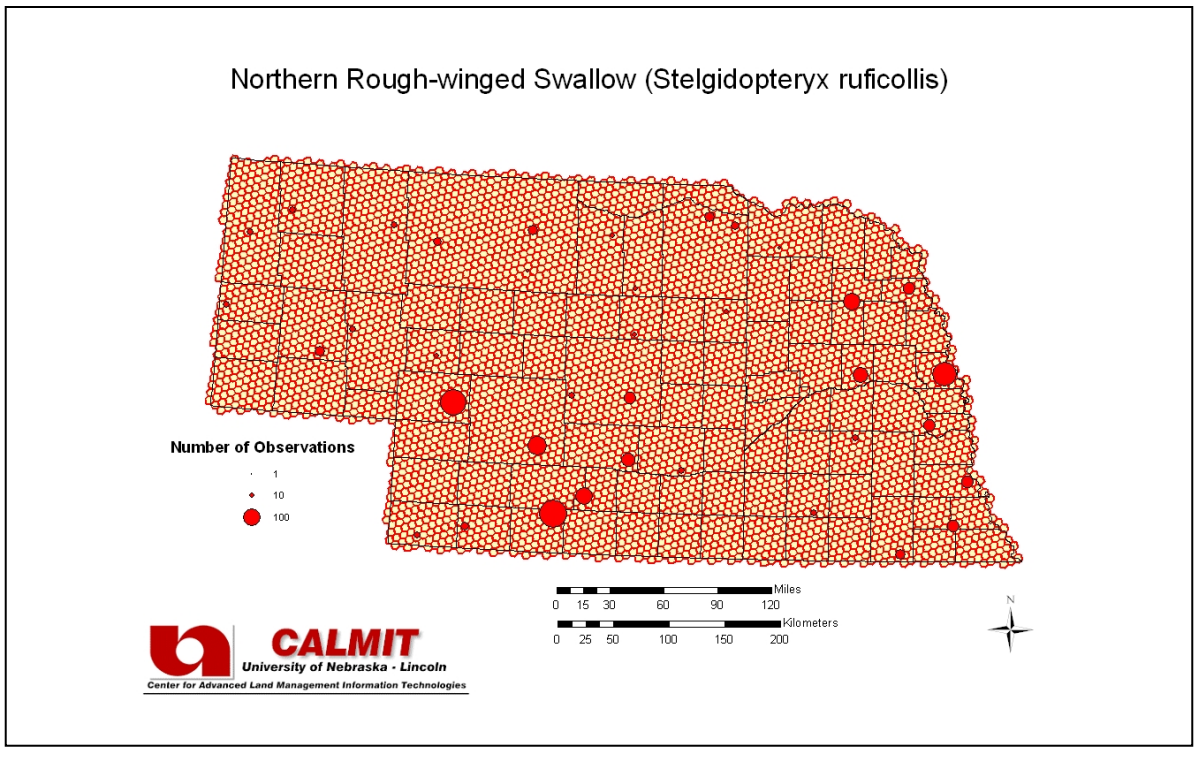
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Northern Rough-winged Swallow**	TNC Global Status:	G5
Scientific Name:	***Stelgidopteryx ruficollis***	Federal Status:	--
TNC Element Code:	ABPAU07010	State (NE) Status:	S?
AOU Code:	06170		

Habitat Description:
This species can be found in a variety of habitats and breeds statewide. Found most frequently in open-country around watercourses, streams, lakes, even farm ponds and stock tanks. Preferred nesting habitats often occur near rivers or streams in dirt, clay or sand banks that can be excavated to provide nest sites. Occasionally they nest in dry loess road cuts and canyons or in vertical blowout faces in the Sandhills (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description: statewide
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

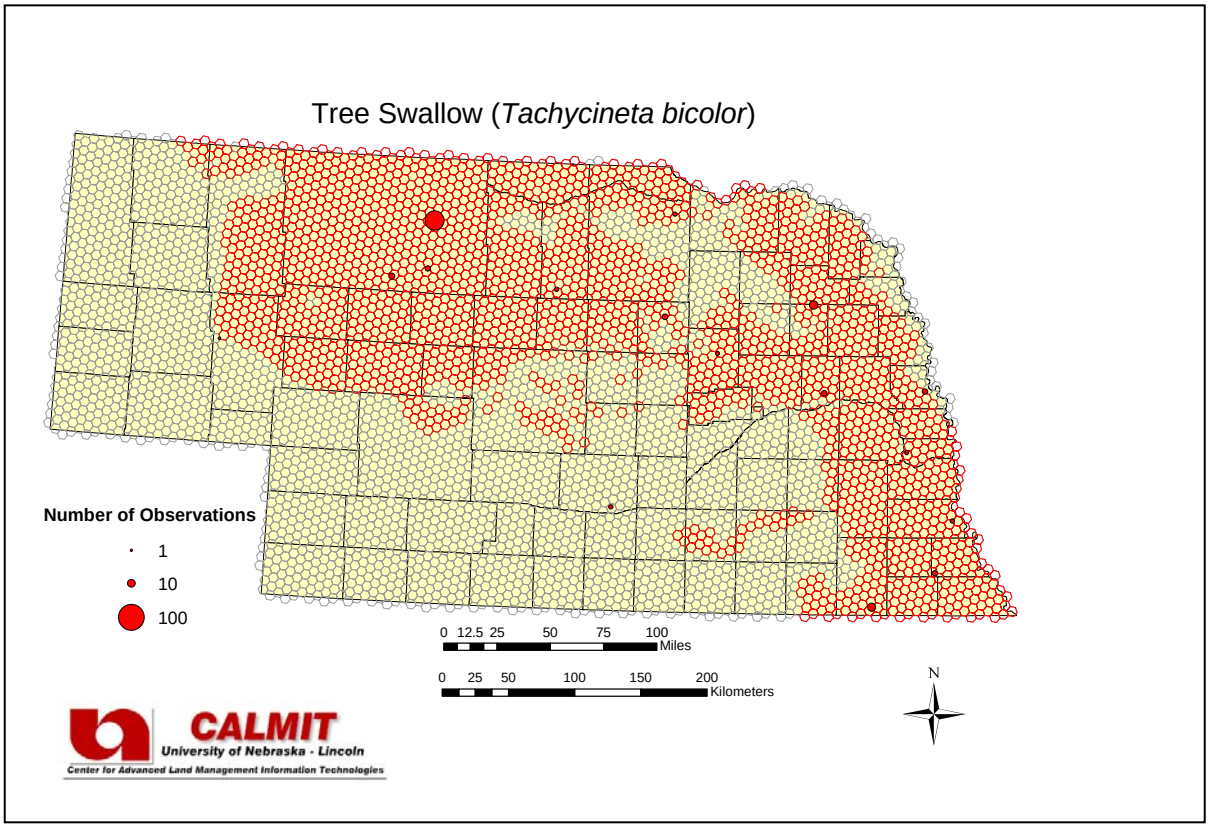
Common Name:	**Tree Swallow**	TNC Global Status:	G5
Scientific Name:	***Tachycineta bicolor***	Federal Status:	--
TNC Element Code:	ABPAU03010	State (NE) Status:	S?N
AOU Code:	06140		

Habitat Description:
Breeding occurs most commonly in the Missouri Valley, although breeding there and elsewhere in the state is dependent on transitory nest-site requirements. This species nests alongside lakes, streams and swamps lined with numerous trees and snags that provide nest cavities. Sandhills lakes with a fringe of large willows or dead cottonwoods seem especially attractive. In Nebraska it was reported at scattered locations almost statewide, but was found rarely or not at all in the south and southwest (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 9,102,618

Model Description:
Modeled distribution using the set of variables ('Average 30-year Precipitation for July > 92 mm') OR ('Average 30-year Precipitation for July ≤ 92 mm' AND 'August Growing Degree Days Weighted Average Coefficient of Variation > 18%' AND 'Percentage of Moderately Fine-textured Soils > 19%') OR ('Average 30-year Precipitation for July ≤ 92 mm' AND 'August Growing Degree Days Weighted Average Coefficient of Variation > 18%' AND 'Percentage of Moderately Fine-textured Soils ≤ 19%' AND 'Land Cover class Agricultural Field ≤ 15%').

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

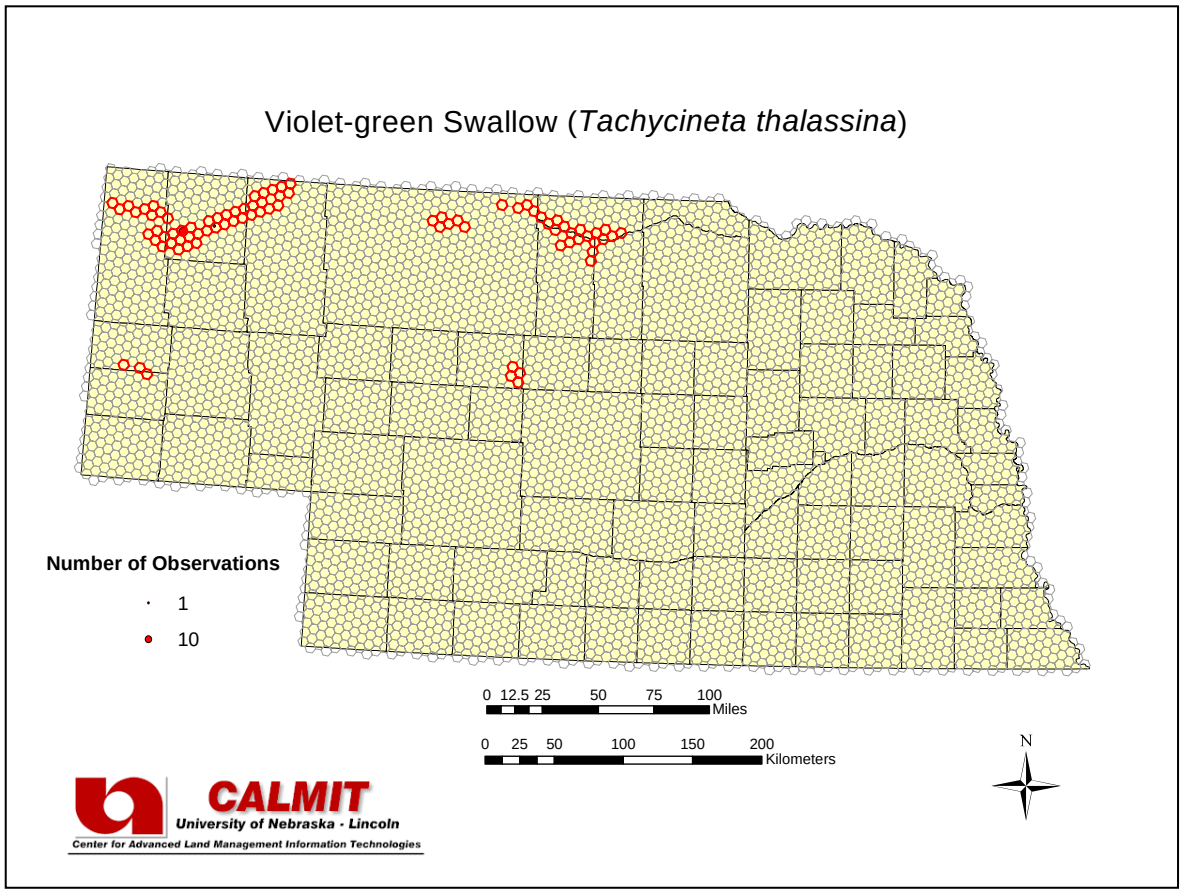
Common Name:	**Violet-green Swallow**	TNC Global Status:	G5
Scientific Name:	***Tachycineta thalassina***	Federal Status:	--
TNC Element Code:	ABPAU03040	State (NE) Status:	S3
AOU Code:	06150		

Habitat Description:
This species is found in open forests such as ponderosa pine forests or poplar woodlands (Johnsgard 1997). They are primarily found in ponderosa pine in the Pine Ridge, and red cedar and pines along the North Platte River Valley and Wildcat Hills (Mollhoff 2001, Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 243,281

Model Description:
Modeled distribution using the variable 'Land Cover class Ponderosa Pine Forests and Woodlands > 10%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



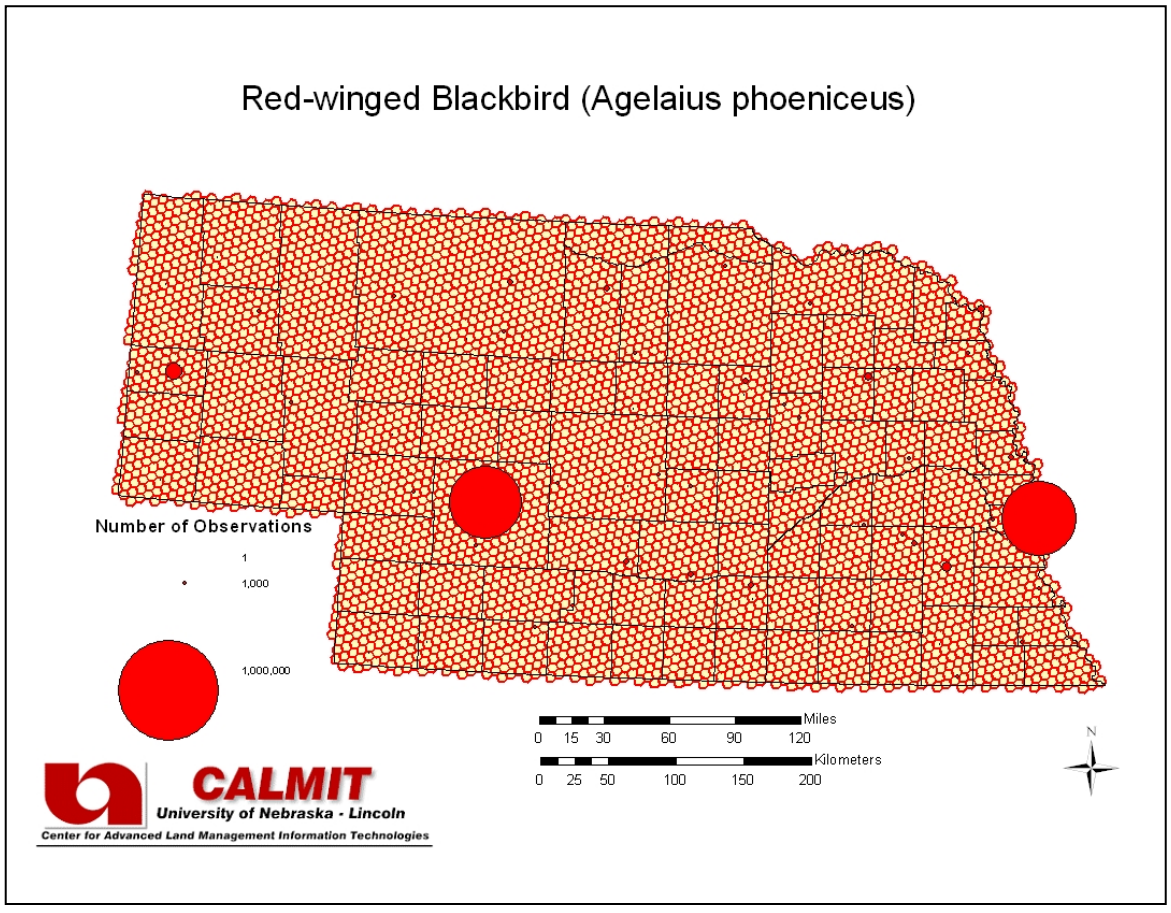
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Red-winged Blackbird**	TNC Global Status:	G5
Scientific Name:	***Agelaius phoeniceus***	Federal Status:	--
TNC Element Code:	ABPBXB0010	State (NE) Status:	S5
AOU Code:	04980		

Habitat Description:
Breeding occurs statewide in a wide range of habitats, from deep marshes or emergent zones of lakes or impoundments, through drier habitats such as wet meadows, ditches, brushy patches in prairie, hayfields, and weedy croplands or roadsides (Johnsgard 1997, Mollhoff 2001). Breeds mainly in the vicinity of water or damp situations (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

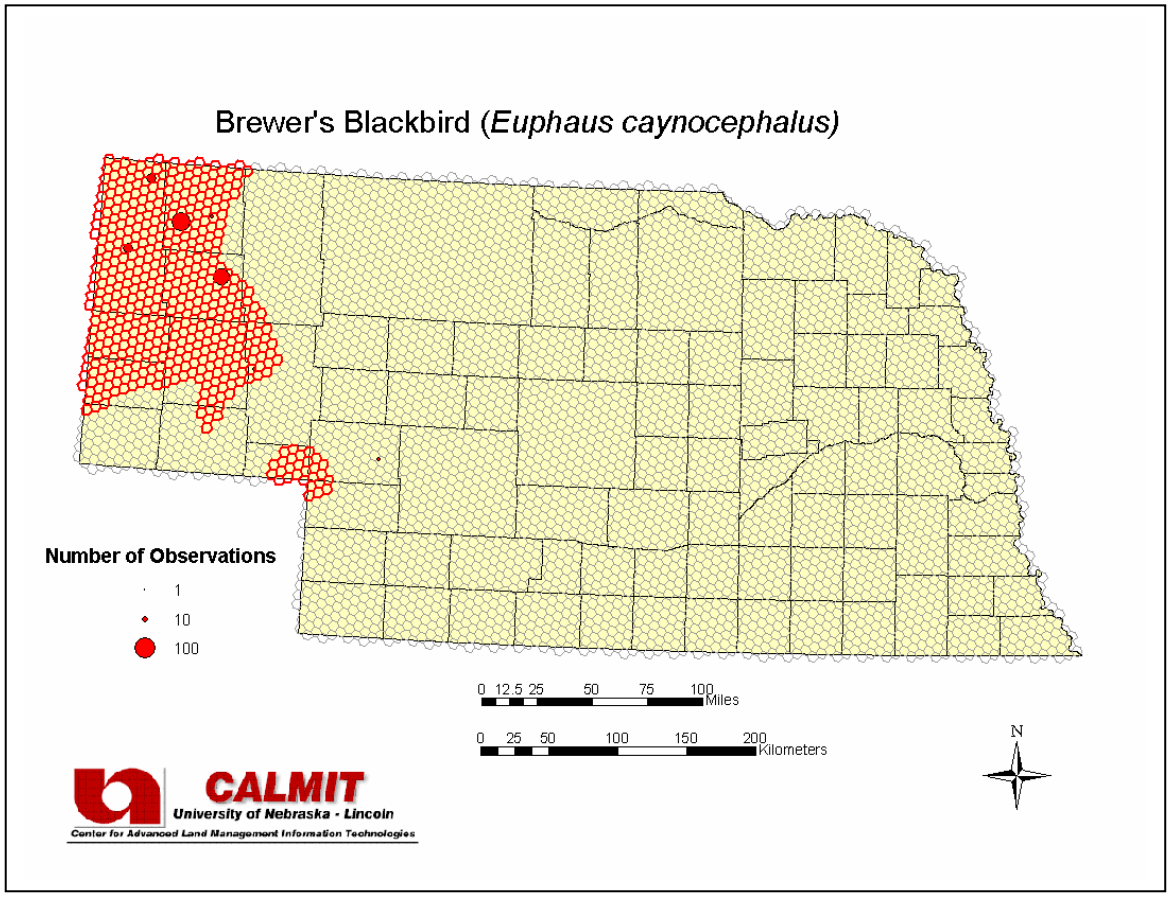
Common Name:	**Brewer's Blackbird**	TNC Global Status:	G5
Scientific Name:	***Euphagus cyanocephalus***	Federal Status:	--
TNC Element Code:	ABPBXB5020	State (NE) Status:	S4
AOU Code:	05100		

Habitat Description:
Birds favor low-stature grasslands, such as mowed roadsides or burned areas near railroads, residential areas and farmsteads (Johnsgard 1997). Areas favored have a combination of grassy habitats, scattered shrubs or small trees, and nearby water.

Total Area of Modeled Habitat (ha): 2,059,729

Model Description:
Modeled distribution using the variable 'Average 30-year Precipitation for July $\leq$ 62.5 mm'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

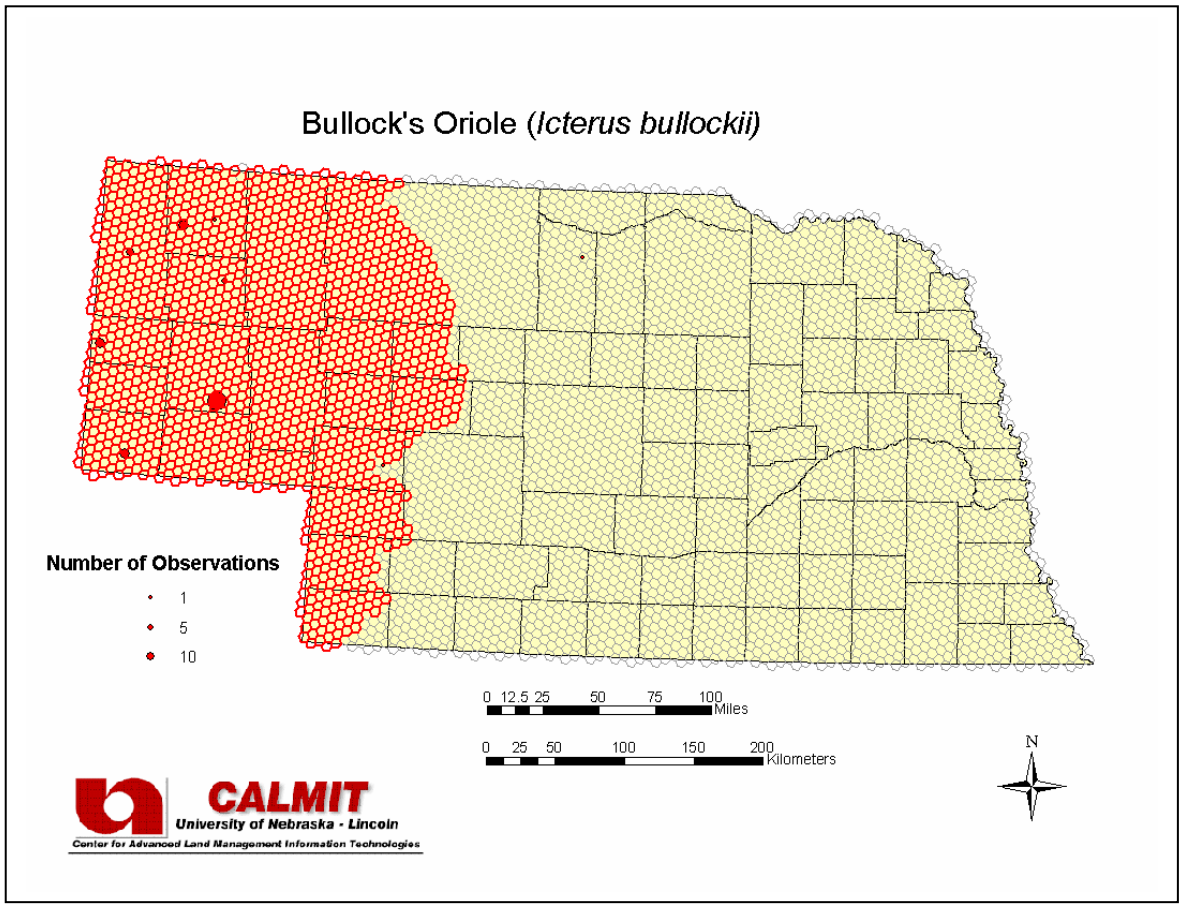
Common Name:	**Bullock's Oriole**	TNC Global Status:	G5
Scientific Name:	***Icterus bullockii***	Federal Status:	--
TNC Element Code:	ABPBXB9220	State (NE) Status:	S?
AOU Code:	05080		

Habitat Description:
Breeds in riparian woodlands in the Panhandle (western Nebraska); with river-bottom stands of cottonwoods as the usual habitat (Johnsgard 1997, Sharpe et al. 2001). Also found in cottonwoods and elms in residential areas and farmsteads.

Total Area of Modeled Habitat (ha): 6,171,110

Model Description:
Modeled distribution using the variable 'Elevation > 980 m'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



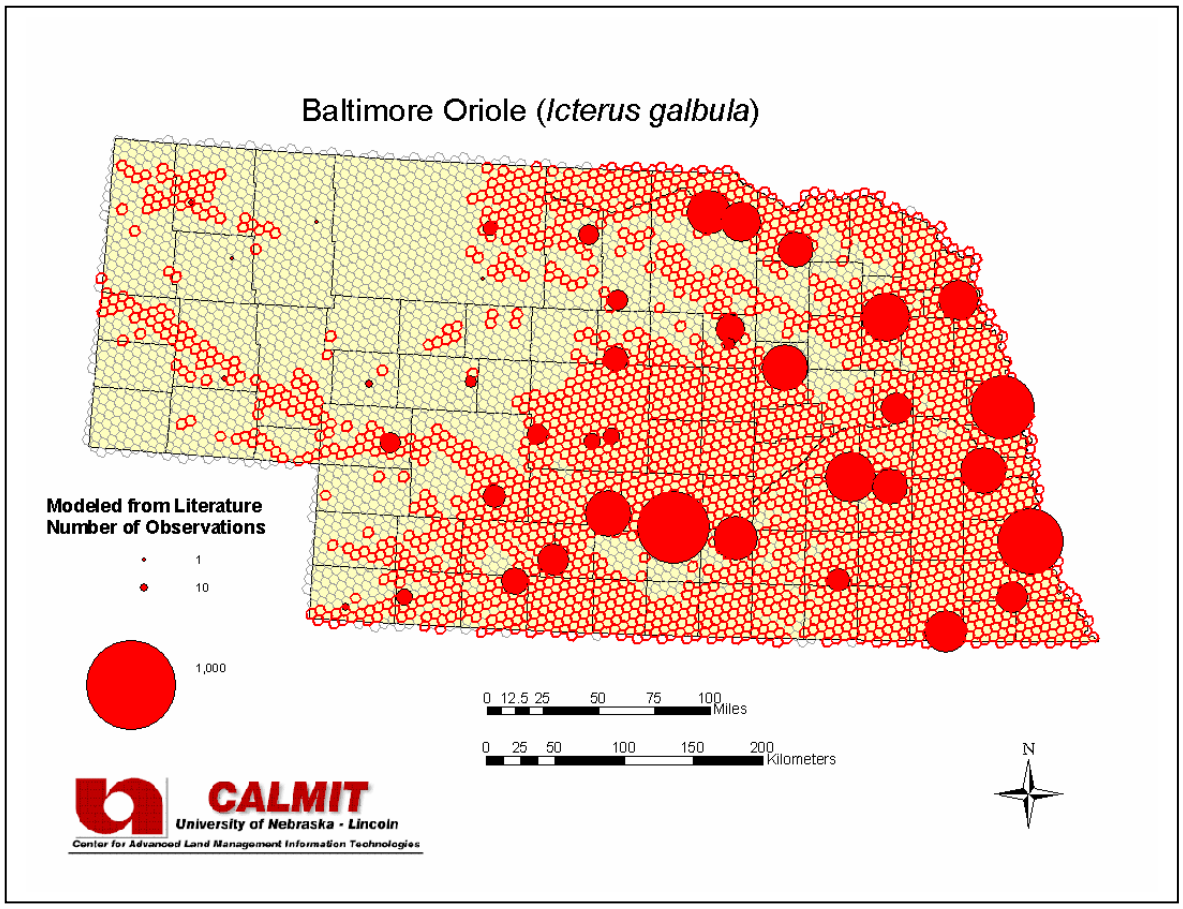
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Baltimore Oriole**	TNC Global Status:	G5
Scientific Name:	***Icterus galbula***	Federal Status:	--
TNC Element Code:	ABPBXB9190	State (NE) Status:	S5
AOU Code:	05070		

Habitat Description:
During the breeding season occupies woodland, wooded river bottoms, upland forests, shelterbelts, and partially wooded residential areas and farmsteads (Johnsgard 1997, Mollhoff 2001). Preferred nesting habitat is riparian, but also occurs commonly in both rural and urban residential situations (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.05×10^7

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Deciduous Forests and Woodlands > 0.5%'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



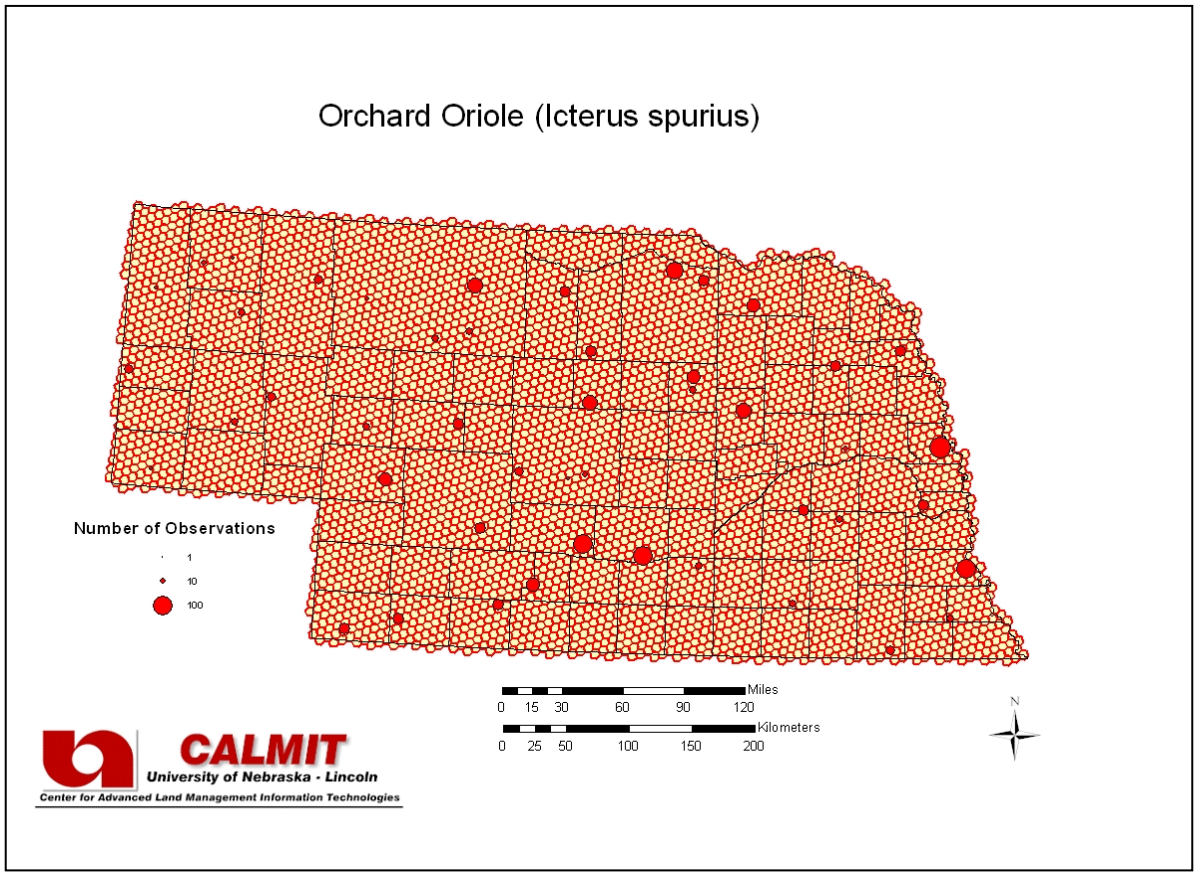
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Orchard Oriole**	TNC Global Status:	G5
Scientific Name:	***Icterus spurius***	Federal Status:	--
TNC Element Code:	ABPBXB9070	State (NE) Status:	S5
AOU Code:	05060		

Habitat Description:
Breeds statewide in open deciduous woodland and edge habitats, especially brushy thickets in riparian situations (Sharpe et al. 2001). In Nebraska, the species is found statewide and is only absent from areas devoid of trees and brushy areas (Mollhoff 2001). Relatively open rather than closed woodland are preferred, and areas of low junipers or even grasslands may be used, if suitable nest sites are nearby (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



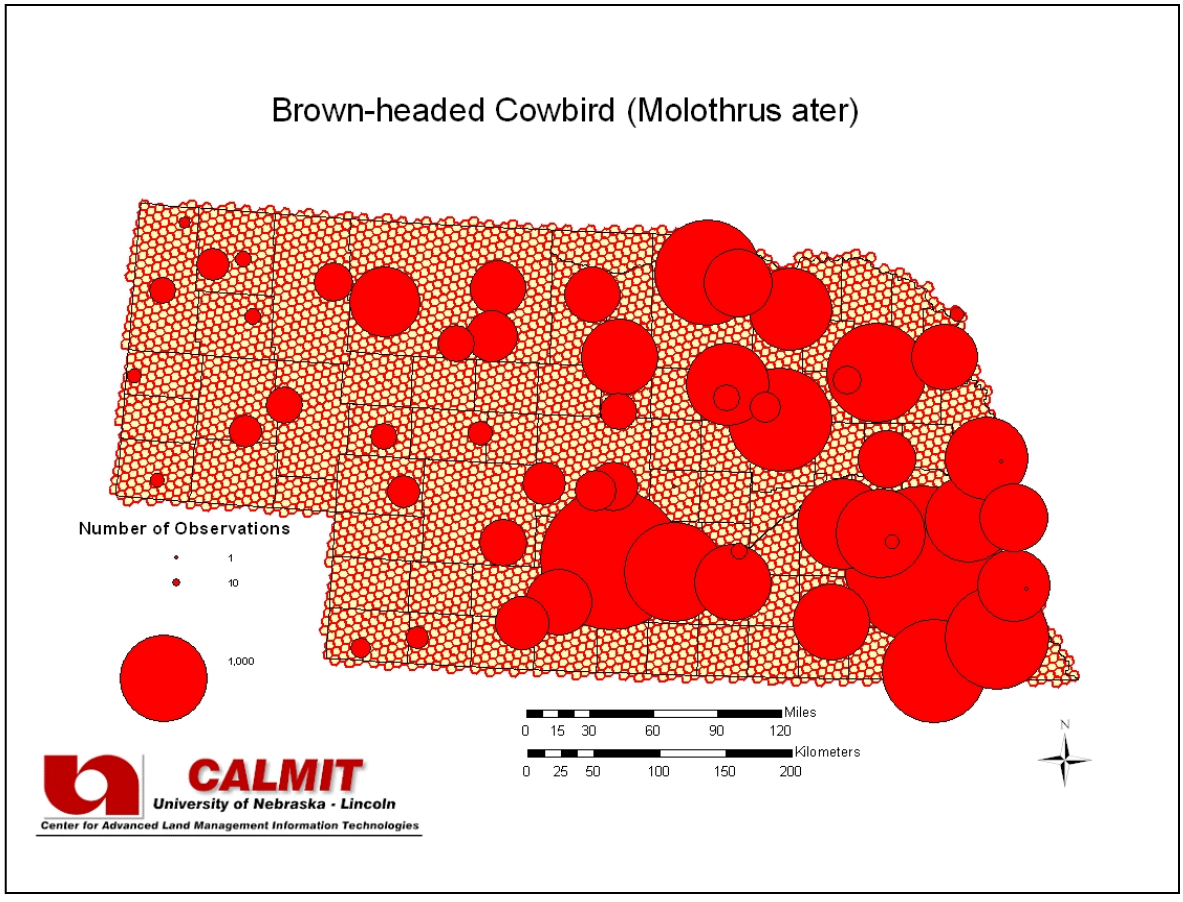
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Brown-headed Cowbird**	TNC Global Status:	G5
Scientific Name:	***Molothrus ater***	Federal Status:	--
TNC Element Code:	ABPBXB7030	State (NE) Status:	S5
AOU Code:	04950		

Habitat Description:
Breeding usually occurs in woodland edges, brushy thickets and other habitats where low and scattered trees are interspersed with grasslands (Johnsgard 1997). Found nearly everywhere except in urban situations; most abundant in grassland and farmland settings (Mollhoff 2001). Preferred habitat is edge and thickets, but species has adapted to a wide range of habitat types, from grassland to woodland (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



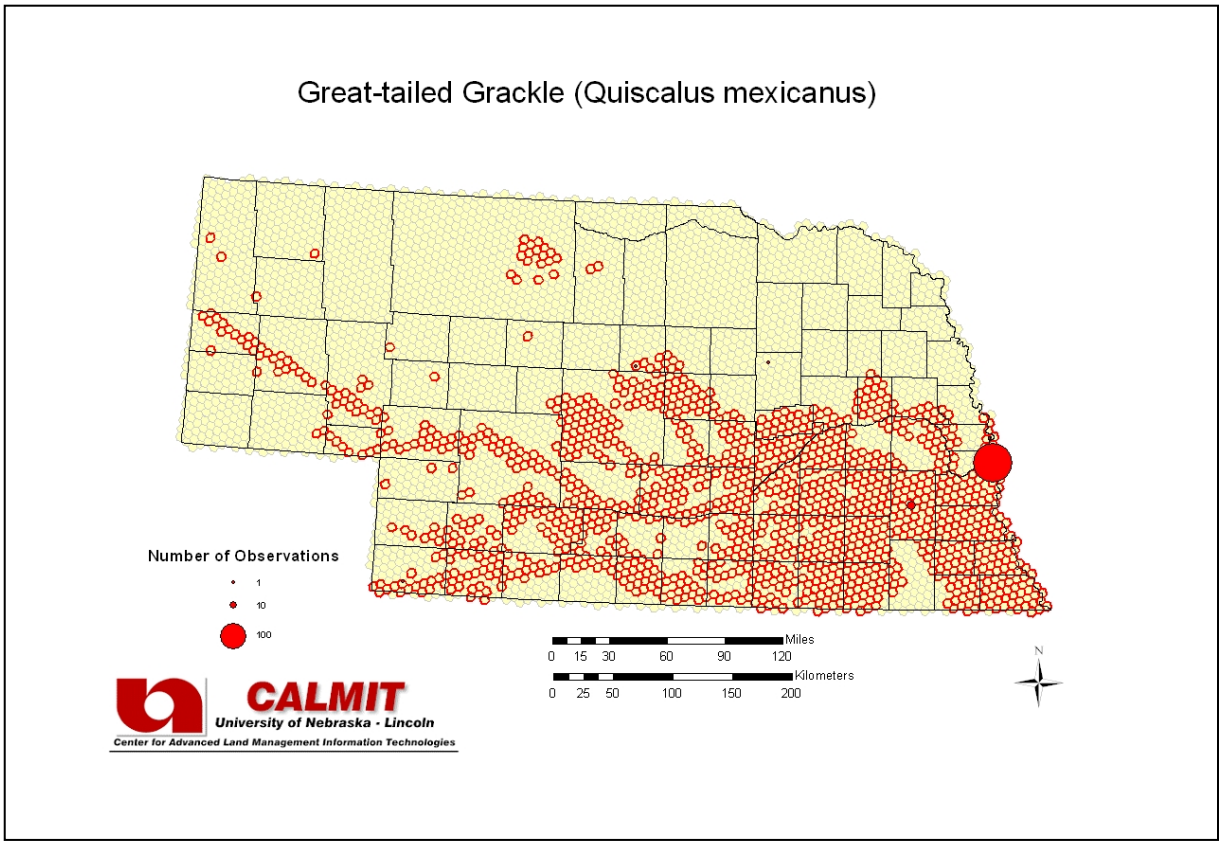
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Great-tailed Grackle**	TNC Global Status:	G5
Scientific Name:	***Quiscalus mexicanus***	Federal Status:	--
TNC Element Code:	ABPBXB6050	State (NE) Status:	S?N
AOU Code:	05120		

Habitat Description:
The species uses a variety of habitats (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001). Breeding in Nebraska is usually associated with wetlands, especially cattail marshes, but it has also been found in residential park-like settings and cedar windbreaks, well away from any water. Given the wide latitude of acceptable habitat and its abundance in the state, it seems likely that the species will continue to expand in the state, very likely in competition with other species (Mollhoff 2001). Most Nebraska reports are from the south-central and southeast part of the state, where breeding occurs in widely scattered colonies, often involving new sites (Dinsmore and Dinsmore 1993, Sharpe et al. 2001). Since 1977 nesting has been regularly reported from an area of southeast Nebraska bounded by Phelps, Buffalo, Hall, and Lancaster Counties, with most reports from the Rainwater Basin.

Total Area of Modeled Habitat (ha): 5,331,839

Model Description:
Adequate model could not be resolved using QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Hydric Soil is present' AND 'Land Cover class Deciduous Forests and Woodlands > 0.5%' AND 'June Growing Degree Days Weighted Average Coefficient of Variation ≤ 21%'. Extent clipped to southeastern and central counties, the area of known breeding records (Sharpe et al. 2001).



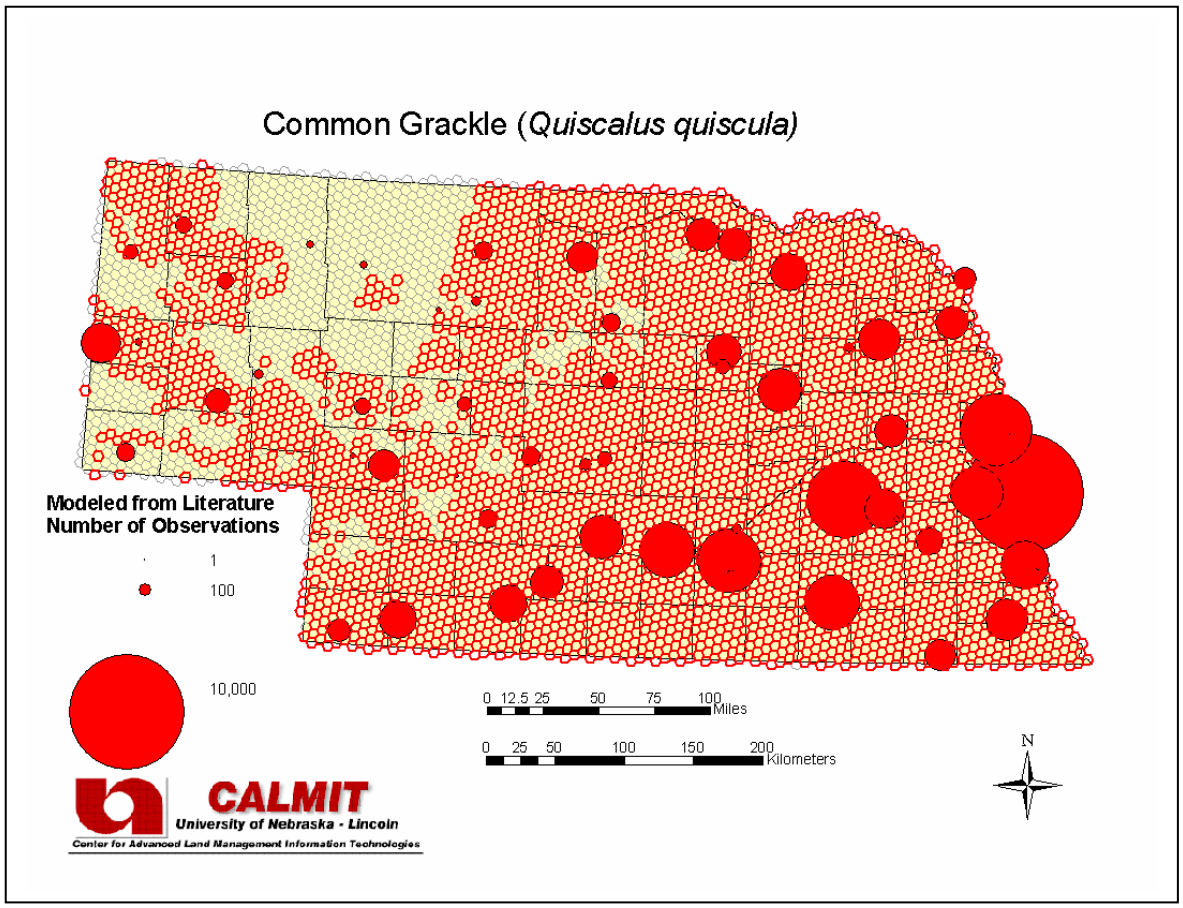
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Common Grackle**	TNC Global Status:	G5
Scientific Name:	***Quiscalus quiscula***	Federal Status:	--
TNC Element Code:	ABPBXB6070	State (NE) Status:	S5
AOU Code:	05110		

Habitat Description:
Frequent woodland edges or areas partially planted to trees, such as residential areas, parks, farmsteads, and shelterbelts (Johnsgard 1997, Sharpe et al. 2001). Occur statewide, but are most numerous in southern and eastern Nebraska (Mollhoff 2001). Found most often in woodland edge habitat, along wood margins, in the brushy scattered trees along creeks, in newly planted conifers and around any sort of human habitation.

Total Area of Modeled Habitat (ha): 1.57×10^7

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Deciduous Forests and Woodlands is present'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

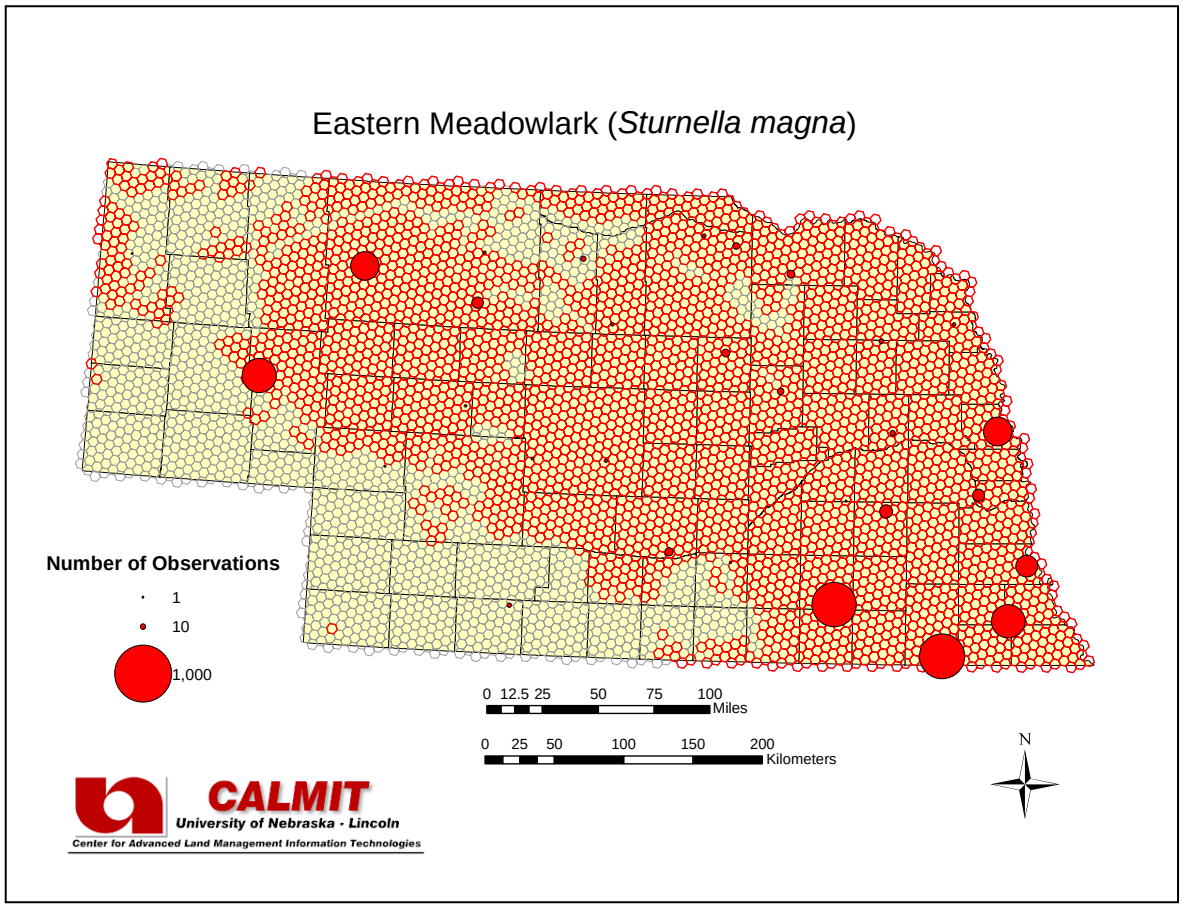
Common Name:	**Eastern Meadowlark**	TNC Global Status:	G5
Scientific Name:	***Sturnella magna***	Federal Status:	--
TNC Element Code:	ABPBXB2020	State (NE) Status:	S5
AOU Code:	05010		

Habitat Description:
Breeding birds are most numerous south of the Platte River in the southeast, where they occupy pastures, prairie remnants, open croplands of small grain, and other grasslands (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001). There is also a significant population breeding throughout the Sandhills at the western edge of its range, where wet meadows and other low-lying grasslands are utilized (Johnsgard 1997, Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.39×10^7

Model Description:
Modeled distribution using the set of variables 'Land Cover class Fallow Agricultural Fields $\leq$ 0.5%' AND 'Land Cover class Ponderosa Pine Forests and Woodlands $\leq$ 0.15%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



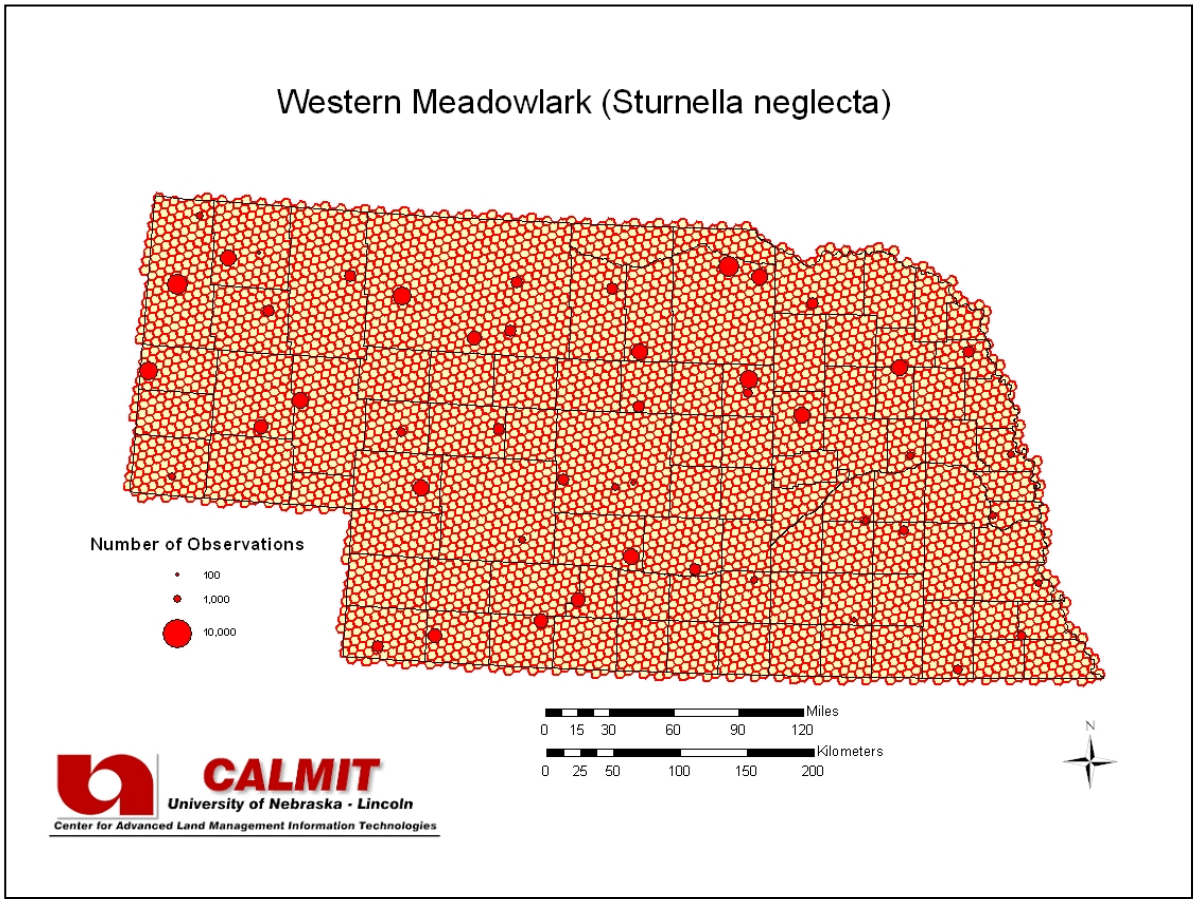
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Western Meadowlark**	TNC Global Status:	G5
Scientific Name:	***Sturnella neglecta***	Federal Status:	--
TNC Element Code:	ABPBXB2030	State (NE) Status:	S5
AOU Code:	05011		

Habitat Description:
Common summer resident virtually throughout Nebraska, except perhaps in the extreme southeast (Johnsgard 1997). Associated with tall-grass and mixedgrass prairies, hayfields, wet meadows, the weedy borders of croplands, retired croplands, and, to a limited extent, moister areas of shortgrass and sage-dominated plains. Breeds commonly statewide in all types of grasslands and agricultural areas, least common in the extreme southeast (Sharpe et al. 2001). Breeds most abundantly in native prairie (Mollhoff 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



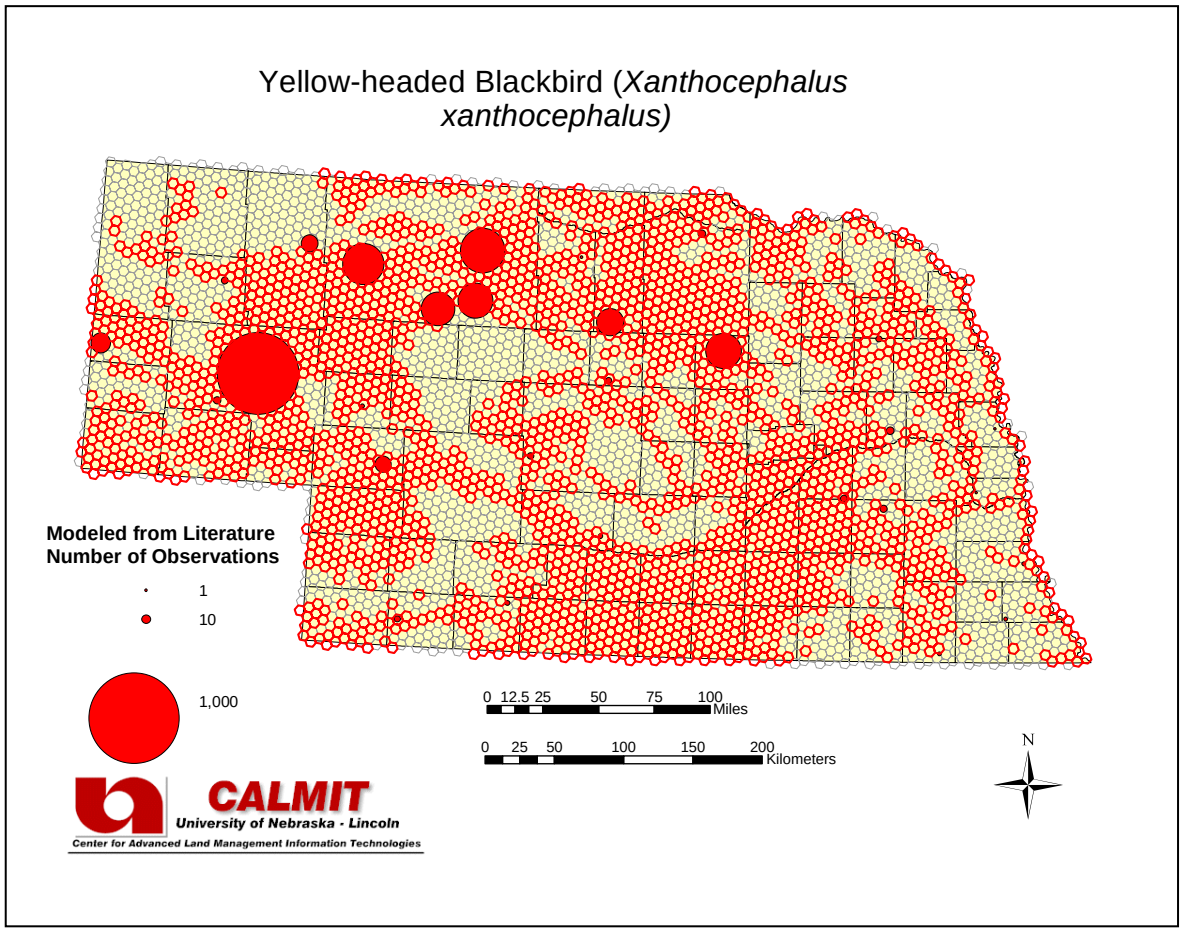
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Yellow-headed Blackbird**	TNC Global Status:	G5
Scientific Name:	***Xanthocephalus xanthocephalus***	Federal Status:	--
TNC Element Code:	ABPBXB3010	State (NE) Status:	S4
AOU Code:	04970		

Habitat Description:
A locally common summer resident in permanent marshes throughout Nebraska (Johnsgard 1997). During the breeding season this species occurs in deep marshes, the marsh zones of lakes, shallow impoundments and elsewhere where there are extensive stands of cattails, bulrushes or phragmites. In Nebraska, found in scattered locations statewide (Mollhoff 2001).

Total Area of Modeled Habitat (ha): 1.10×10^7

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Emergent Wetland > 0.25%'. Distribution was supported by Breeding Bird Survey observations.



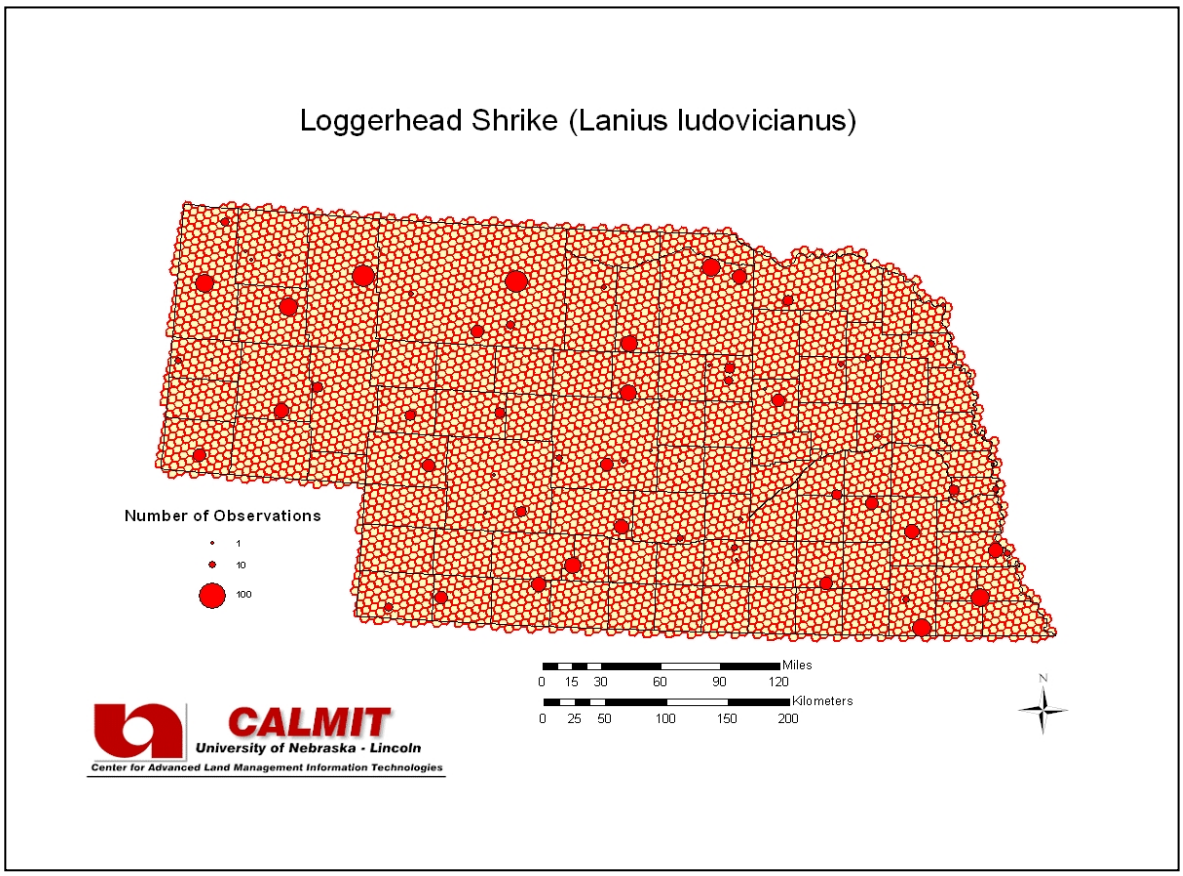
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Loggerhead Shrike**	TNC Global Status:	G4T3Q
Scientific Name:	***Lanius ludovicianus***	Federal Status:	--
TNC Element Code:	ABPBR01030	State (NE) Status:	S?
AOU Code:	06220		

Habitat Description:
Breeding habitat includes open native grassland areas with a scattering of small trees and brush that provide nesting sites, especially in the Sandhills and in dry pasture canyons (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001). This species can be found statewide however they occur in higher numbers and increased frequency in more arid, open country as well as in summer breeding habitat where agriculture is less intensive leading to reduced disturbance. Loggerhead shrikes occur in lower numbers in the eastern third of the state (Mollhoff 2001, Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description: statewide
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

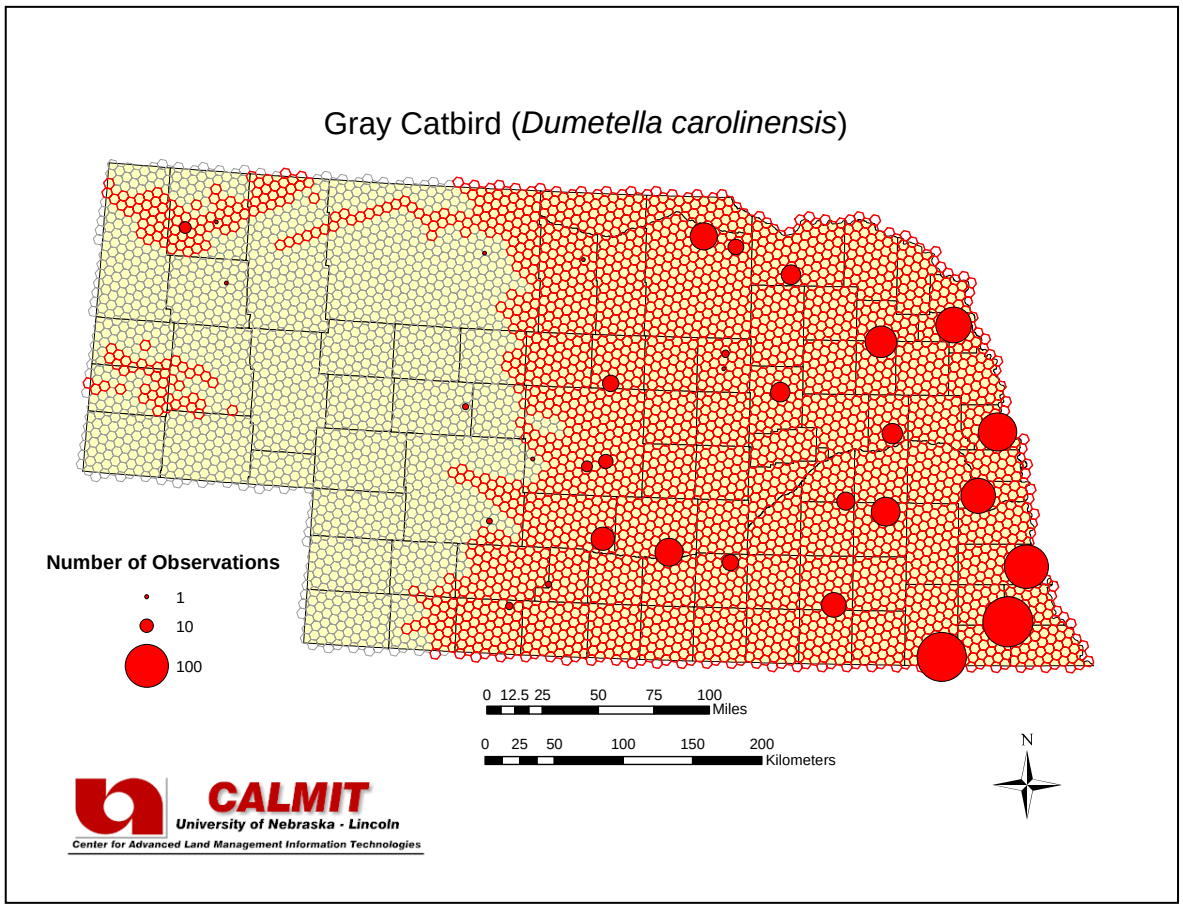
Common Name:	**Gray Catbird**	TNC Global Status:	G5
Scientific Name:	***Dumetella carolinensis***	Federal Status:	--
TNC Element Code:	ABPBK01010	State (NE) Status:	S5
AOU Code:	07040		

Habitat Description:
Favors brushy habitats, often near water especially riparian settings and associated with woodland edge such as shrubby marsh borders, orchards, parks, shelterbelts and thickets (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001). The stratum of low-growing gray dogwood that commonly develops in mature riparian forest is especially suitable habitat (Sharpe et al. 2001). Occurs primarily in eastern Nebraska where their desired habitat is most developed.

Total Area of Modeled Habitat (ha): 1.31×10^7

Model Description:
Modeled distribution using the set of variables 'Elevation $\leq$ 870 m' OR 'Elevation > 870 m' AND 'Land Cover class Ponderosa Pine Forests and Woodlands > 1%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



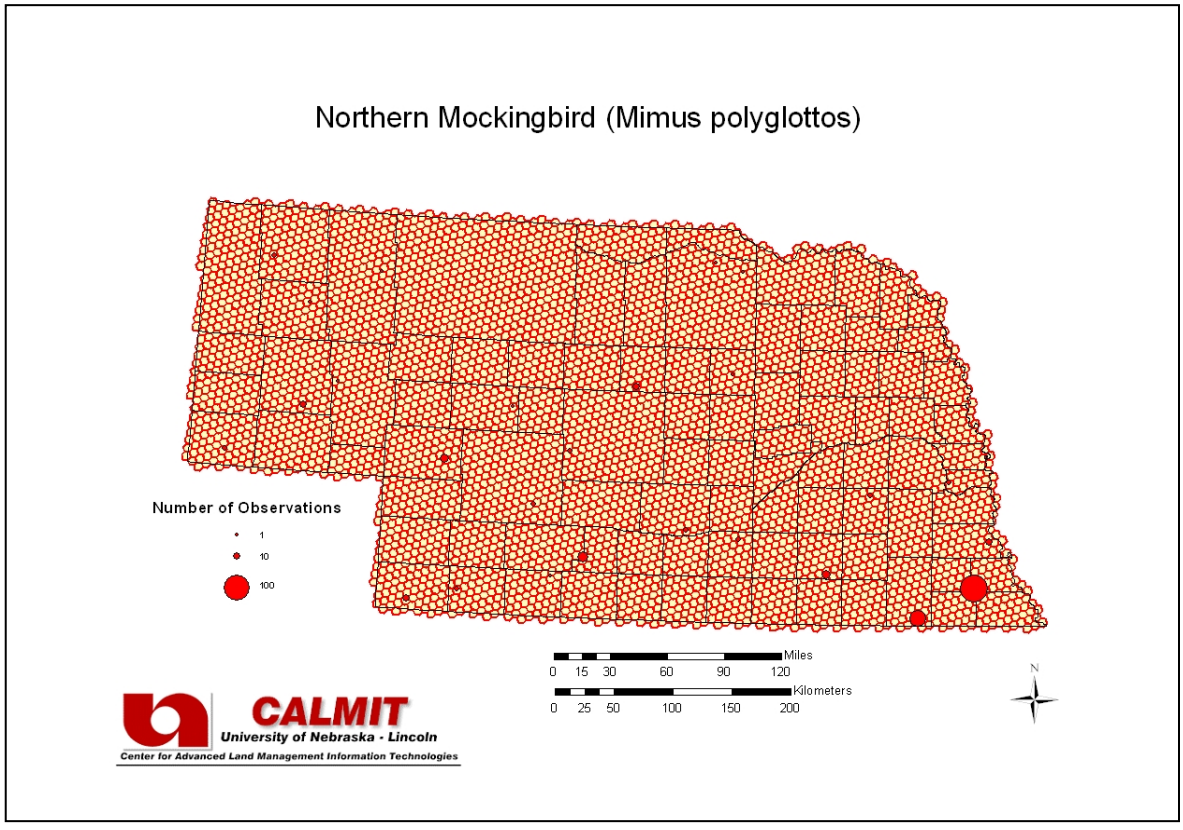
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Northern Mockingbird**	TNC Global Status:	G5
Scientific Name:	***Mimus polyglottos***	Federal Status:	--
TNC Element Code:	ABPBK03010	State (NE) Status:	S4
AOU Code:	07030		

Habitat Description:
The Northern Mockingbird is an uncommon regular breeder statewide but found in limited numbers north of the Platte River (Mollhoff 2001, Sharpe et al. 2001). This species occupies a variety of habitats ranging from open woodlands, forest edges, and areas of grass and cropland mixed with patches of brush, brushy ravines, or pasture partially overgrown with red cedars to parks and cities. There was some affinity to river valleys, probably due more to the availability of brush and cedars on the valley margins than to the riparian woodland itself. Areas consisting of heavy forest and treeless grassland are avoided. Found statewide in these habitats, it is nowhere numerous (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description: statewide
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



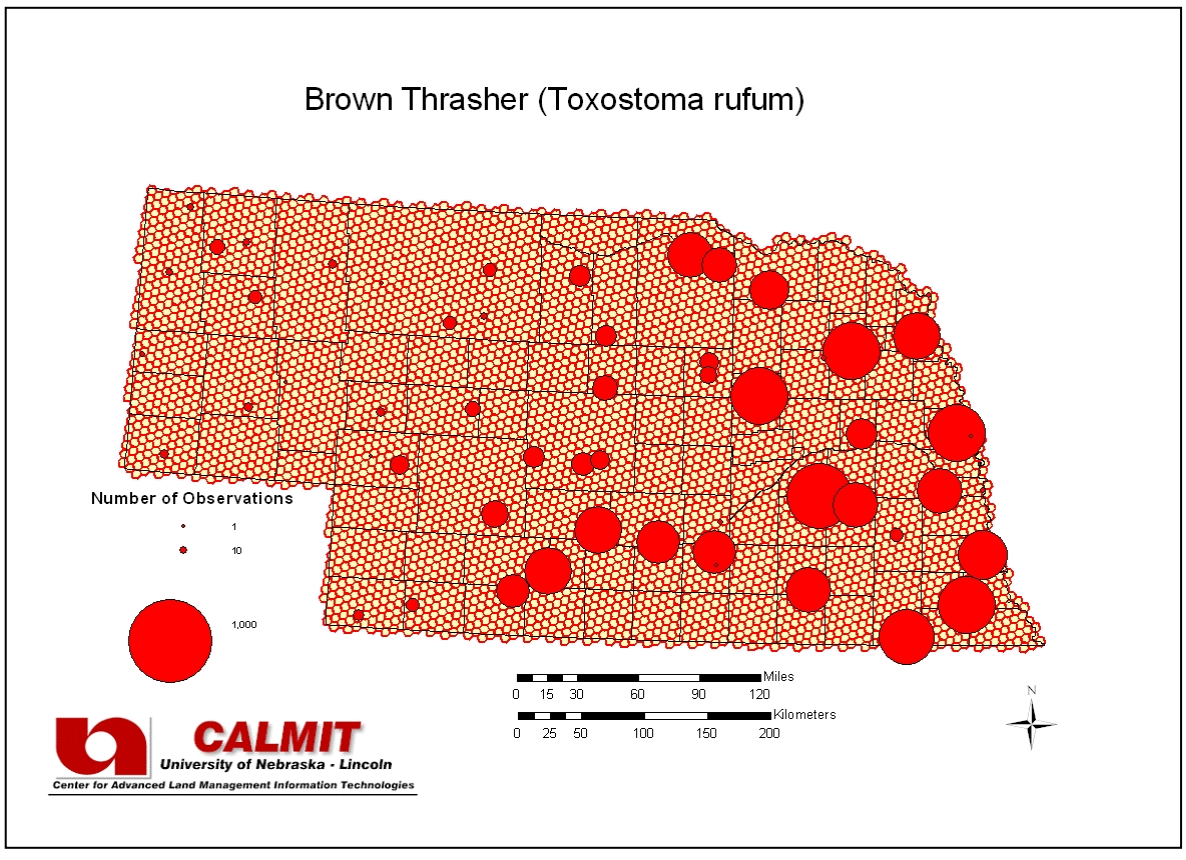
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Brown Thrasher**	TNC Global Status:	G5
Scientific Name:	***Toxostoma rufum***	Federal Status:	--
TNC Element Code:	ABPBK06010	State (NE) Status:	S5
AOU Code:	07050		

Habitat Description:
Frequents open brushy woods, scattered patches of brush and small trees in open environments, shelterbelts, woodlands, and shrubby residential areas (Johnsgard 1997). Typical woodland edge-brushy filed margin species, usually frequenting thickets and woodland edge (Mollhoff 2001). Found in edge habitats where dense brush and small trees predominate; in the Panhandle habitat primarily riparian, but also found in towns and around farmsteads, while in the east, woodland edges provide best habitat (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

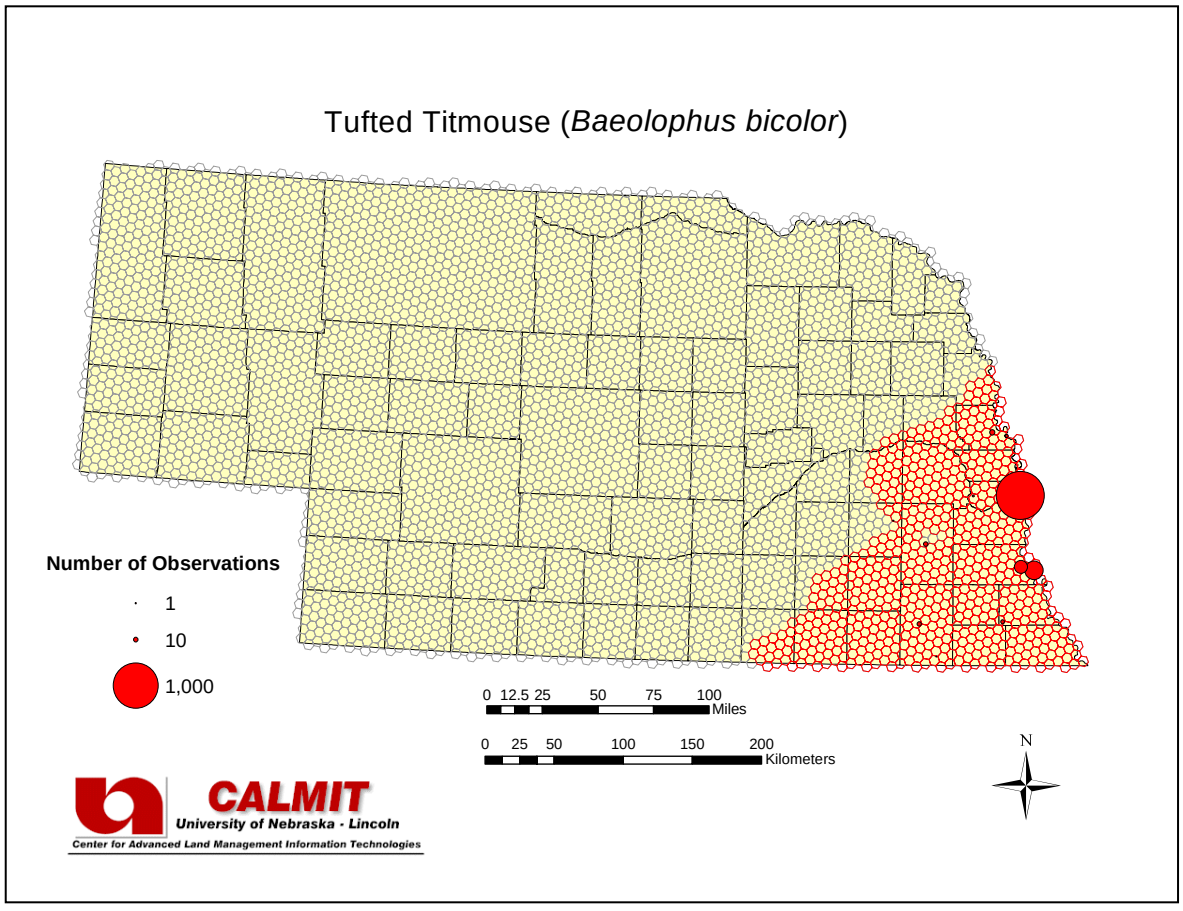
Common Name:	**Tufted Titmouse**	TNC Global Status:	G5
Scientific Name:	***Baeolophus bicolor***	Federal Status:	--
TNC Element Code:	ABPAW01110	State (NE) Status:	S3
AOU Code:	07310		

Habitat Description:
Restricted to mature oak-hickory woodland and forest in the southeast but may utilized immediately adjacent riparian woods. Currently the breeding range is restricted to counties bordering the Missouri River north to Washington Co. and west in decreasing numbers to Lancaster, Saline, and Thayer counties (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 2,680,100

Model Description:
Modeled distribution using the variable 'Average 30-year Precipitation for September > 87.5 mm'.

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



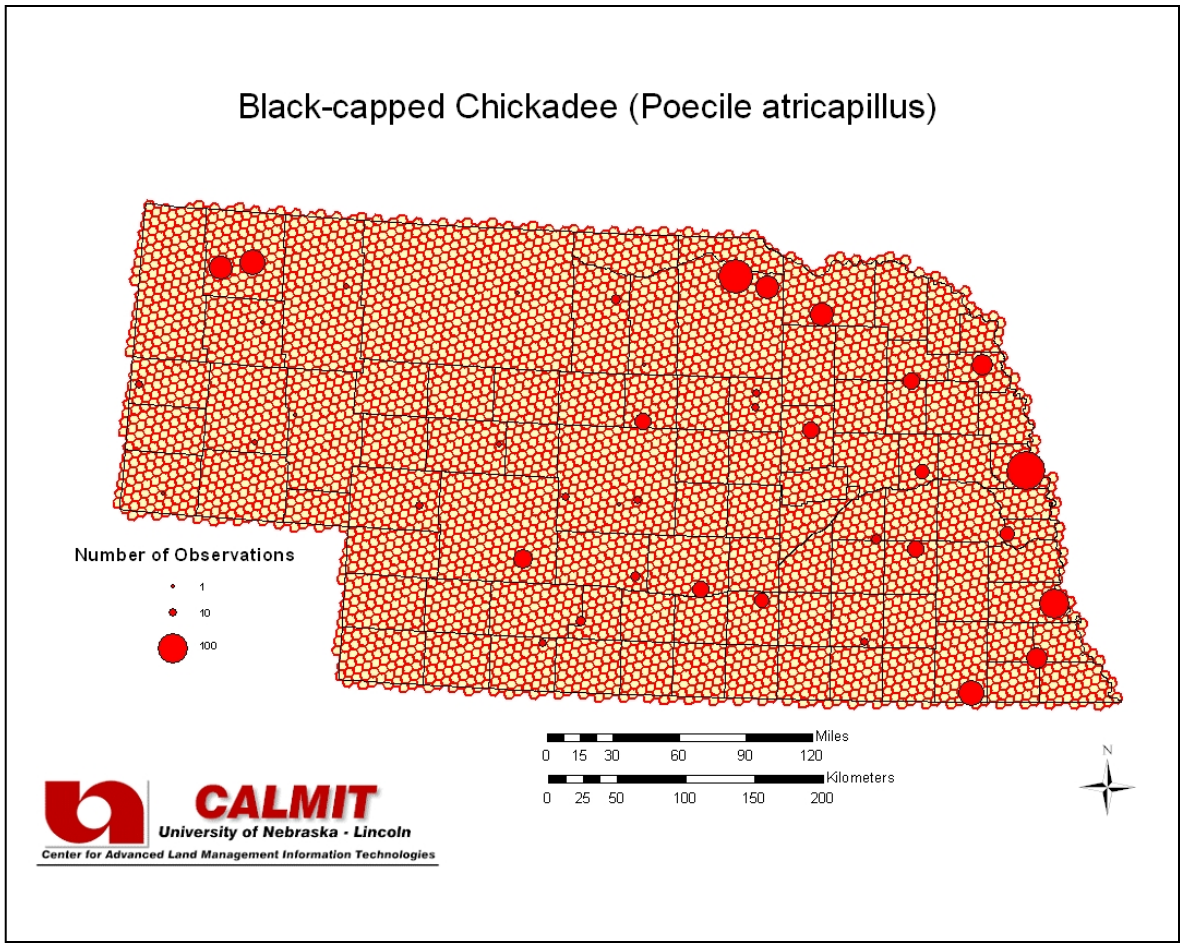
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Black-capped Chickadee**	TNC Global Status:	G5
Scientific Name:	***Poecile atricapillus***	Federal Status:	--
TNC Element Code:	ABPAW01010	State (NE) Status:	S5
AOU Code:	07350		

Habitat Description:
Found in deciduous and coniferous forests, as well as orchards and woodlots (Johnsgard 1997); in a variety of woodland habitats, from oak-hickory and riparian woodlands in the southeast, to coniferous Pine Ridge woodland in the northwest; also uses shelterbelts, groves of cottonwoods and residential areas (Mollhoff 2001, Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

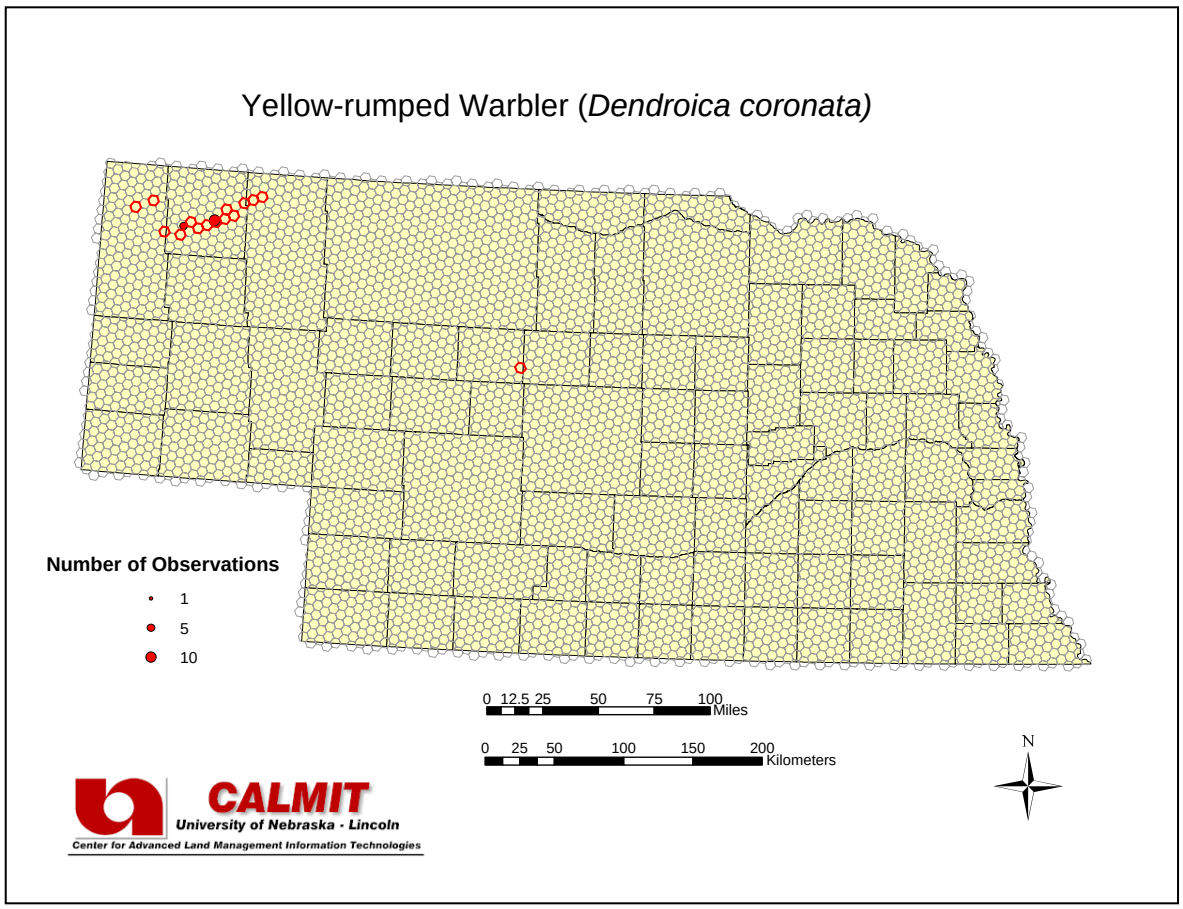
Common Name:	**Yellow-rumped Warbler**	TNC Global Status:	G5
Scientific Name:	***Dendroica coronata***	Federal Status:	--
TNC Element Code:	ABPBX03060	State (NE) Status:	S4
AOU Code:	06556		

Habitat Description:
Nests in forests or open woodlands. A summer resident in the Pine Ride area (Johnsgard 1997, Mollhoff 2001). Breeding birds occupy coniferous forests and usually nest in scattered trees, rather than in dense forest. Restricted to the ponderosa pine forest of the western Pine Ridge (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 60,821

Model Description:
Modeled distribution using the variable 'Land Cover class Ponderosa Pine Forests and Woodlands > 32.5%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



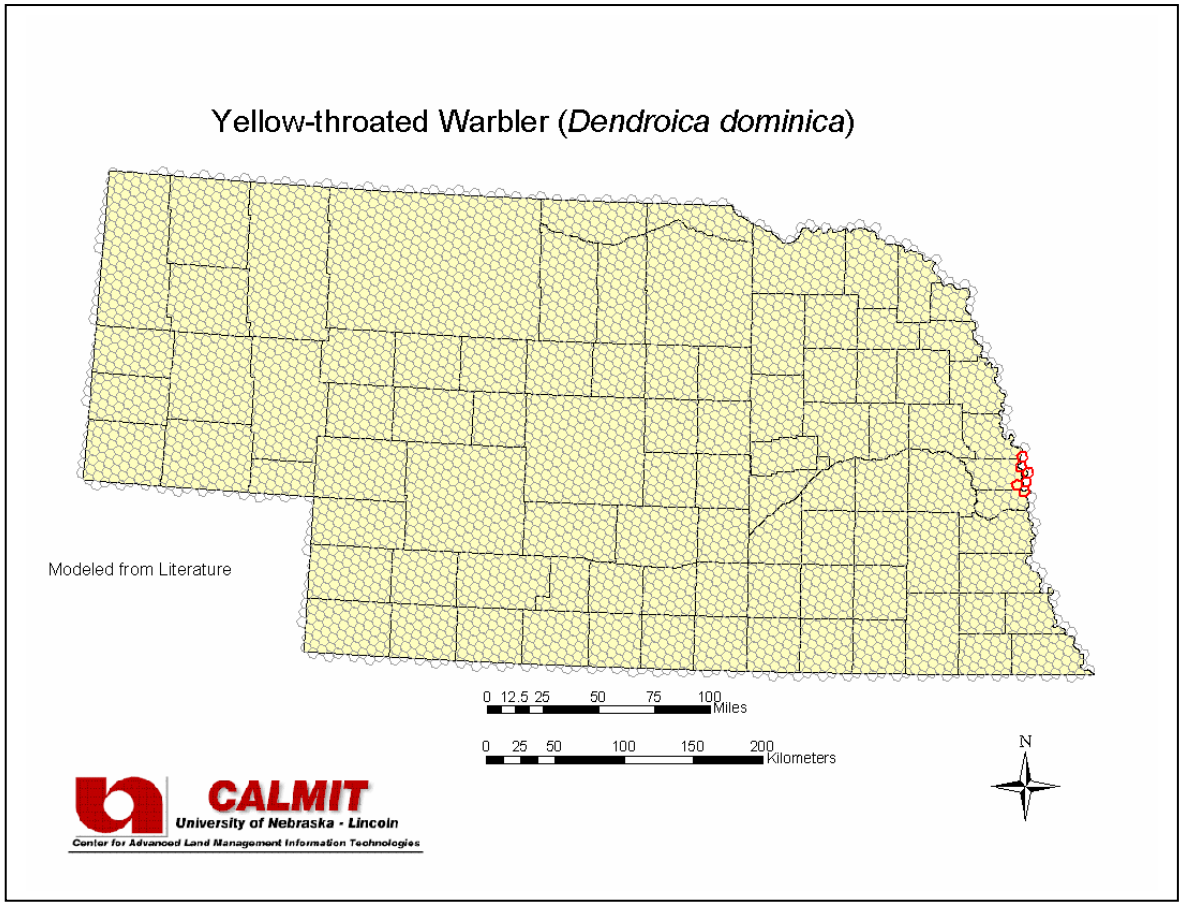
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Yellow-throated Warbler**	TNC Global Status:	G5
Scientific Name:	***Dendroica dominica***	Federal Status:	--
TNC Element Code:	ABPBX03130	State (NE) Status:	S?N
AOU Code:	06630		

Habitat Description:
Local breeding population may be present in Fontenelle Forest (Johnsgard 1997). Prefers large trees along riverbanks, swamps, and bottomlands, as well as open stands of pines, live oaks, and mixed forests (DeGraff and Rappole 1995). This species is probably limited as a breeding bird, therefore, to areas in the lower Missouri Valley. Breeding reported only at Fontenelle Forest since 1981 and at Neale Woods since 1997 (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 24,327

Model Description:
No observational data were available for this species. Modeled from literature using the variable 'Land Cover class Riparian Woodland is present'. Extent clipped to area of recent breeding records- Fontenelle Forest and Neale Woods near the Missouri River (Sharpe et al. 2001).



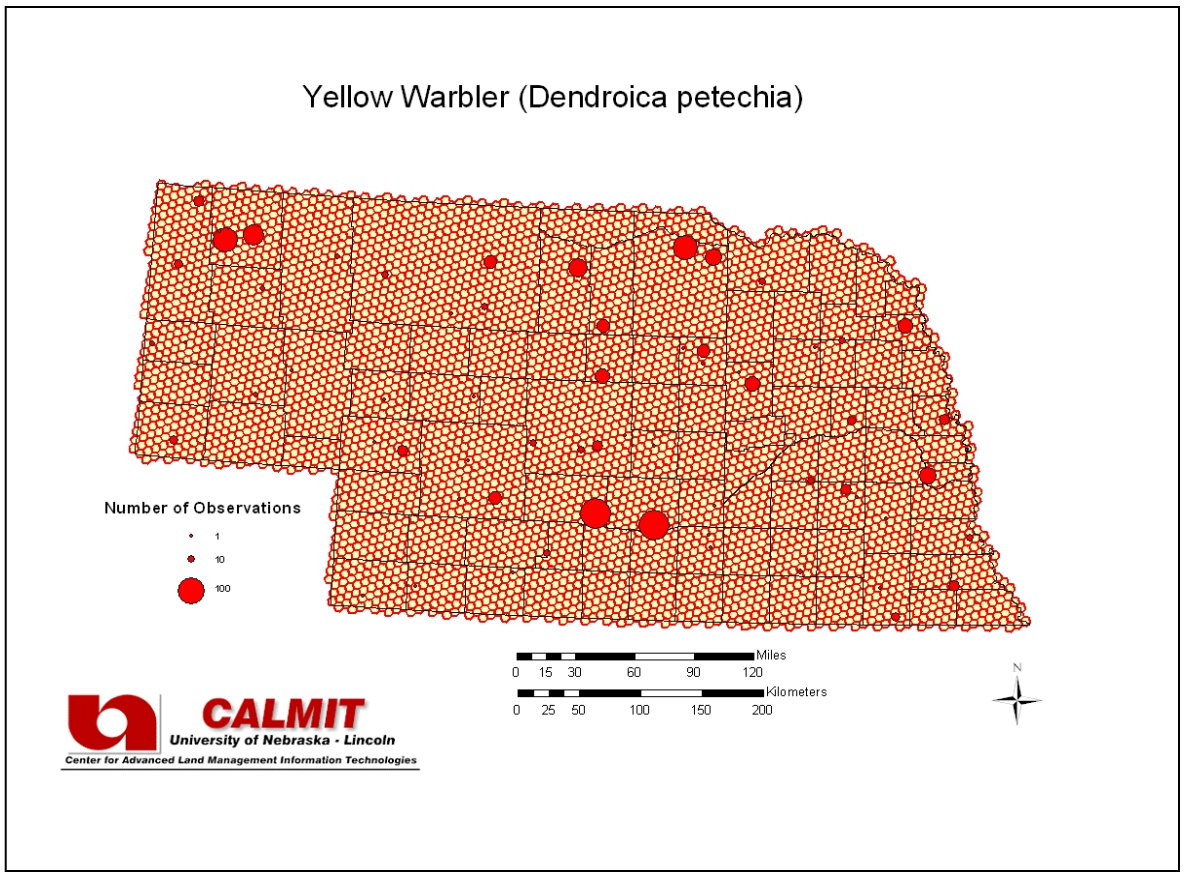
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Yellow Warbler**	TNC Global Status:	G5
Scientific Name:	***Dendroica petechia***	Federal Status:	--
TNC Element Code:	ABPBX03010	State (NE) Status:	S5
AOU Code:	06520		

Habitat Description:
Common summer resident statewide (Johnsgard 1997). During the breeding season birds prefer rather wet habitats, such as brushy edges of swamps, marshes or creeks, but will also nest in roadside thickets, hedgerows, orchards, and forest edges, avoiding both heavy forests and grassy environments. Also occasionally reported in dry upland edge habitat (Mollhoff 2001). In the eastern Sandhills it was one of the characteristic birds of brushy swamps with a scattering of small trees. Breeds statewide in riparian brush and thickets, esp. willows, and less commonly in upland thickets. Most numerous along major rivers and streams (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



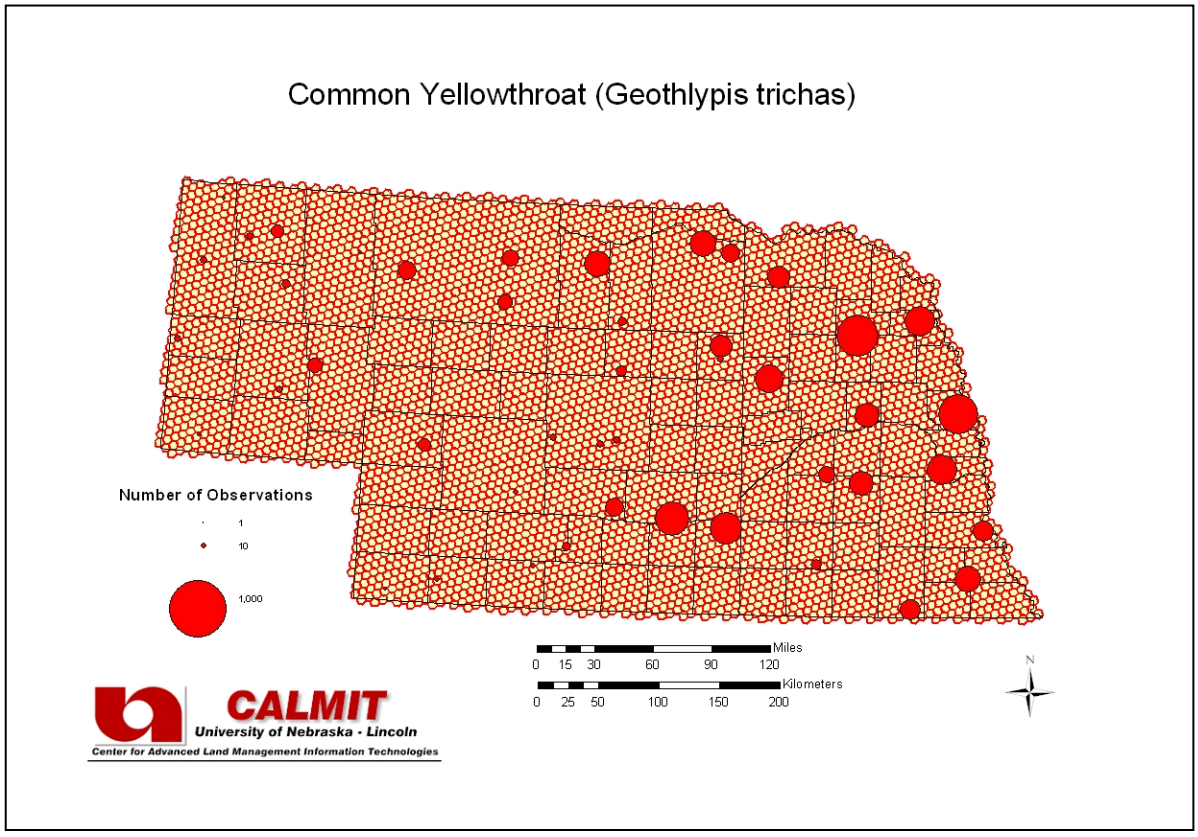
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Common Yellowthroat**	TNC Global Status:	G5
Scientific Name:	***Geothlypis trichas***	Federal Status:	--
TNC Element Code:	ABPBX12010	State (NE) Status:	S5
AOU Code:	06810		

Habitat Description:
Common statewide near moist or aquatic sites (Johnsgard 1997). Found in a variety of wetland settings; most common in swamps with mixed false indigo and willow brush interspersed with cattails; also commonly found in marshes without standing water and even in dry brushy weedy upland ravines (Mollhoff 2001). Breeds commonly statewide in wet marshy meadows or marsh edge habitats, especially those associated with cattail marshes (Sharpe et al. 2001). Decline in breeding bird density westward.

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

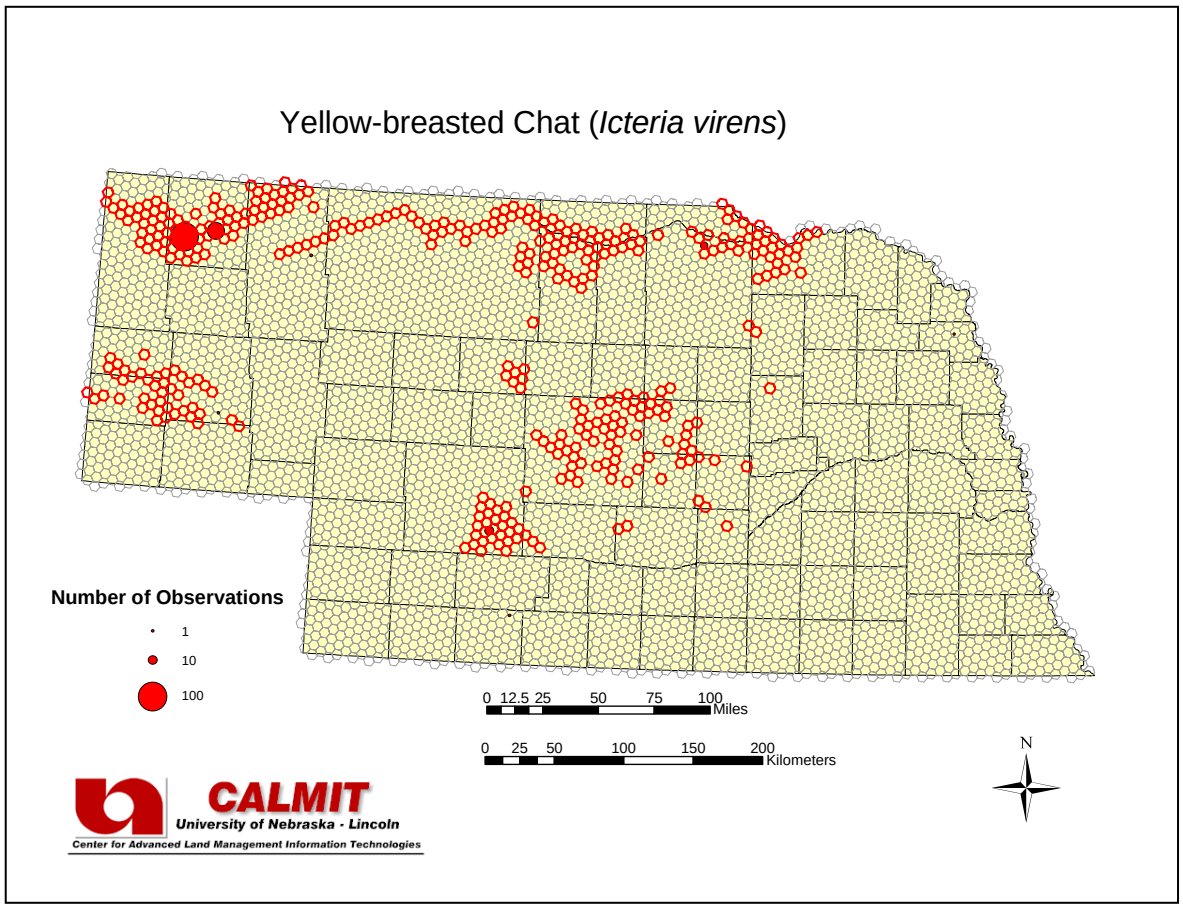
Common Name:	**Yellow-breasted Chat**	TNC Global Status:	G5
Scientific Name:	***Icteria virens***	Federal Status:	--
TNC Element Code:	ABPBX24010	State (NE) Status:	S5
AOU Code:	06830		

Habitat Description:
Breeding birds usually favor ravine or streamside thickets, especially those with small trees and tall shrubs, as well as forest edges, dense stands of tree saplings, and clumps of shrubs in overgrazed pastures (Johnsgard 1997, Mollhoff 2001). Found in dense thickets and brush, usually riparian; breeding populations have declined in the east and it has disappeared from the southeast (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1,573,193

Model Description:
Modeled distribution using the set of variables 'Land Cover class Ponderosa Pine Forests and Woodlands > 1%' OR 'Land Cover class Juniper Woodlands > 4%'.

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

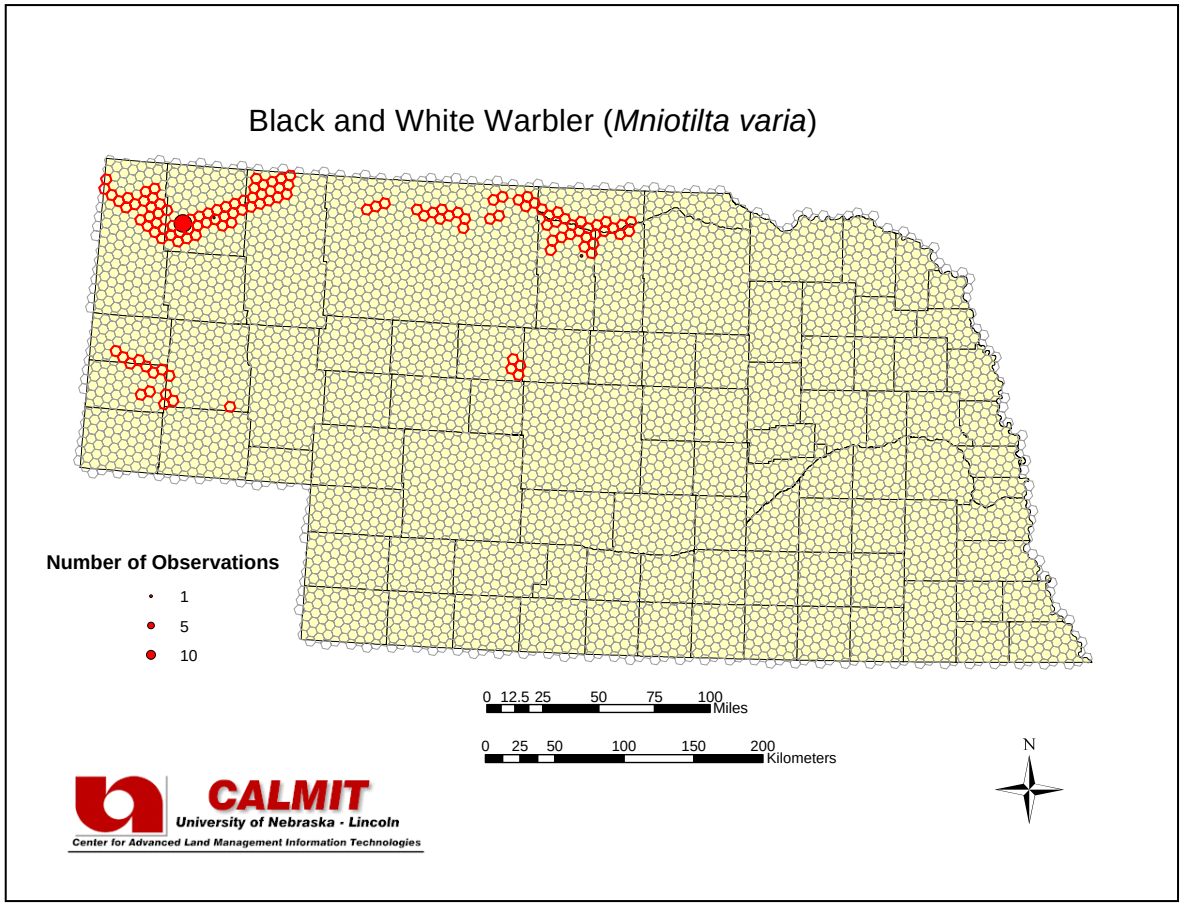
Common Name:	**Black and White Warbler**	TNC Global Status:	G5
Scientific Name:	***Mniotilta varia***	Federal Status:	--
TNC Element Code:	ABPBX05010	State (NE) Status:	S3
AOU Code:	06360		

Habitat Description:
Nests in semi-open upland stands of deciduous or coniferous forest (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 506,831

Model Description:
Modeled distribution using variable 'Land Cover class Ponderosa Pine Forests and Woodlands > 5%'.

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



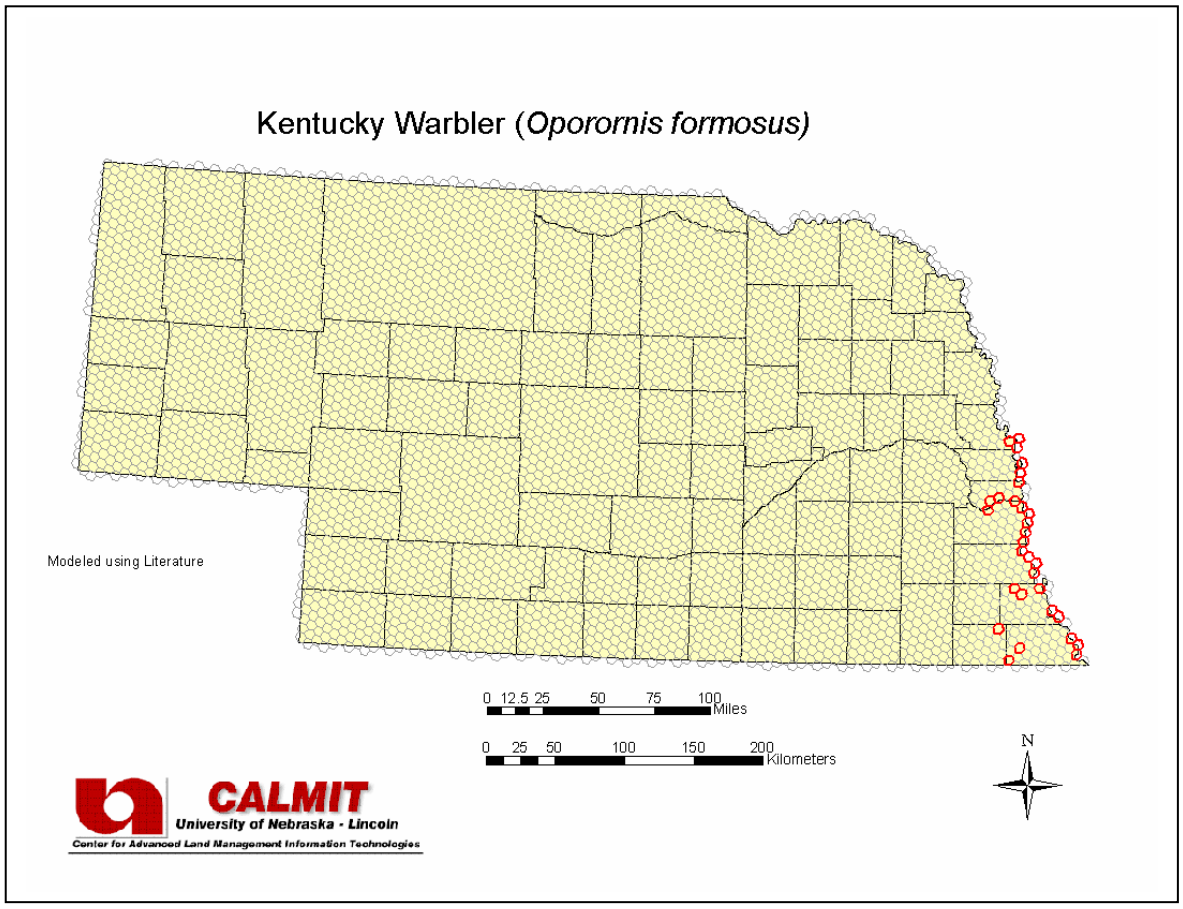
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Kentucky Warbler**	TNC Global Status:	G5
Scientific Name:	***Oporornis formosus***	Federal Status:	--
TNC Element Code:	ABPBX11010	State (NE) Status:	S3
AOU Code:	06770		

Habitat Description:
Nests in shrubby moist ravines and bottomlands (Johnsgard 1997). Occupies dense upland forest, primarily oak-hickory, where a shrubby forest-floor understory has developed beneath a closed canopy (Sharpe et al. 2001). This habitat is present in larger tracts of upland forest that are associated with the Missouri Valley and is the locale of most reports. Present in suitable breeding habitat most years in the Missouri Valley, where the population appears to be increasing. Records from Douglas, Sarpy, Nemaha, and Richardson Counties.

Total Area of Modeled Habitat (ha): 121,639

Model Description:
No observational data were available for this species. Modeled from literature using the set of variables 'Land Cover class Riparian Woodland > 0.05%' AND 'Land Cover class Riparian Shrubland > 0.05%', clipped to the southeast corner of the state (Nemaha and Richardson Counties), north to Douglas and Sarpy Counties, according to reported breeding records (Sharpe et al. 2001).



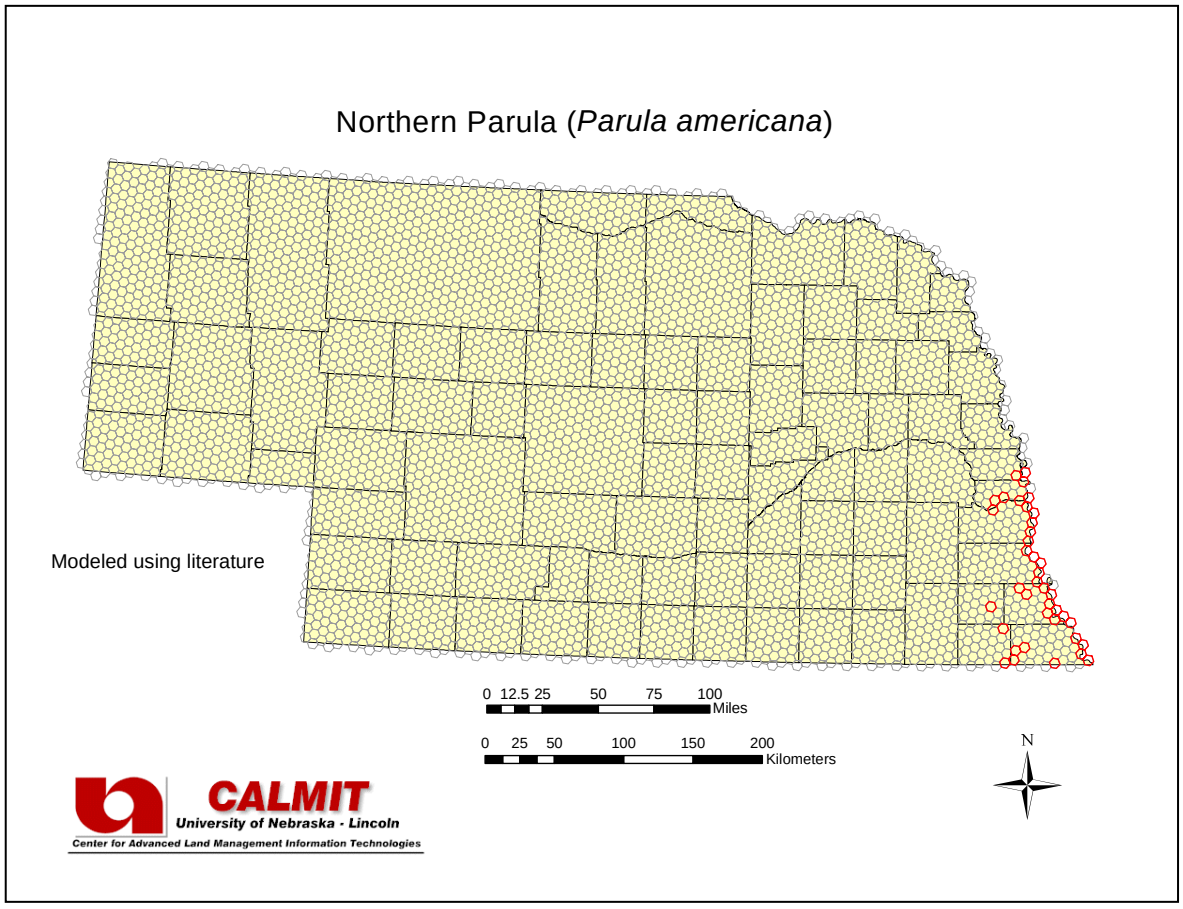
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Northern Parula**	TNC Global Status:	G5
Scientific Name:	***Parula americana***	Federal Status:	--
TNC Element Code:	ABPBX02010	State (NE) Status:	--
AOU Code:	06480		

Habitat Description:
This species prefers swampy riparian woodland as breeding habitat but in migration occurs in all types of woodland, spending most of its time in the canopy (DeGraff and Rappole 1995; Johnsgard 1997; Sharpe et al. 2001). Spanish moss or *Usnea* lichens are preferred for nesting material or nesting sites (DeGraff and Rappole 1995, Johnsgard 1997). Breeding only occurs in southeastern counties of Nebraska (i.e. Sarpy, Nemaha, and Richardson) and Indian Cave State Park. Most reports are from the Missouri Valley, where it occurs in summer in small numbers and it may be found in the Fontenelle Forest (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 158,131

Model Description:
No observational data were available for this species. Modeled from literature using the variable 'Land Cover class Riparian Woodland is present'. Extent was clipped to the southeast corner of the state, the only area of known breeding records (Sharpe et al. 2001).



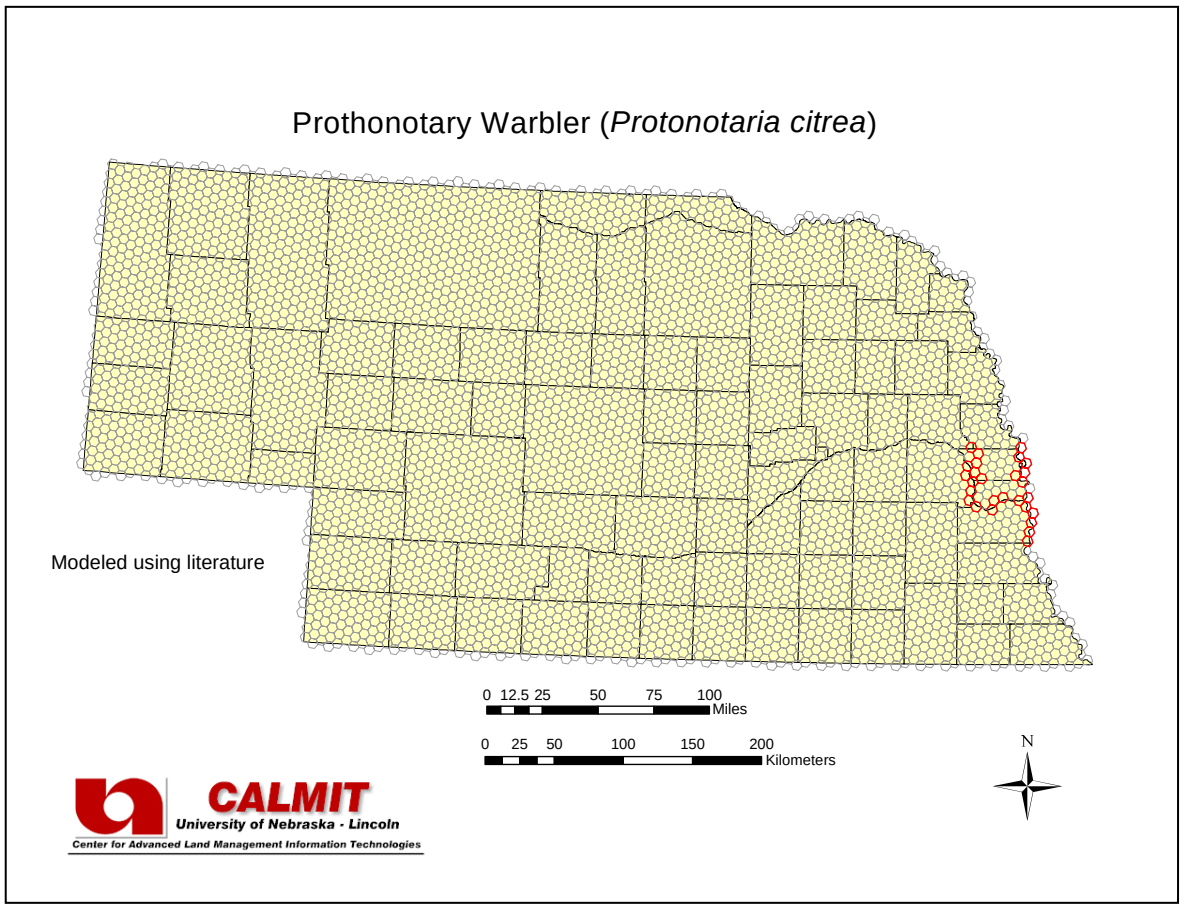
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Prothonotary Warbler**	TNC Global Status:	G5
Scientific Name:	***Protonotaria citrea***	Federal Status:	--
TNC Element Code:	ABPBX07010	State (NE) Status:	S2
AOU Code:	06370		

Habitat Description:
Nebraska lies on the western margin of this species range; therefore occurrences are found primarily along the Missouri River, mainly Sarpy and Cass counties. Individuals are rarely seen outside of breeding habitat (Mollhoff 2001, Sharpe et al. 2001). Oxbows surrounded by dense riparian woodland and flooded forests are the preferred habitats in eastern Nebraska (Mollhoff 2001, Sharpe et al. 2001). They are generally associated with moist bottomland or swampy deciduous forests, including woods that are frequently flooded, and willow-lined streamsides (Johnsgard 1997, DeGraff and Rappole 1995). This species is the only hole-nesting eastern wood warbler. Natural cavities are used for nests, including dead snags found in woodlands adjacent to standing or slow-moving water (Johnsgard 1997; DeGraff and Rappole 1995; Sharpe et al. 2001). Almost all recent observations have been in flooded riparian habitat in Fontenelle Forest (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 109,473

Model Description:
No observational data were available for this species. Modeled from literature using variable 'Land Cover class Riparian Woodland is present'. Extent was clipped to a few southeastern counties, the only areas of known breeding (Sharpe et al. 2001).



Nebraska GAP Analysis 2004
Bird Species Atlas

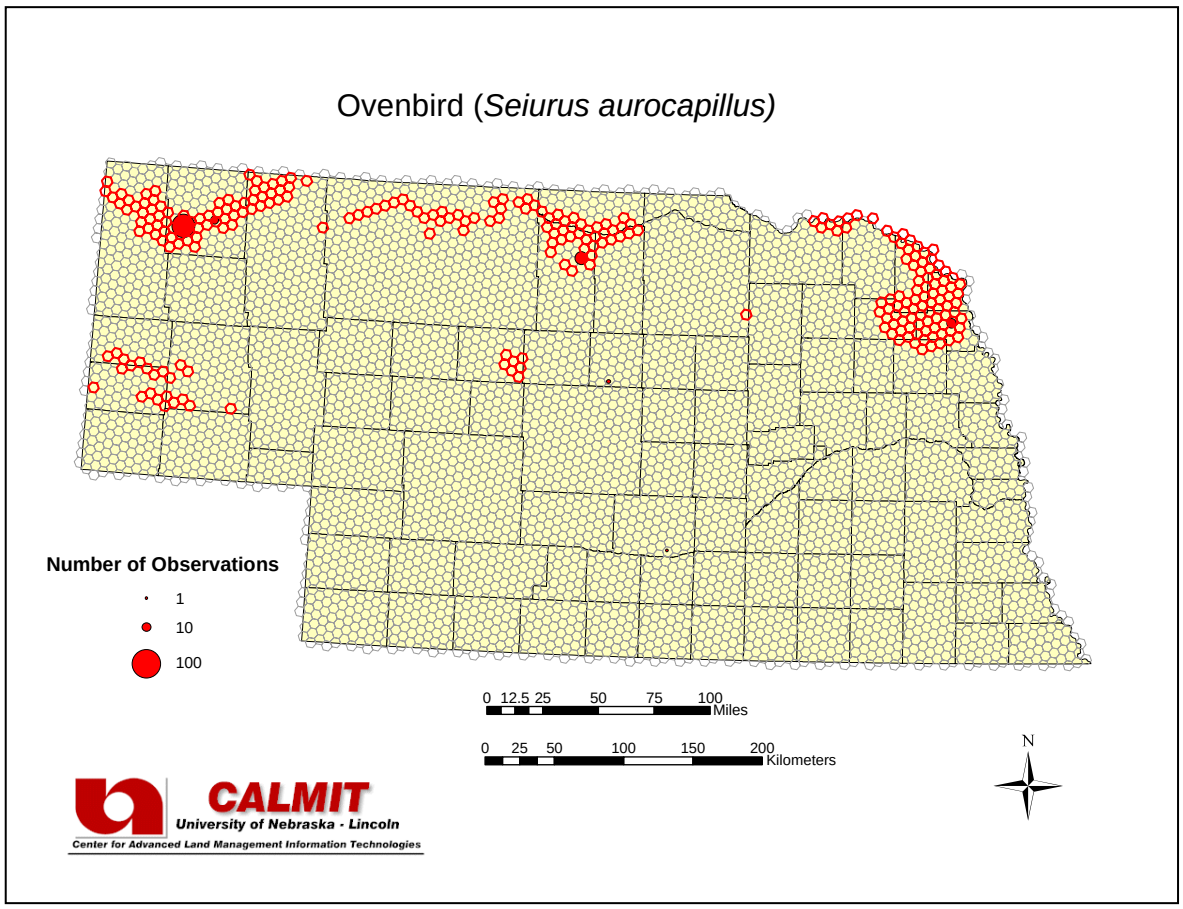
Common Name:	**Ovenbird**	TNC Global Status:	G5
Scientific Name:	***Seiurus aurocapillus***	Federal Status:	--
TNC Element Code:	ABPBX10010	State (NE) Status:	S4
AOU Code:	06740		

Habitat Description:
Locally common, mainly in the Missouri Valley, the Niobrara Valley west to Cherry County, and the Pine Ridge area (Johnsgard 1997, Mollhoff 2001). Birds are mostly limited to well-drained bottomland deciduous forests and to mature and shaded upland forests. Apparently absent from the Republican Valley and most of the Platte Valley (Sharpe et al. 2001). Uncommon to absent in riparian forests.

Total Area of Modeled Habitat (ha): 1,062,312

Model Description:
Modeled distribution using the set of variables 'Land Cover class Ponderosa Pine Forests and Woodlands > 2.5%' OR 'Average 30-year Maximum Temperature Coefficient of Variation for March > 15%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



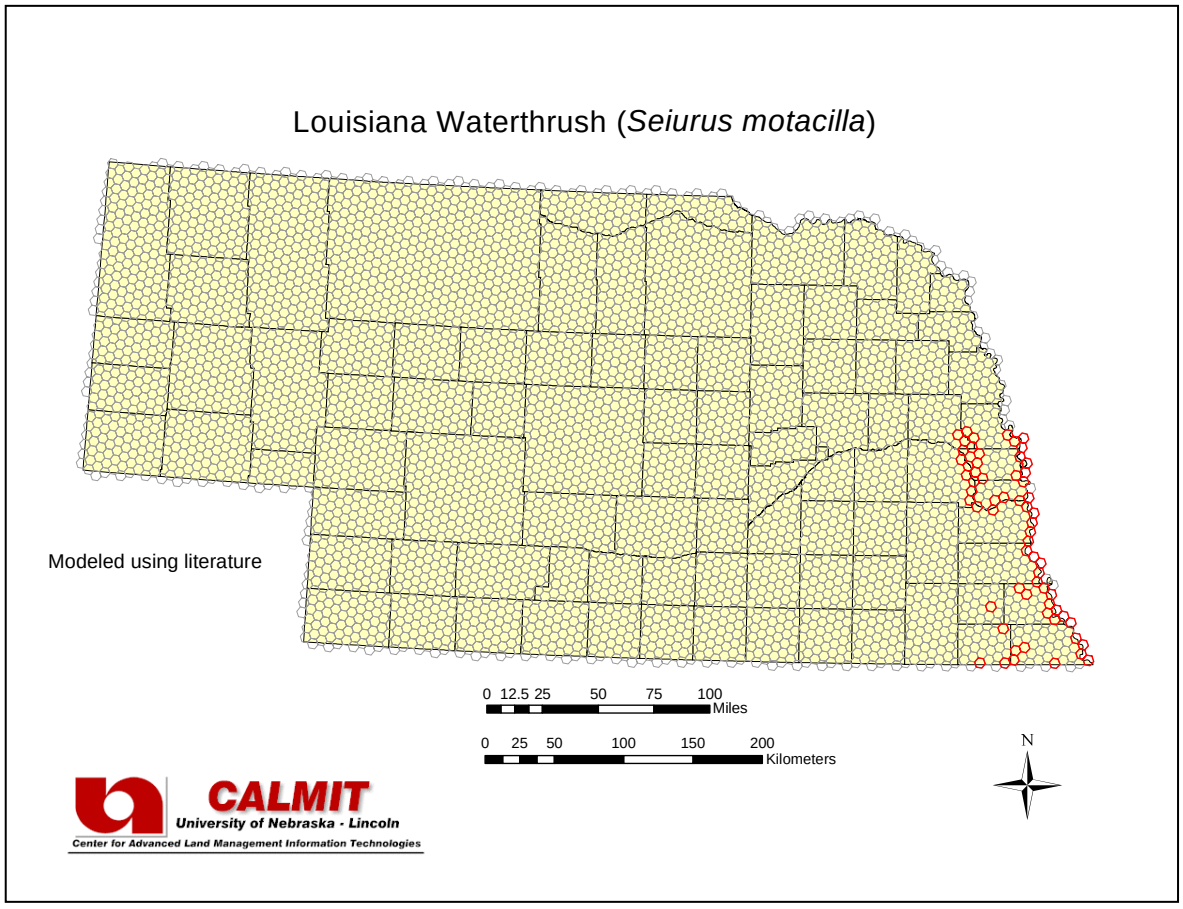
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Louisiana Waterthrush**	TNC Global Status:	G5
Scientific Name:	***Seiurus motacilla***	Federal Status:	--
TNC Element Code:	ABPBX10030	State (NE) Status:	S1
AOU Code:	06760		

Habitat Description:
Restricted as a breeding species to the lower Missouri River valley, as far north as Washington Co (Mollhoff 2001, Sharpe et al. 2001). Preferred breeding habitat includes extensive bottomland forests, wooded ravines or stream banks near running water (Johnsgard 1997; Mollhoff 2001; DeGraff and Rappole 1995; Sharpe et al. 2001). Breeding populations are very small, although territorial birds appear most years at favored locations such as Fontenelle Forest and Indian Cave. Also can be found along the stream at Platte River State Park (Sharpe et al. 2001). Typically builds nests in upturned roots of fallen trees over or near water. (DeGraff and Rappole 1995).

Total Area of Modeled Habitat (ha): 255,440

Model Description:
No observational data were available for this species. Modeled from literature using the variable 'Land Cover class Riparian Woodland is present'. Extent was clipped to match area of known breeding records (Mollhoff 2001, Sharpe et al. 2001).



Nebraska GAP Analysis 2004
Bird Species Atlas

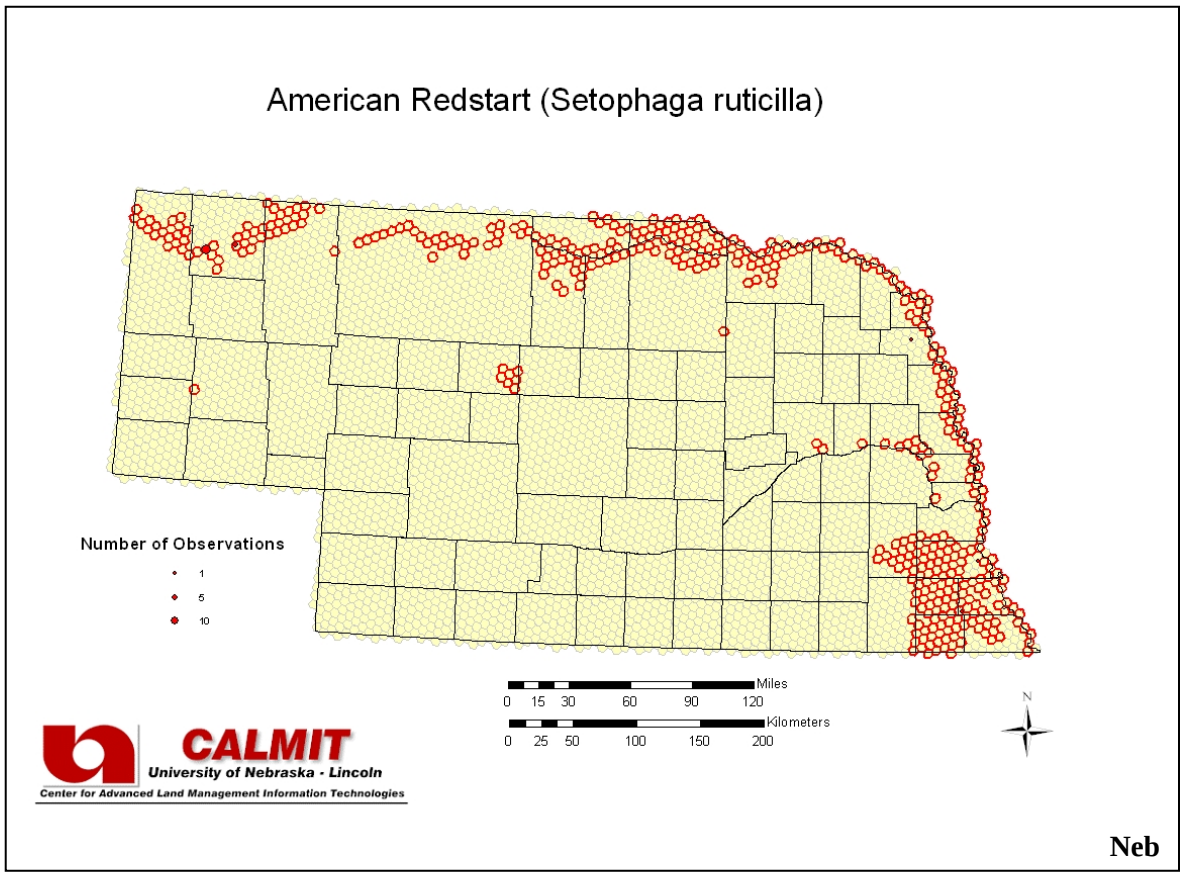
Common Name:	**American Redstart**	TNC Global Status:	G5
Scientific Name:	***Setophaga ruticilla***	Federal Status:	--
TNC Element Code:	ABPBX06010	State (NE) Status:	S4
AOU Code:	06870		

Habitat Description:
Breeding usually occurs in moist bottomland woods, usually deciduous and especially young or second-growth stands, and near the margins of openings of mature forests (Johnsgard 1997). Breeding is limited to the Missouri and Niobrara Valleys and the Pine Ridge (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1,759,705

Model Description:
Modeled distribution using the set of variables ('Land Cover class Ponderosa Pine Forests and Woodlands > 2.5%' AND 'Land Cover class Fallow Agricultural Fields > 7.5%') OR ('Percentage of Fine-textured Soils > 7.5%' AND 'Land Cover class Deciduous Forests and Woodlands > 2.5%').

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

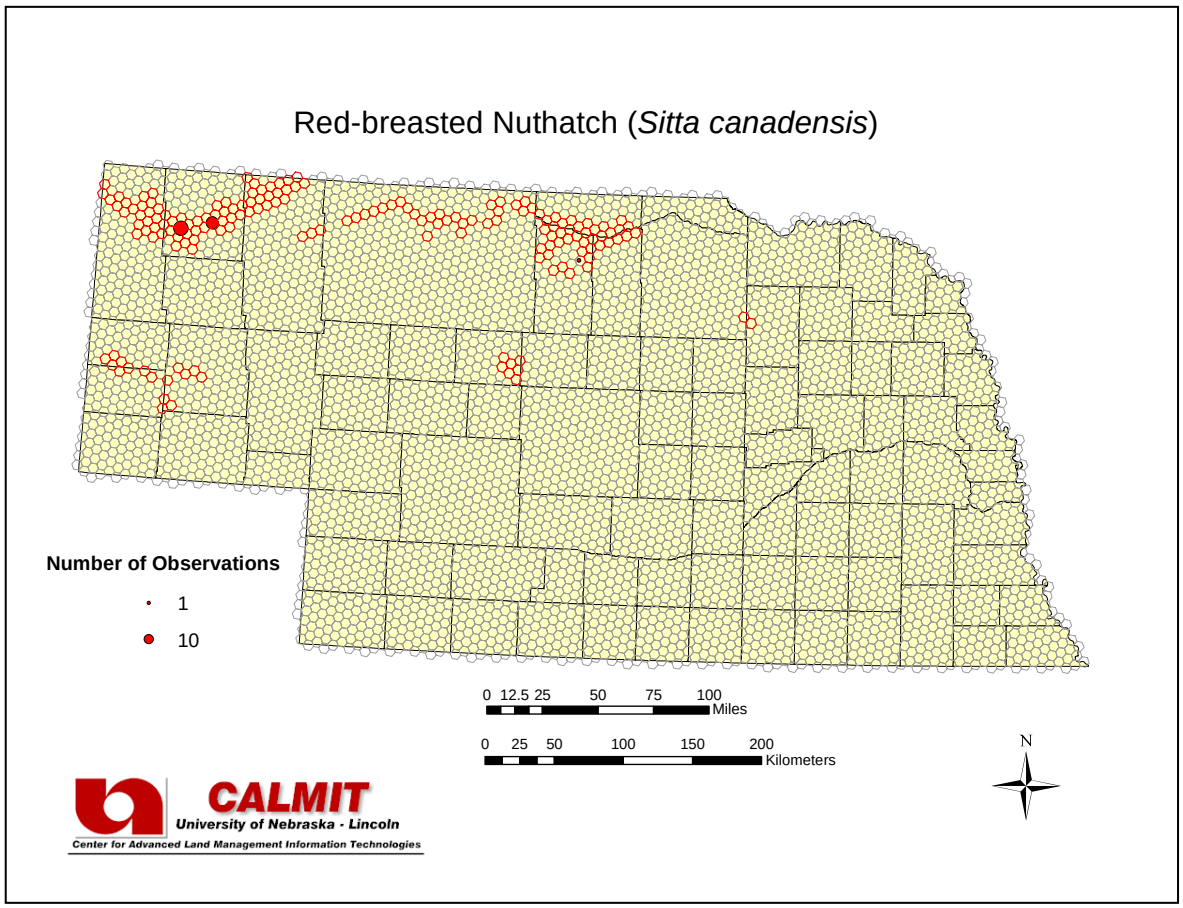
Common Name:	**Red-breasted Nuthatch**	TNC Global Status:	G5
Scientific Name:	***Sitta canadensis***	Federal Status:	--
TNC Element Code:	ABPAZ01010	State (NE) Status:	S4
AOU Code:	07280		

Habitat Description:
Except for the northern Panhandle, where the species probably breeds in coniferous forest. They will likely be found in conifer plantations and mixed coniferous-deciduous forest and appear limited to large tracts of woodland dominated by pines (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001). It breeds most commonly in the central Niobrara Valley, Pine Ridge, Wildcat Hills, as well as the Nebraska National Forest (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 685,235

Model Description:
Modeled distribution using the set of variables 'Land Cover class Ponderosa Pine Forests and Woodlands > 2%' AND 'Land Cover class Fallow Agricultural Field ≤ 2%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

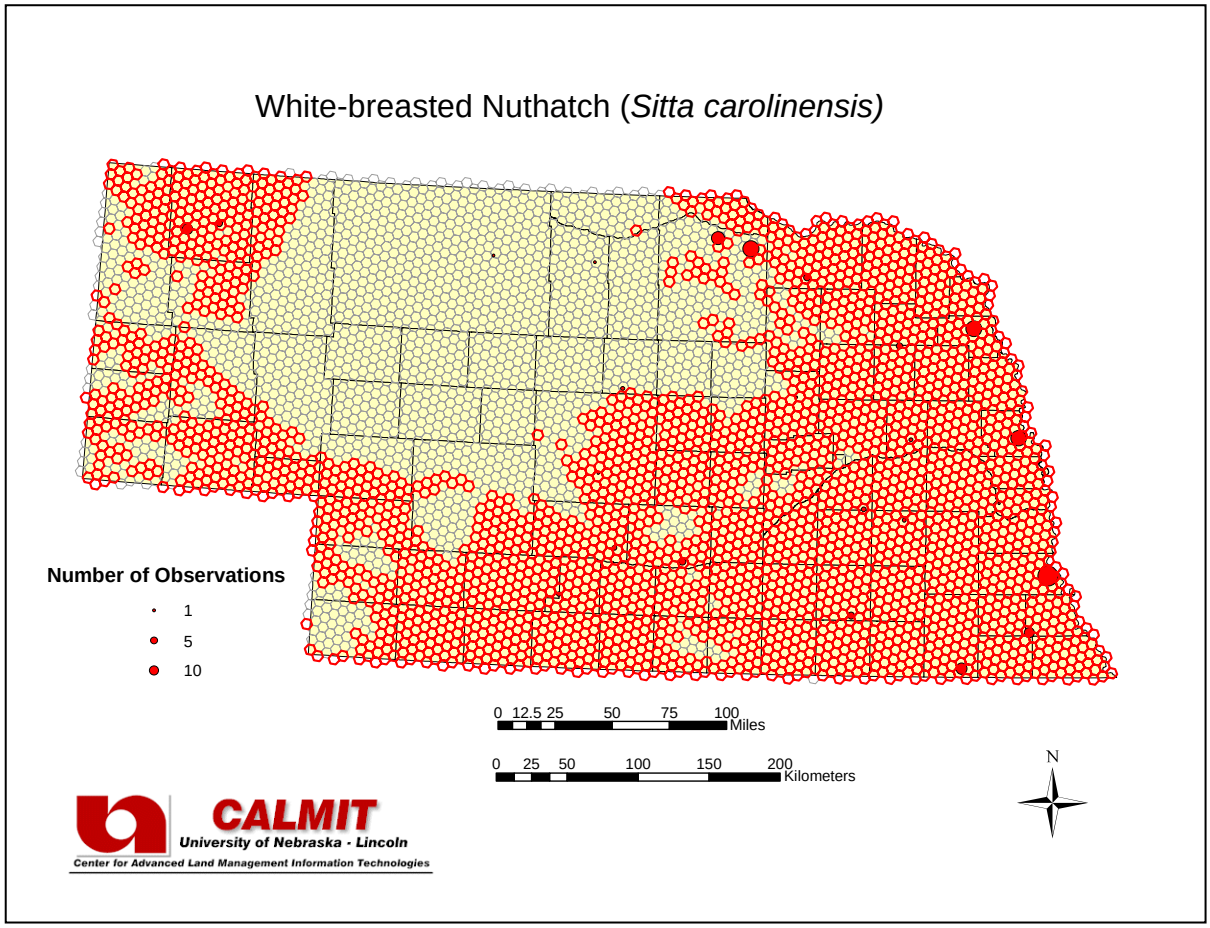
Common Name:	**White-breasted Nuthatch**	TNC Global Status:	G5
Scientific Name:	***Sitta carolinensis***	Federal Status:	--
TNC Element Code:	ABPAZ01020	State (NE) Status:	S3
AOU Code:	07270		

Habitat Description:
In Nebraska this species is generally associated with fairly mature floodplain forests during the breeding season (Johnsgard 1997). Breeds in wooded habitats locally as far west as the Pine Ridge area, in the Niobrara Valley and to at least Hall County in the Platte Valley. Commonly reported in woodlands having numerous mature trees to provide natural cavities for nesting (Mollhoff 2001). Largest numbers are found in mature oak-hickory forest in the southeast. Lesser numbers occur westward in deciduous woodland, in the major river valleys, and also in the ponderosa pine woodland in the northwest (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.22×10^7

Model Description:
Modeled distribution using the variable 'Land Cover class Sandhills Upland Prairie < 7.5%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

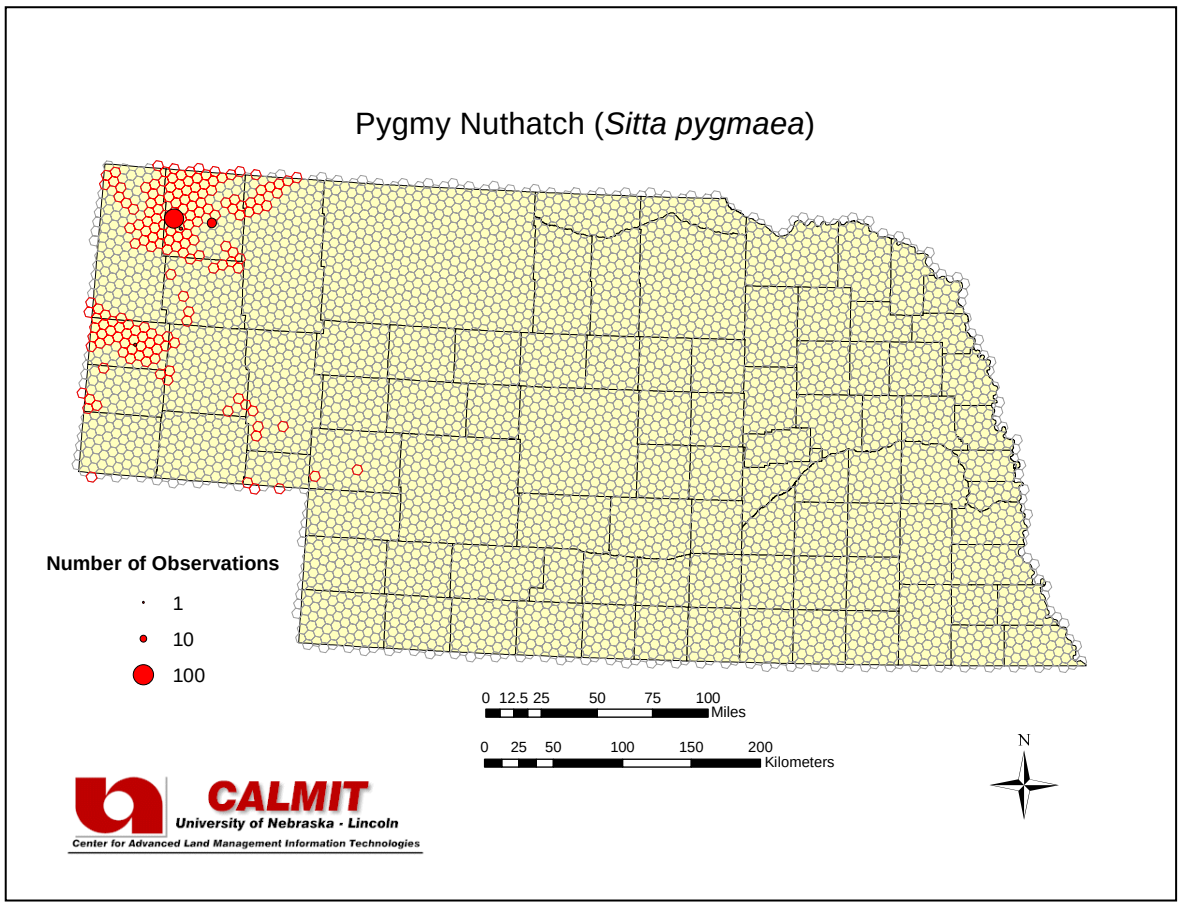
Common Name:	**Pygmy Nuthatch**	TNC Global Status:	G5
Scientific Name:	***Sitta pygmaea***	Federal Status:	--
TNC Element Code:	ABPAZ01030	State (NE) Status:	S3
AOU Code:	07300		

Habitat Description:
This species is restricted to the ponderosa pine in Nebraska, preferring open woodland in dry canyons and on ridgetops, nesting in dead snags. It has been reported only in the Pine Ridge and Wildcat Hills (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 685,230

Model Description:
Modeled distribution using the set of variables 'Land Cover class Western Shortgrass Prairie > 37.5%' AND 'Land Cover class Sandhills Upland Prairie ≤ 3%' OR 'Land Cover class Western Shortgrass Prairie ≤ 37.5%' AND 'Average 30-year Precipitation for July ≤ 56 mm'.

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



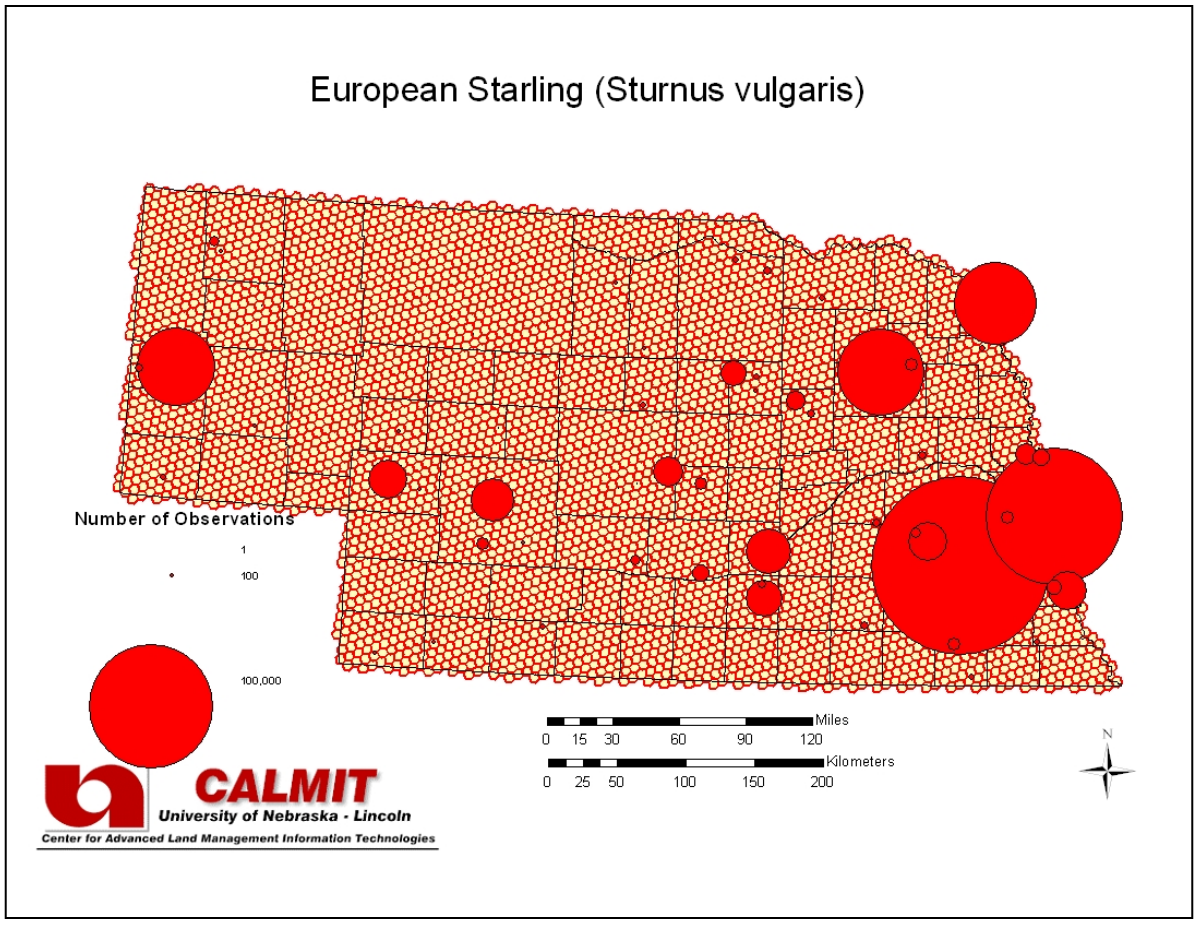
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**European Starling**	TNC Global Status:	G5
Scientific Name:	***Sturnus vulgaris***	Federal Status:	--
TNC Element Code:	ABPBT01010	State (NE) Status:	SE
AOU Code:	04930		

Habitat Description:
Found statewide, nesting in cracks and crevices in buildings both rural and urban, as well as in mature woodlands having woodpecker holes or other tree cavities for nests; numbers are highest where the human population is highest (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



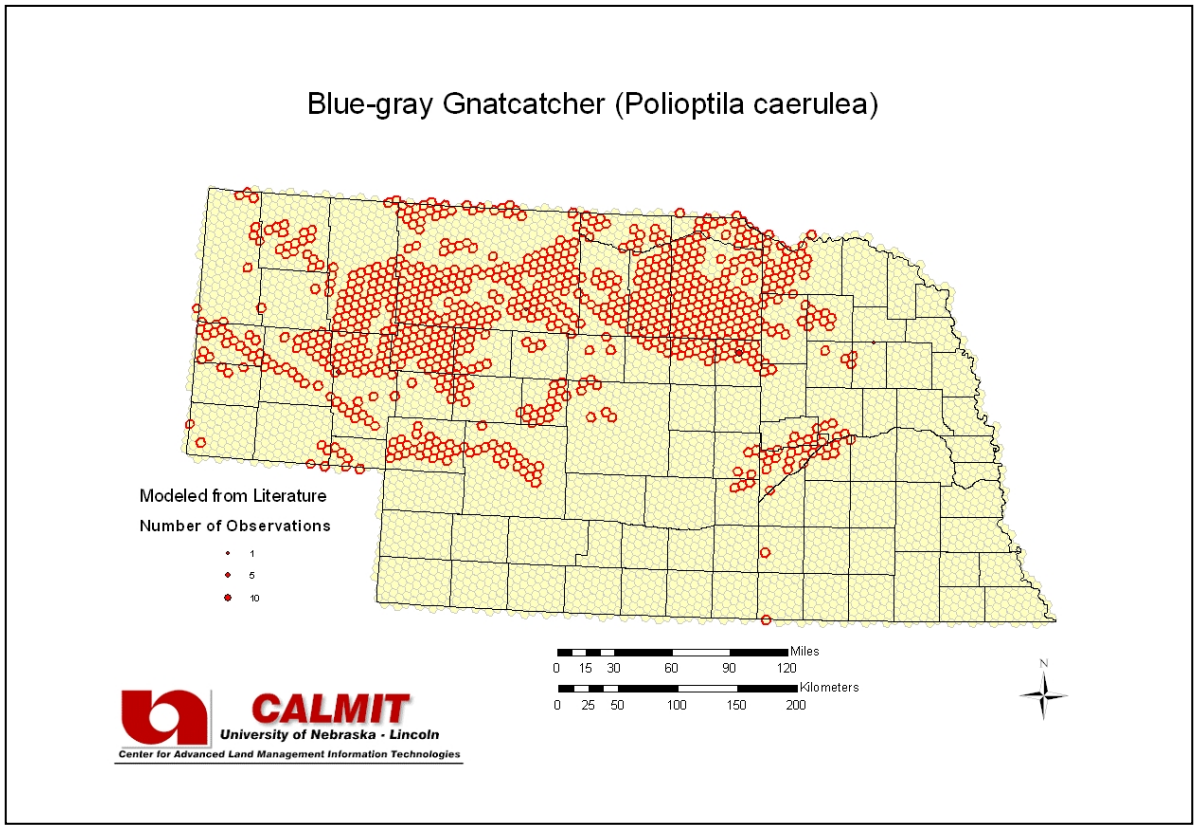
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Blue-gray Gnatcatcher**	TNC Global Status:	G5
Scientific Name:	***Polioptila caerulea***	Federal Status:	--
TNC Element Code:	ABPBJ08010	State (NE) Status:	S3
AOU Code:	07510		

Habitat Description:
Habitat described as deciduous bottomland forests (Johnsgard 1997). In Nebraska it is considered rare, with a local distribution (Mollhoff 2001). The few annotated reports make it difficult to characterize habitat requirements. Most reports were from extensive areas of mature riparian hardwood forests dominated by bur oak, cottonwood, ash and hackberry, with the birds occupying territories that also included the secondary growth of edge habitats. It is generally limited to the Missouri Valley in the extreme southeast, rarely north (Sharpe et al. 2001). Summer reports have been confined to the area south and east of, but including Douglas, Saunders, Saline, and Jefferson Counties. It is reported to be largely confined to riparian or lakeside habitats, at this, the northern edge of its range. Reports from the 'Ranges of North American Breeding Birds/USGS Northern Prairie Science Center' (Price 1995) and the 'North American Breeding Bird Survey Results and Analysis, 1966-2000', (Sauer et al. 2001) support this very limited distribution in Nebraska.

Total Area of Modeled Habitat (ha): 3,653,202

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the set of variables 'Percentage of Fine-textured Soils > 5%' AND 'Land Cover class Deciduous Forests and Woodlands > 5%' AND 'Average 30-year Precipitation for April > 65 mm'.



Nebraska GAP Analysis 2004
Bird Species Atlas

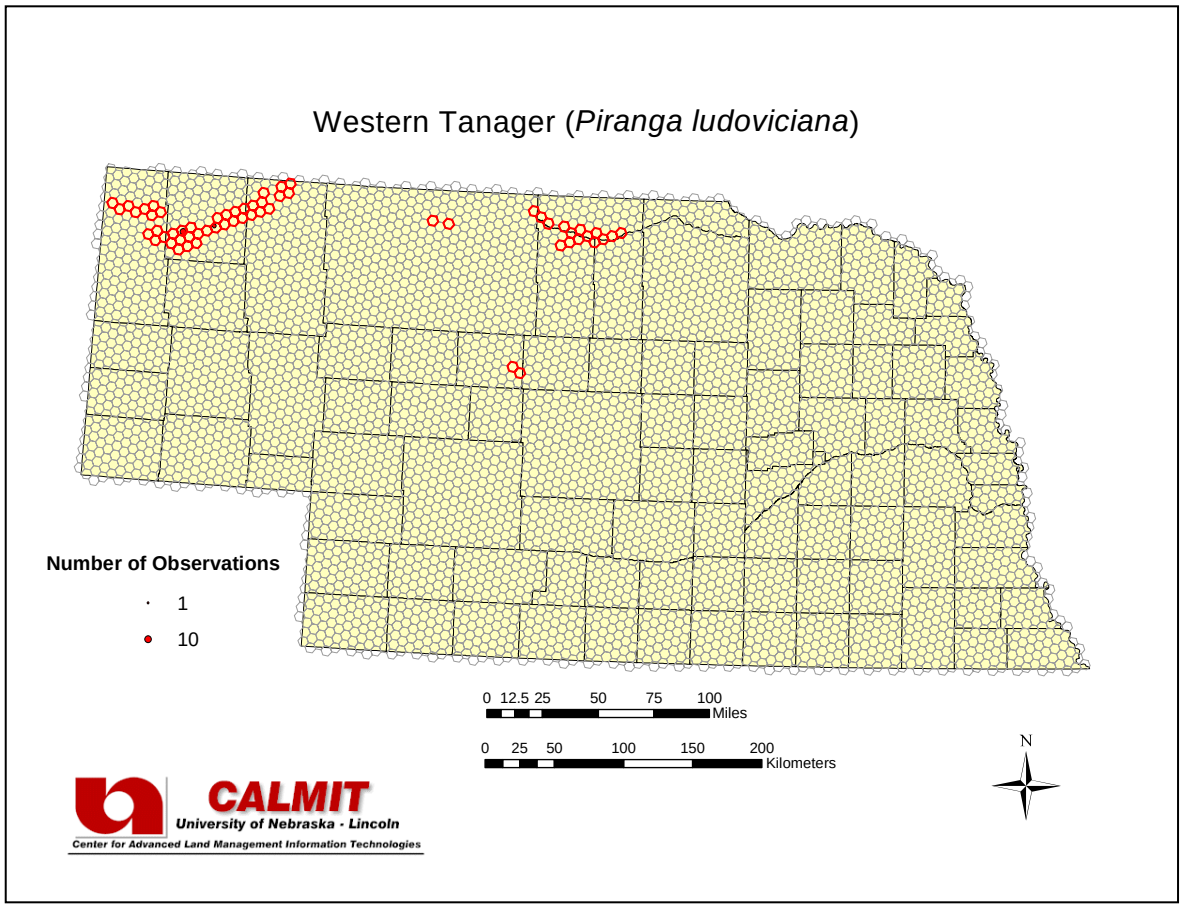
Common Name:	**Western Tanager**	TNC Global Status:	G5
Scientific Name:	***Piranga ludoviciana***	Federal Status:	--
TNC Element Code:	ABPBX45050	State (NE) Status:	S4
AOU Code:	06070		

Habitat Description:
This species is found in the coniferous woodlands and canyons of the Pine Ridge and breeds primarily in the pines. They may also be found in deciduous riparian woodlands in the canyons and along rivers (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001). They may possibly extend as far east as the central Niobrara Valley Preserve (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 243,281

Model Description:
Modeled distribution using the variable 'Land Cover class Ponderosa Pine Forests and Woodlands > 15%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



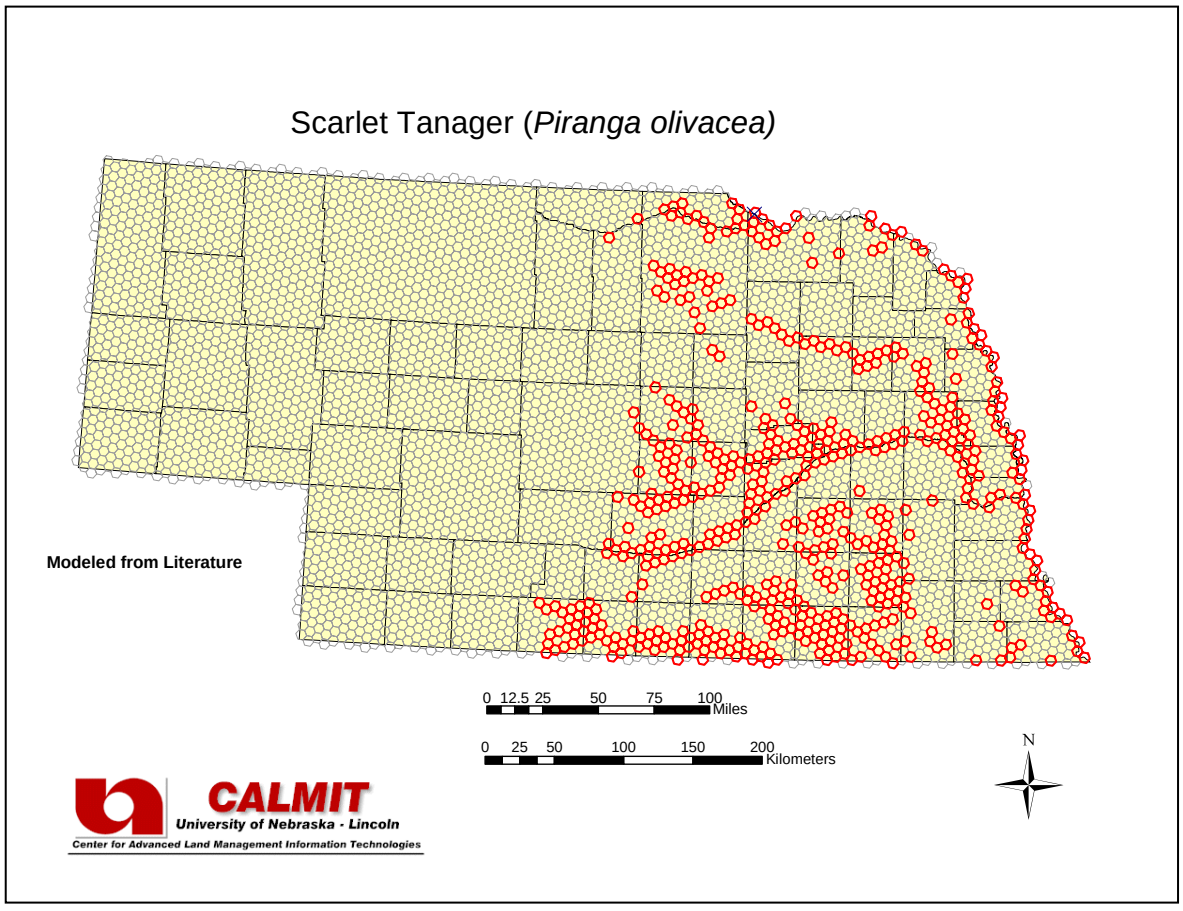
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Scarlet Tanager**	TNC Global Status:	G5
Scientific Name:	***Piranga olivacea***	Federal Status:	--
TNC Element Code:	ABPBX45040	State (NE) Status:	S4
AOU Code:	06080		

Habitat Description:
Found in mature or nearly mature deciduous and mixed deciduous-coniferous woodlands, roadside shade trees, wooded parks, and large shade trees of suburbs (Johnsgard 1997, Mollhoff 2001). In NE, it was found at widely scattered locations from the eastern border, west nearly to mid-state (Mollhoff 2001).

Total Area of Modeled Habitat (ha): 2,384,119

Model Description:
No observational data were available for this species. Modeled from literature using the set of variables 'Land Cover class Riparian Woodland > 0.05%' AND 'Elevation < 700 m'.



Nebraska GAP Analysis 2004
Bird Species Atlas

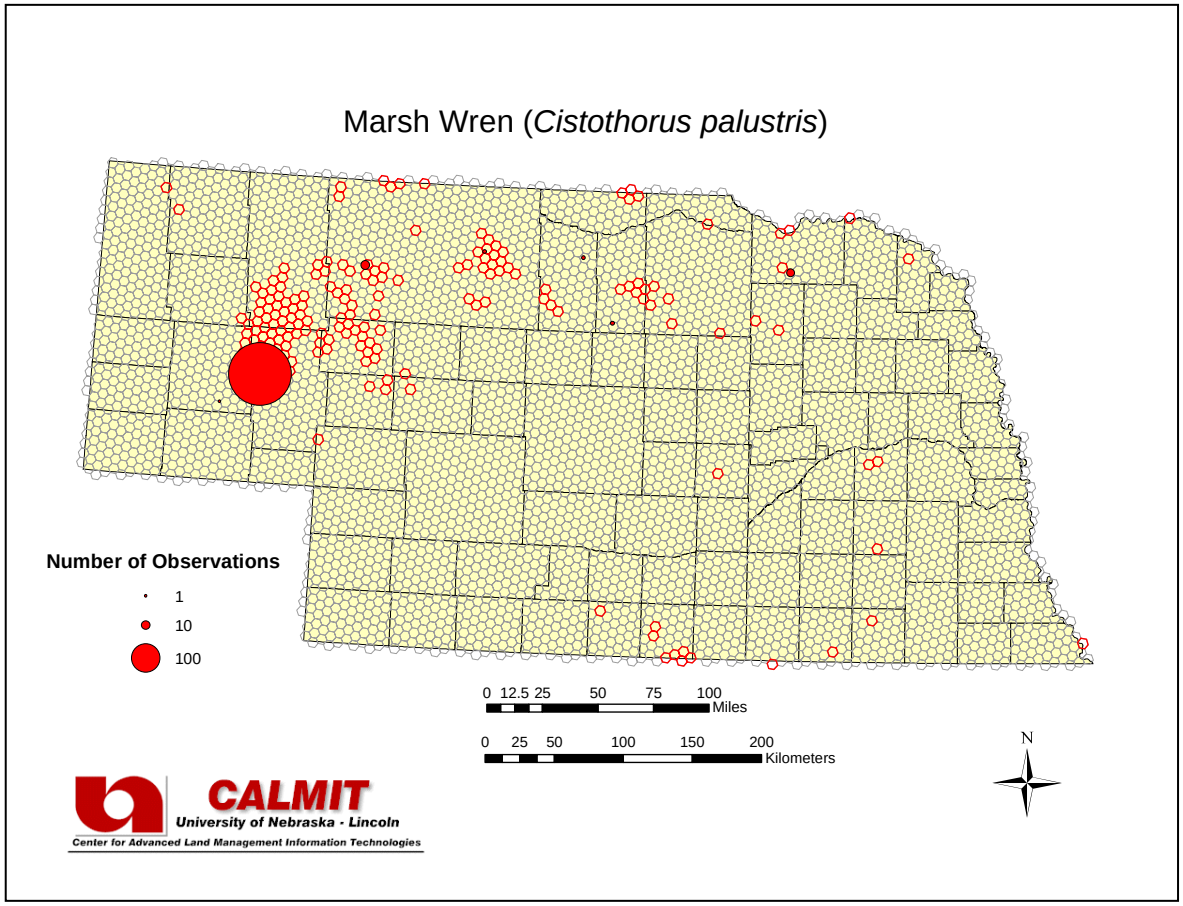
Common Name:	**Marsh Wren**	TNC Global Status:	G5
Scientific Name:	***Cistothorus palustris***	Federal Status:	--
TNC Element Code:	ABPBG10020	State (NE) Status:	S4
AOU Code:	07250		

Habitat Description:
Summer residents occur throughout most of the north, reaching greatest numbers in the Sandhills cattail marshes. It may also utilize bulrushes, phragmites, or brushy (willow or false indigo) areas that area adjacent to cattail beds (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001). Due to highly localized distribution of acceptable habitat, it should be looked for statewide wherever suitable habitat is found (Mollhoff 2001).

Total Area of Modeled Habitat (ha): 729,830

Model Description:
Modeled distribution using variable 'Land Cover class Aquatic Bed Wetland > 0.8%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, variable indicated above was determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

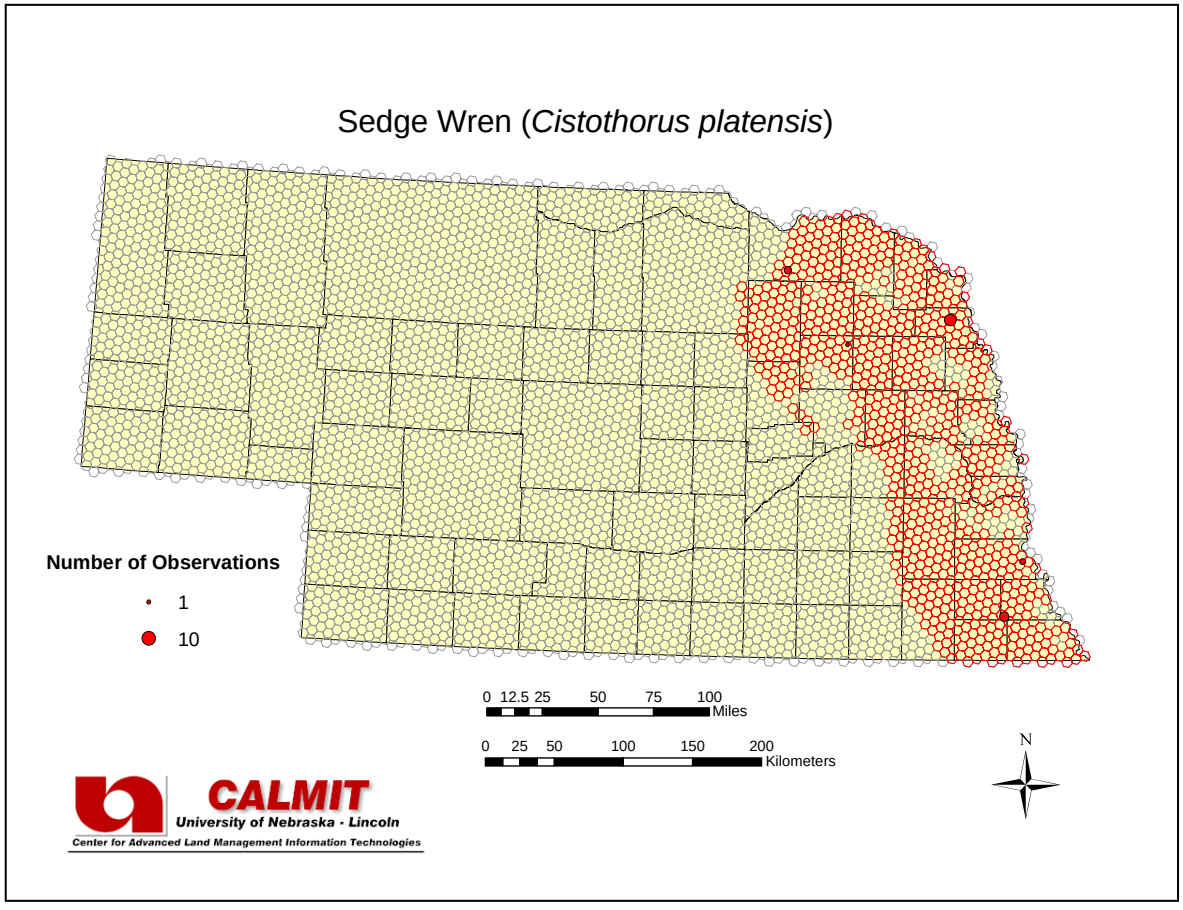
Common Name:	**Sedge Wren**	TNC Global Status:	G5
Scientific Name:	***Cistothorus platensis***	Federal Status:	--
TNC Element Code:	ABPBG10010	State (NE) Status:	S2
AOU Code:	07240		

Habitat Description:
The sedge wren's breeding habitat requirements are wet meadows, dominated by sedges and tall grasses, and less often breed in the emergent vegetation of marshes as well as retired croplands and hayfields (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001). This species has the ability to search out suitable habitat and breed as late as August if necessary (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 3,239,627

Model Description:
Modeled distribution using variable 'Land Cover class Upland Tallgrass Prairie > 10%'.

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

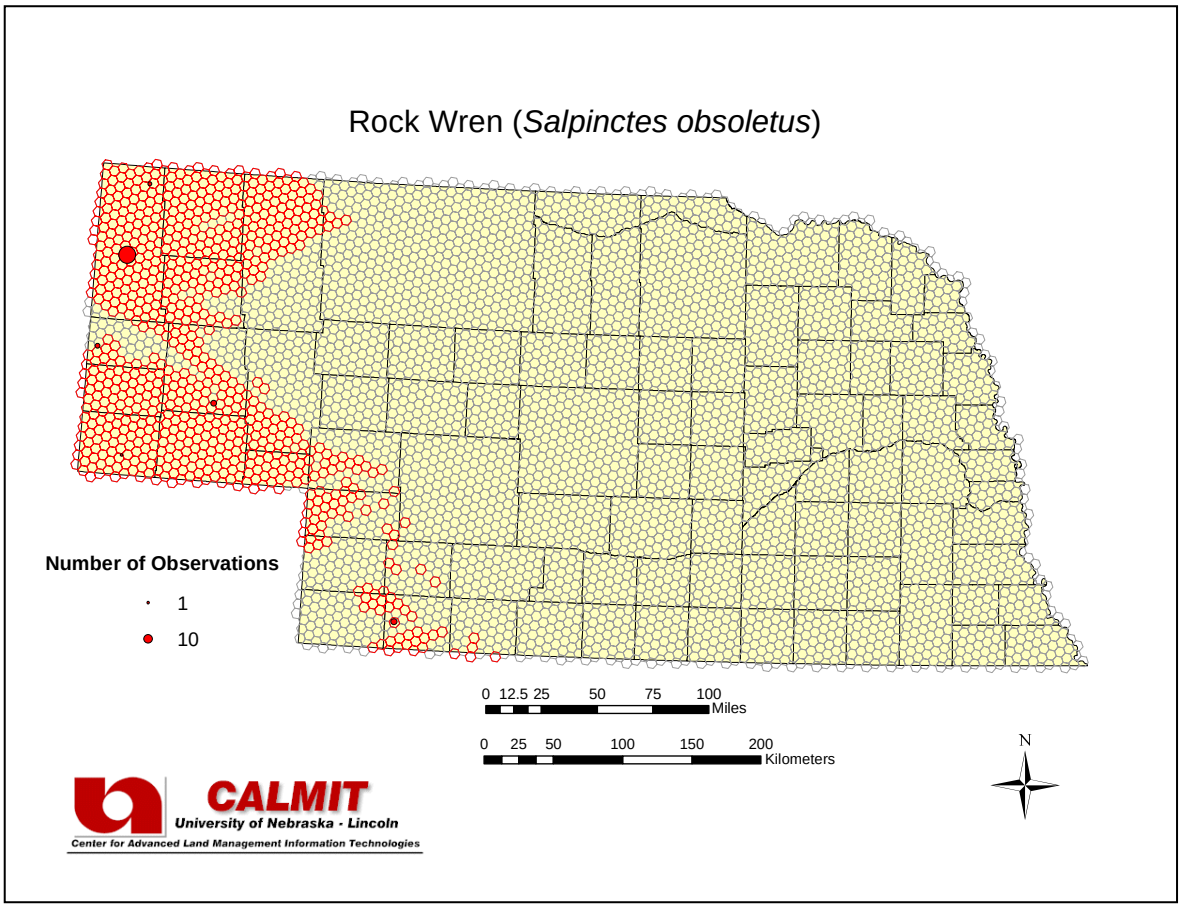
Common Name:	**Rock Wren**	TNC Global Status:	G5
Scientific Name:	***Salpinctes obsoletus***	Federal Status:	--
TNC Element Code:	ABPBG03010	State (NE) Status:	S4
AOU Code:	07150		

Habitat Description:
Cliffs, ledges, and other outcroppings of rock are habitat requirements and offer the advantage of natural holes and crevices for nesting (Johnsgard 1997, Sharpe et al. 2001). Their eastward distribution is evidently limited by factors other than the absence of rocky ledges (Mollhoff 2001).

Total Area of Modeled Habitat (ha): 3,235,562

Model Description:
Modeled distribution using the set of variables 'Land Cover class Western Shortgrass Prairie > 30%' OR 'Land Cover class Western Shortgrass Prairie ≤ 30%' AND 'Land Cover class Fallow Agricultural Fields > 20%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

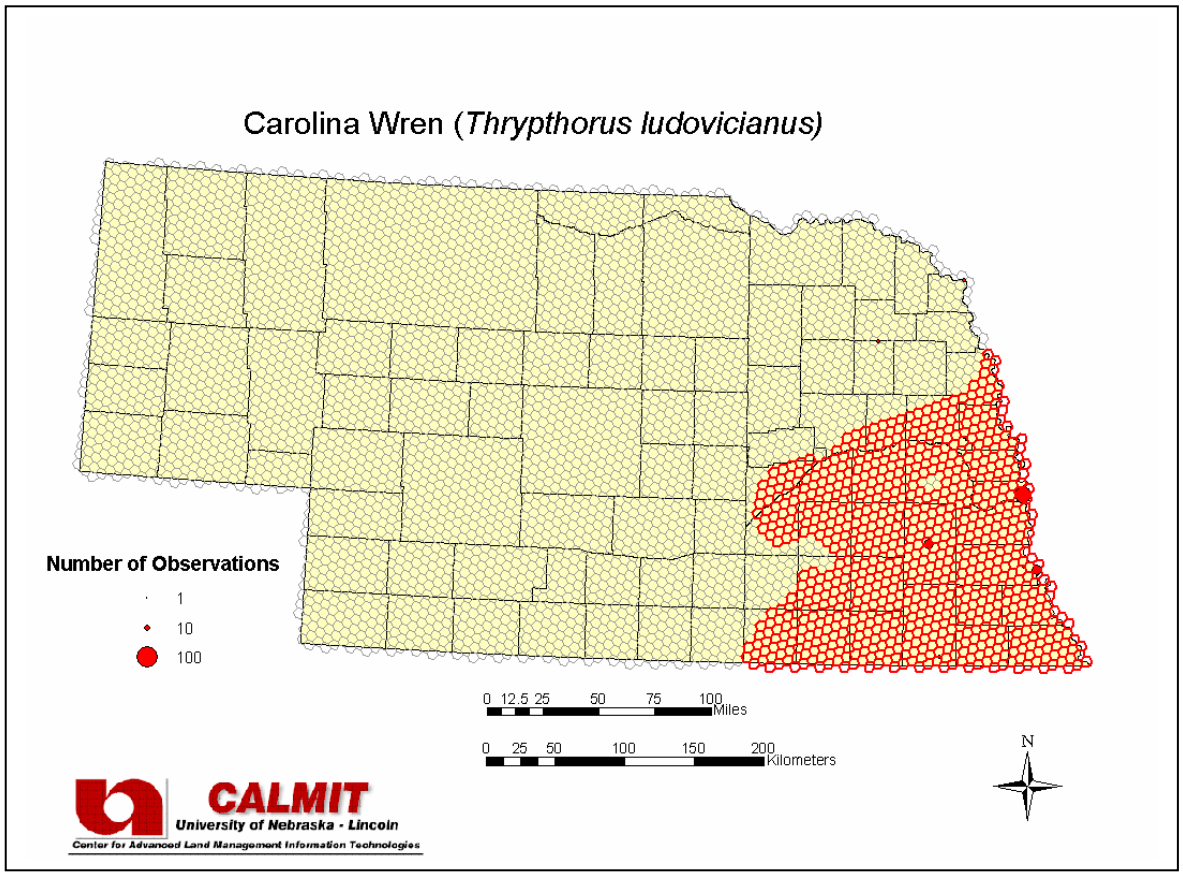
Common Name:	**Carolina Wren**	TNC Global Status:	G5
Scientific Name:	***Thryothorus ludovicianus***	Federal Status:	--
TNC Element Code:	ABPBG06130	State (NE) Status:	S2
AOU Code:	07180		

Habitat Description:
Riverbottom forest, forest edges, cutover forests, cultivated areas with brush heaps and suburban parks (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 3,458,588

Model Description:
Modeled distribution using the variable 'Average 30-year Minimum Temperature for November > -3.0ºC'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



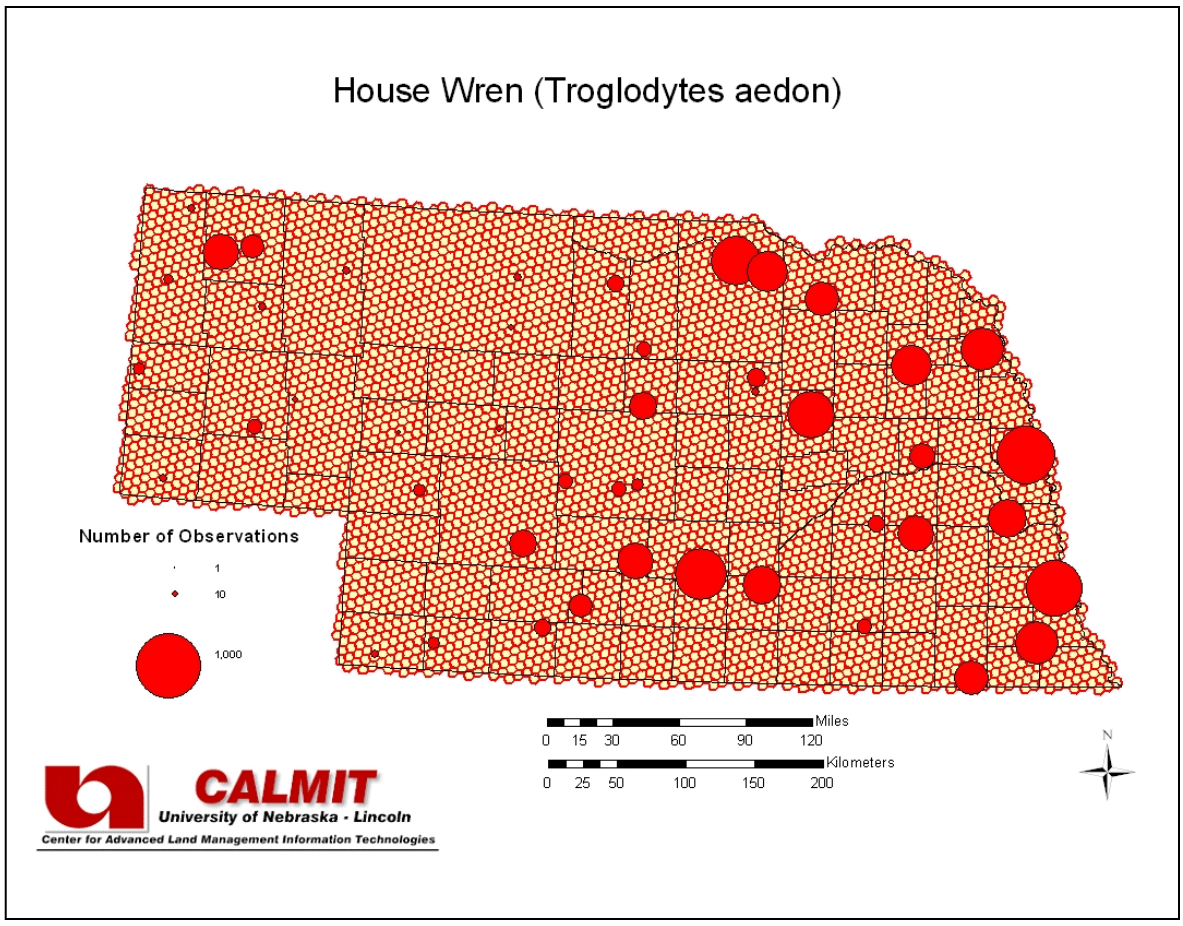
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**House Wren**	TNC Global Status:	G5
Scientific Name:	***Troglodytes aedon***	Federal Status:	--
TNC Element Code:	ABPBG09010	State (NE) Status:	S5
AOU Code:	07210		

Habitat Description:
Associated with deciduous forests and open woods, and urban birdhouses; also abundant in riverbottom forests, cottonwood groves and wooded hillsides or canyons (Johnsgard 1997). Found in any type of wooded area; frequent inhabitant of residential areas, parks, and farmsteads, reaches its highest densities in the riparian woodlands of the eastern half of the state (Mollhoff 2001). Ubiquitous in woodland in the east and elsewhere in woodland and residential areas wherever brushy cover exists (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

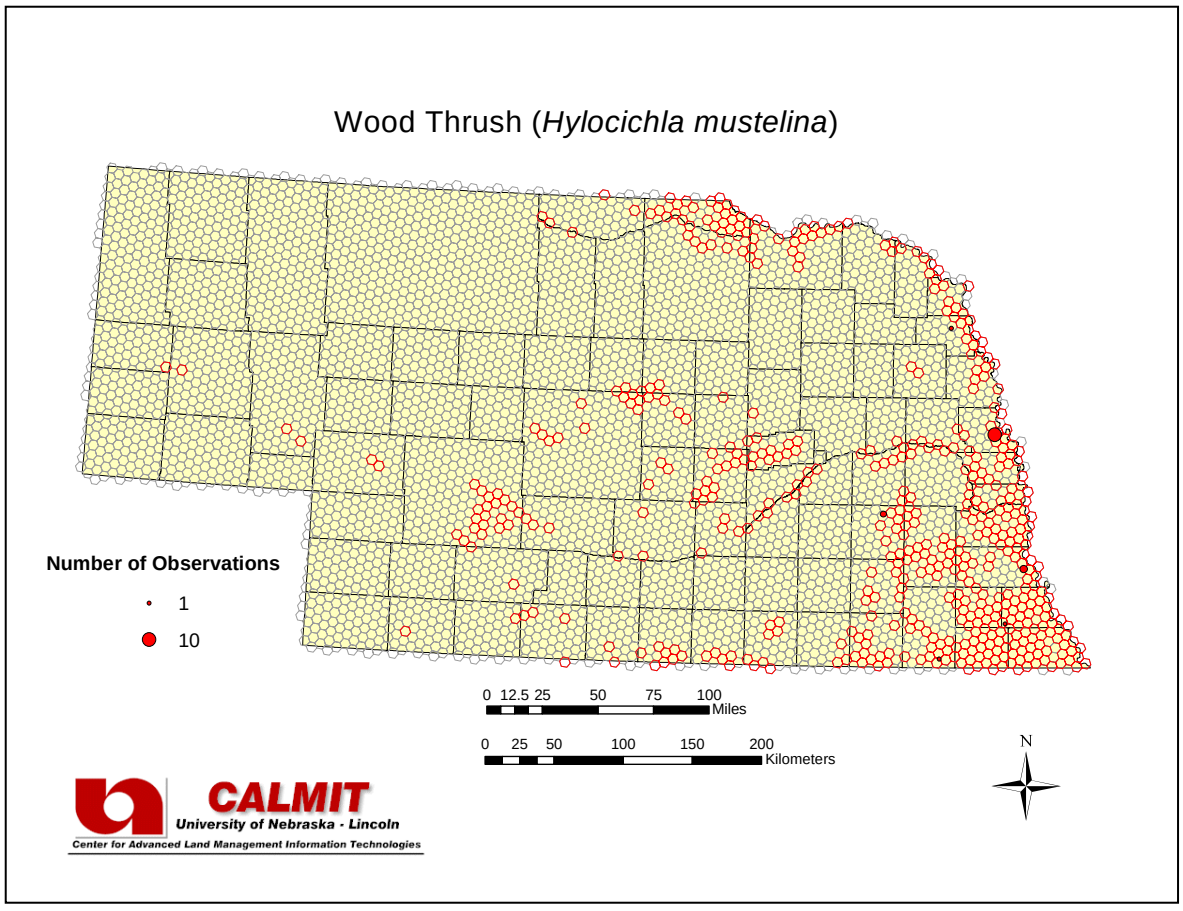
Common Name:	**Wood Thrush**	TNC Global Status:	G5
Scientific Name:	***Hylocichla mustelina***	Federal Status:	--
TNC Element Code:	ABPBJ19010	State (NE) Status:	S4
AOU Code:	07550		

Habitat Description:
This species requires moist areas of extensive woodland found in the eastern third of the state. Breeds in oak-hickory forest associated with the Missouri River Valley as well as extensive mature stands of riparian forest as in the lower Platte, Elkhorn, and Niobrara Valleys (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 2,071,909

Model Description:
Modeled distribution using variable 'Land Cover class Deciduous Forests and Woodlands > 5%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



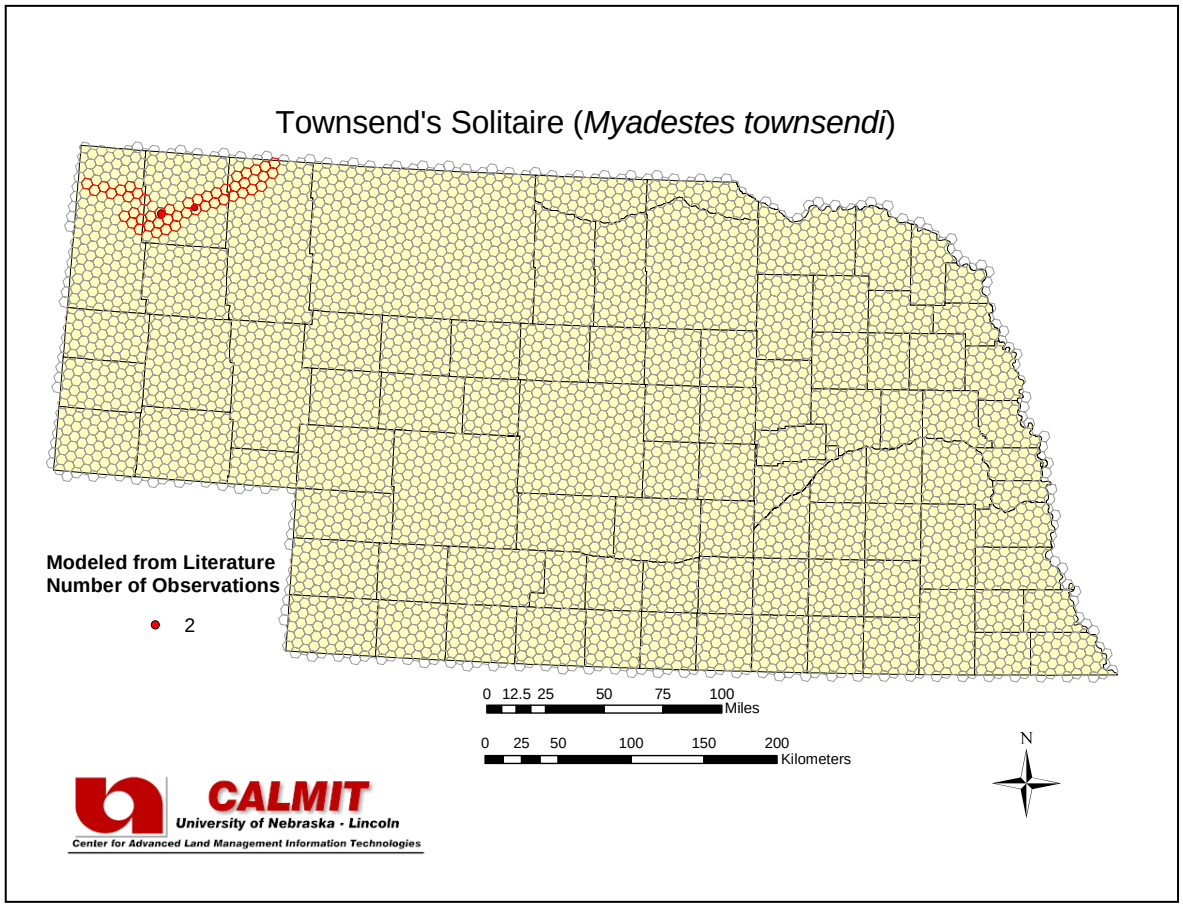
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Townsend's Solitaire**	TNC Global Status:	G5
Scientific Name:	***Myadestes townsendii***	Federal Status:	--
TNC Element Code:	ABPBJ16010	State (NE) Status:	S2
AOU Code:	07540		

Habitat Description:
During the breeding season this species occurs only casually in the Pine Ridge area. Breeding habitats of this species are rather dense coniferous forests, usually some species of pine with a mixture of juniper and/or hardwoods (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 190,571

Model Description:
Adequate model could not be resolved using QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Ponderosa Pine Forests and Woodlands > 10%'. Extent clipped to northwestern counties in the Pine Ridge, the area of known breeding records (Sharpe et al. 2001).



Nebraska GAP Analysis 2004
Bird Species Atlas

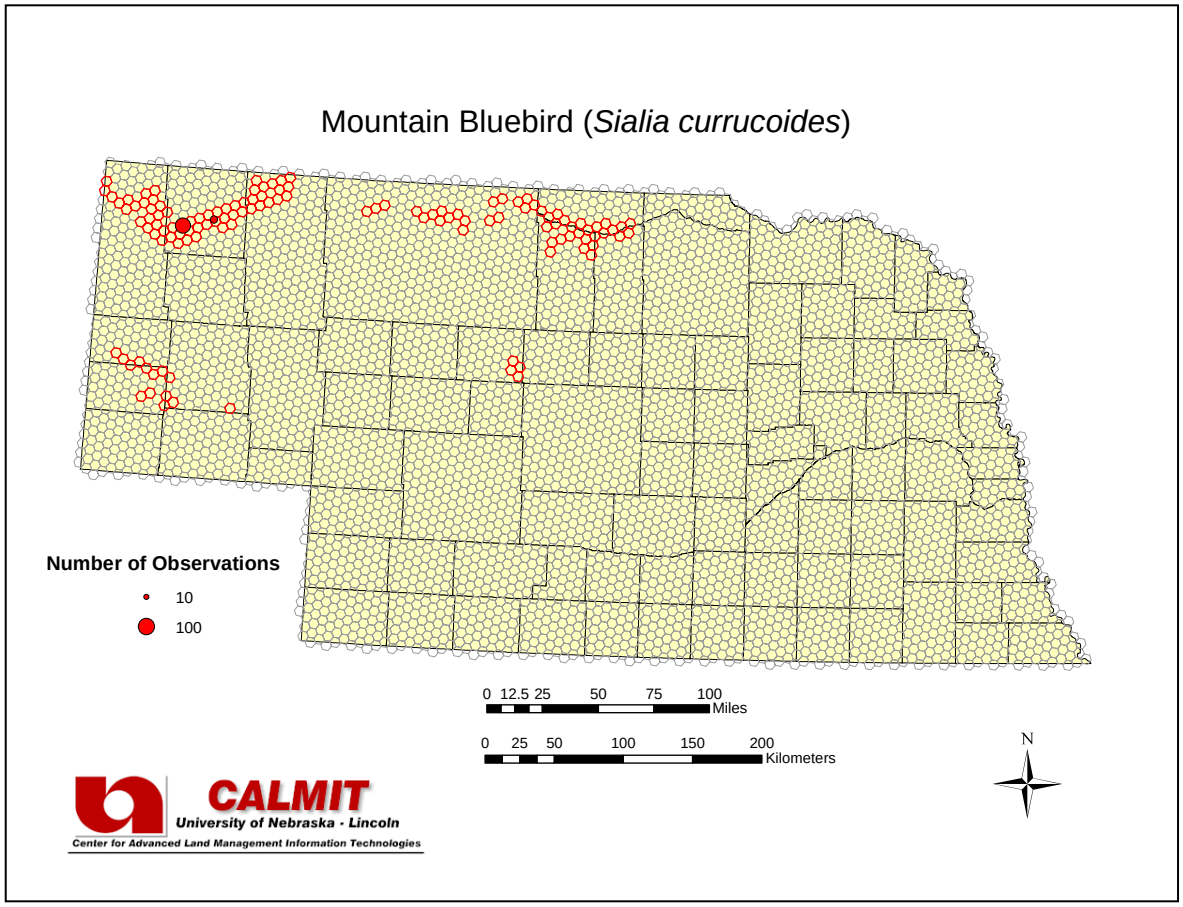
Common Name:	**Mountain Bluebird**	TNC Global Status:	G5
Scientific Name:	***Sialia currucoides***	Federal Status:	--
TNC Element Code:	ABPBJ15030	State (NE) Status:	S4
AOU Code:	07680		

Habitat Description:
This species is essentially restricted to the Panhandle, where it is fairly common in the open pine or pine-juniper woodlands of the Pine Ridge and Wildcat Hills. Regular breeding has occurred only in Sioux, Dawes, and Scotts Bluff counties, where preferred habitat of open ponderosa pine woodlands is found (Johnsgard 1997, Mullhoff 2001, Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 506,831

Model Description:
Modeled distribution using the variable 'Land Cover class Ponderosa Pine Forests and Woodlands > 5%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



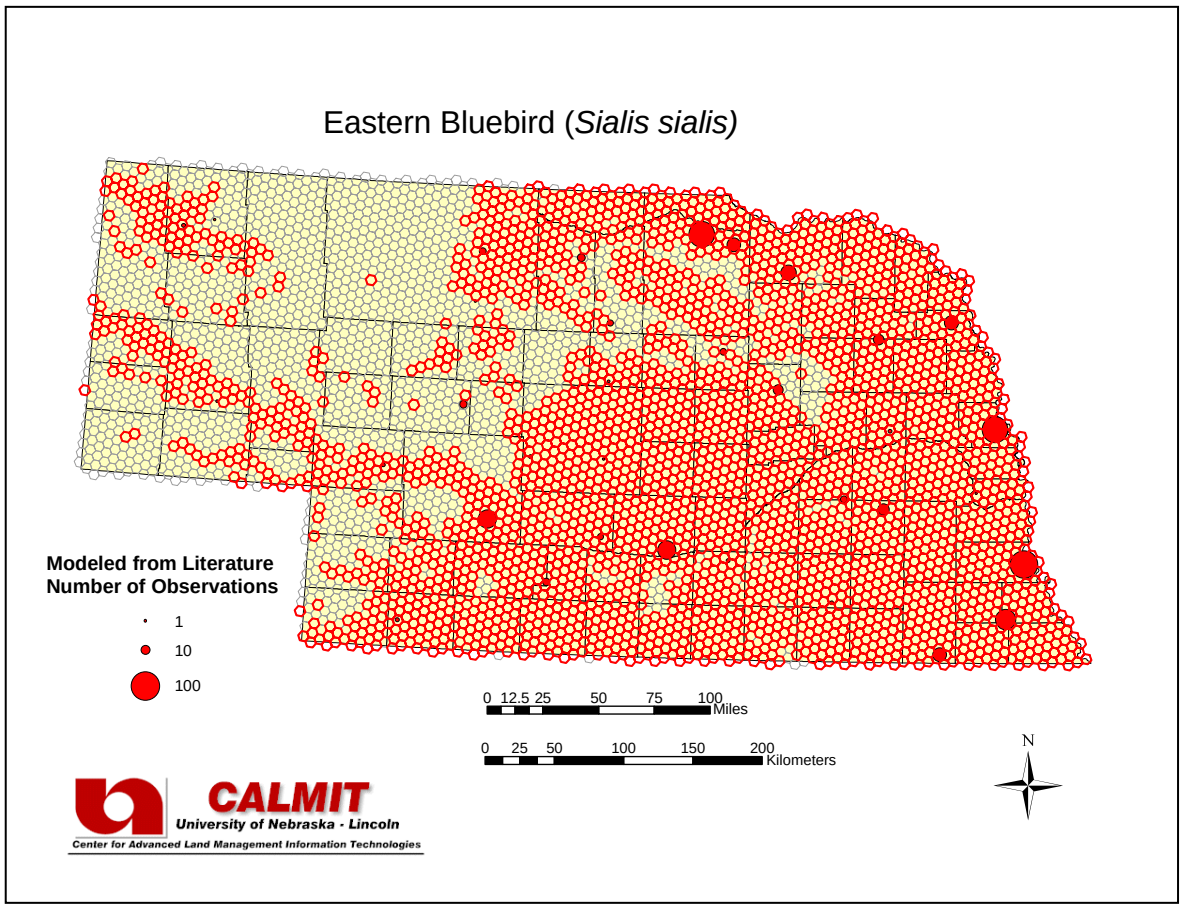
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Eastern Bluebird**	TNC Global Status:	G5
Scientific Name:	***Sialia sialis***	Federal Status:	--
TNC Element Code:	ABPBJ15010	State (NE) Status:	S4/S5
AOU Code:	07660		

Habitat Description:
Frequents open hardwood forests, especially those adjacent to grasslands: forest edges, shelterbelts, city parks, farmsteads, and similar habitats are used by breeding birds (Johnsgard 1997). Most common in open riparian woodland, either along the edges if clearings and woodland margins, or else in open woodland with scattered streamside trees (Mollhoff 2001). Common in summer only in the east, particularly in oak savannah and is rare, although increasing, in the Panhandle, where it is confined to deciduous trees along major river valleys (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.29×10^7

Model Description:
Adequate model could not be resolved using QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Deciduous Forests and Woodlands > 0.25%'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



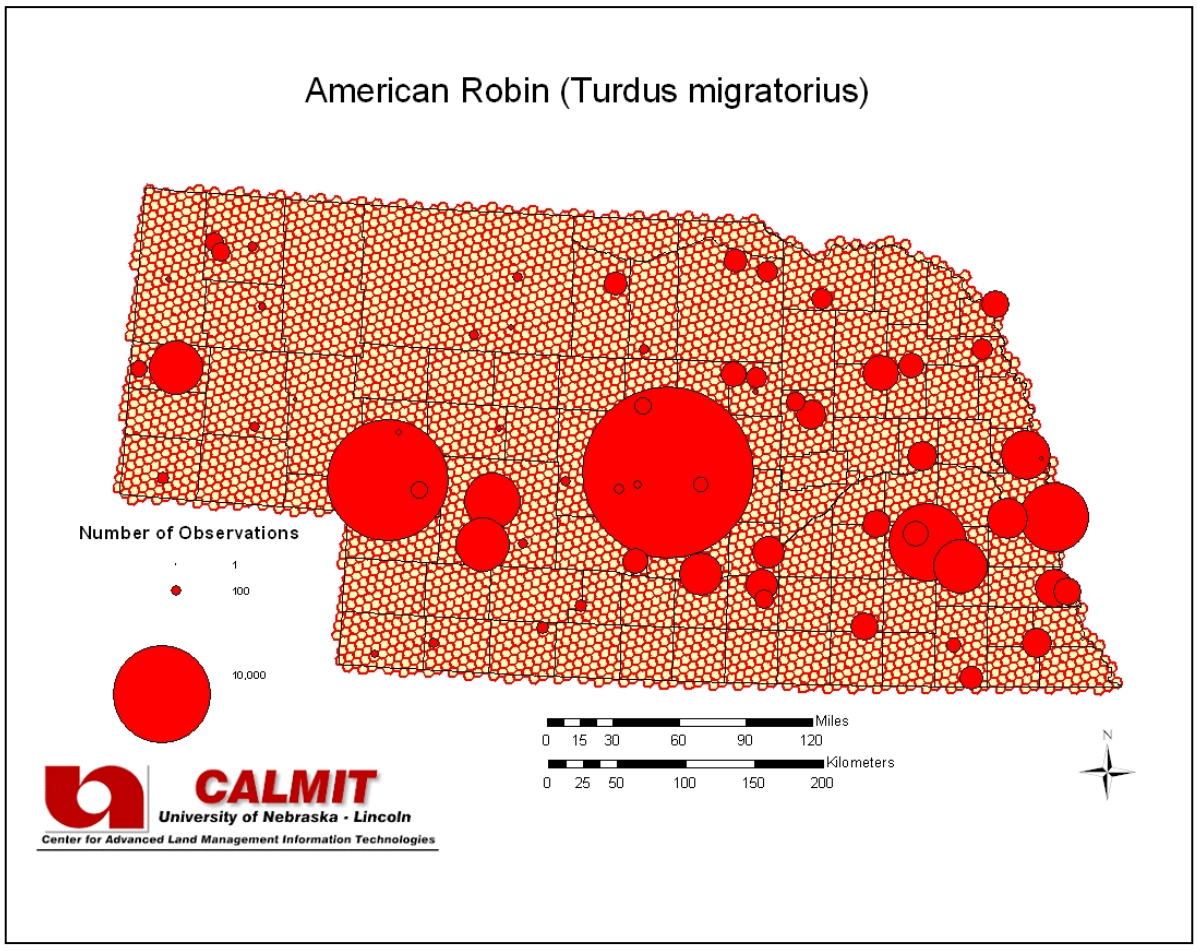
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**American Robin**	TNC Global Status:	G5
Scientific Name:	***Turdus migratorius***	Federal Status:	--
TNC Element Code:	ABPBJ20170	State (NE) Status:	S5
AOU Code:	17610		

Habitat Description:
Probably most common in cities, suburbs, parks and gardens, and farmlands (Johnsgard 1997). In Nebraska, the species appeared to be absent only from those areas that lacked both trees and human habitation (Mollhoff 2001). Its original breeding habitat was typical parkland, scattered trees with a grassy understory, or woodland edge adjacent to grasslands (Sharpe et al. 2001). Now common around human habitation, largely because urban and suburban yards and parks provide an adequate substitute for its original habitat.

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

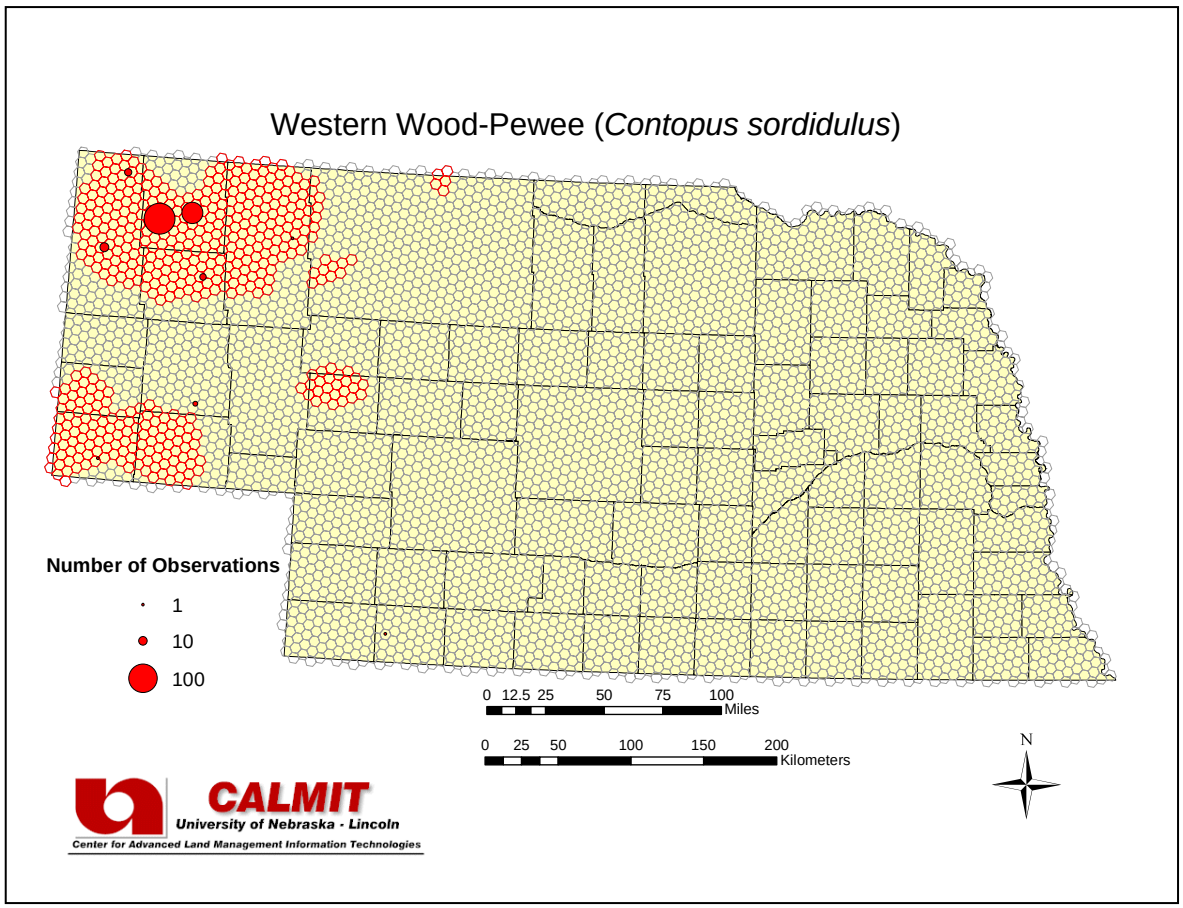
Common Name:	**Western Wood-Pewee**	TNC Global Status:	G5
Scientific Name:	***Contopus sordidulus***	Federal Status:	--
TNC Element Code:	ABPAE32050	State (NE) Status:	S4
AOU Code:	04620		

Habitat Description:
This species distribution is restricted to the Panhandle in Nebraska. Breeding birds are found in the Pine Ridge and Niobrara Valley as well as the Platte Valley and Wildcat Hills in Scotts Bluff county. The eastern most site of regular breeding in canyons was in Morrill county. Generally they use habitats dominated by conifers, but also use mixed woodlands and riparian habitats (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 2,007,035

Model Description:
Modeled distribution using the set of variables 'Frost Free Days $\leq$ 186 days' AND '30-year Weighted Coefficient of Variation of Precipitation for April, May, June, July, August, and September $\leq$ 62%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

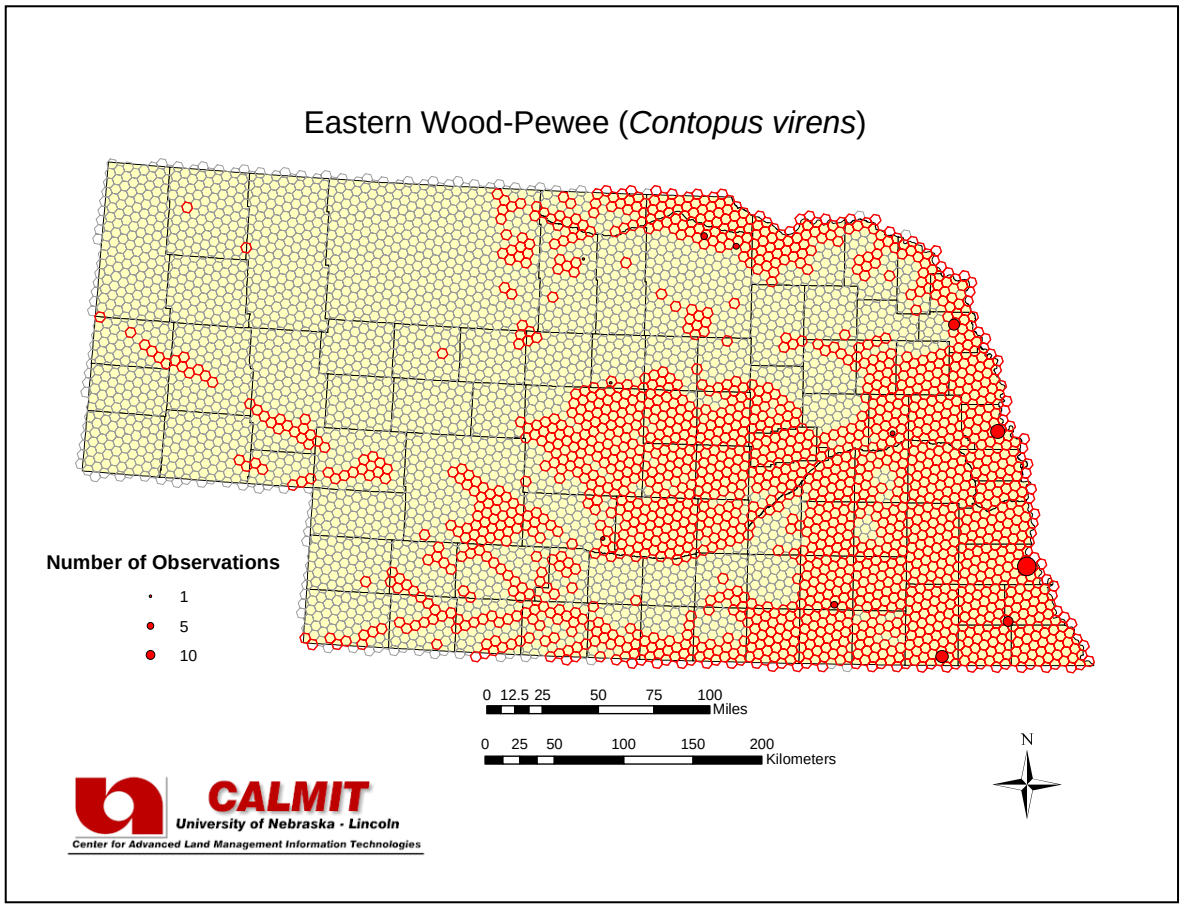
Common Name:	**Eastern Wood-Pewee**	TNC Global Status:	G5
Scientific Name:	***Contopus virens***	Federal Status:	--
TNC Element Code:	ABPAE32060	State (NE) Status:	S4
AOU Code:	04610		

Habitat Description:
Prefer deciduous forest during the breeding season, utilizing both upland hardwoods and mature floodplain forests. It is most common in forests associated with the Missouri, Lower Platte, and lower Elkhorn Valleys but is only casual west of North Platte and in Cherry Co (Sharpe et al. 2001). The species is associated with deciduous forests, including floodplain and river-bluff forests, but also occurs in woodlots, orchards, and suburban areas with tree plantings (Johnsgard 1997). Over much of the state the range is limited to narrow fringes of riparian woodland along the streams. The species seems to be restricted to natural woodlands (Mollhoff 2001).

Total Area of Modeled Habitat (ha): 7,642,952

Model Description:
Modeled distribution using the set of variables 'Average 30-year Maximum Temperature Coefficient of Variation for June $\leq$ 3.7%' OR 'Average 30-year Maximum Temperature Coefficient of Variation for June > 3.7%' AND 'Land Cover class Deciduous Forests and Woodlands > 1.5%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

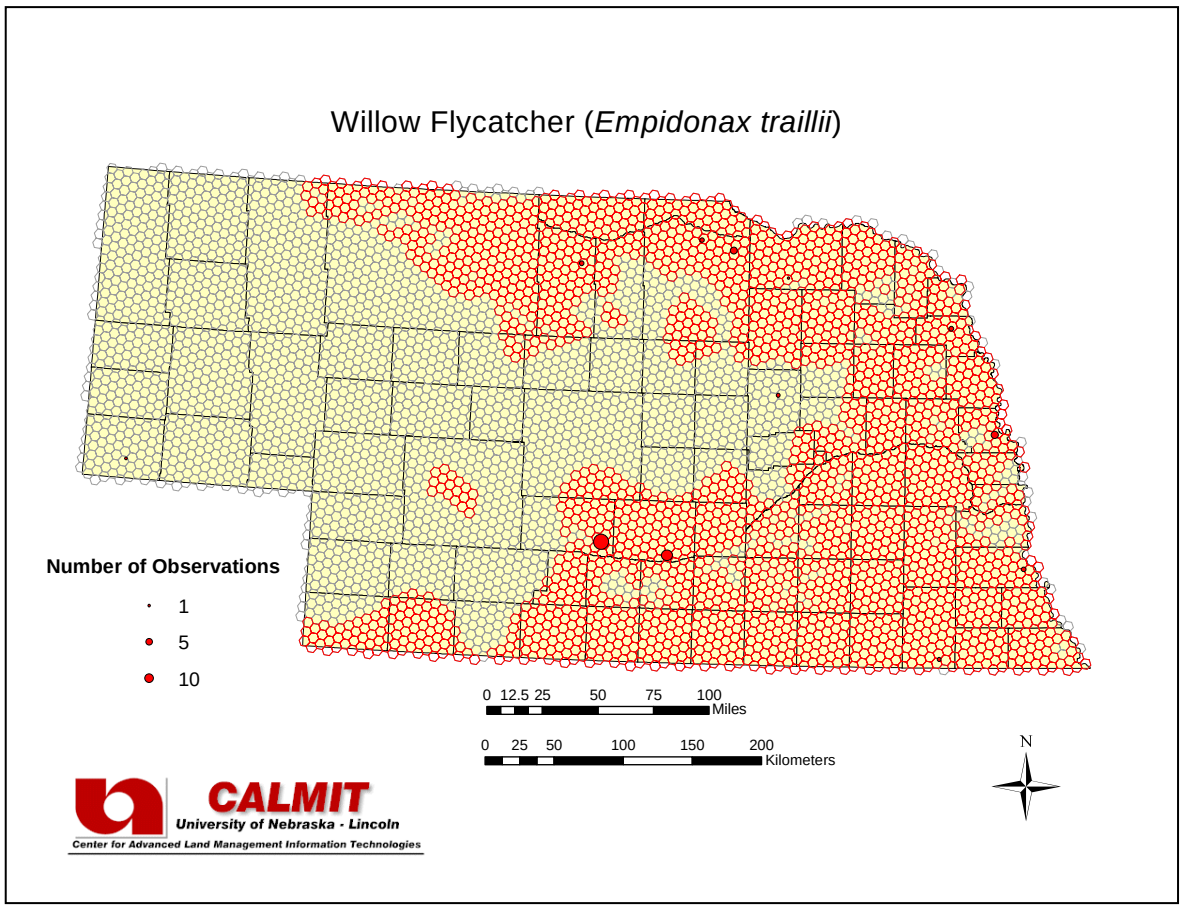
Common Name:	**Willow Flycatcher**	TNC Global Status:	G5
Scientific Name:	***Empidonax traillii***	Federal Status:	--
TNC Element Code:	ABPAE33040	State (NE) Status:	S4
AOU Code:	04660		

Habitat Description:
Inhabits shrubby edge habitats, with a preference during breeding for willows. The preferred breeding habitat of shrubs and small trees is somewhat transitory, especially in the panhandle and southwest (Johnsgard 1997, Sharpe et al. 2001). The breeding range of this species extends west to Cherry, Thomas, and Keith counties in the Sandhills and to Sheridan County in the Panhandle (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 9,560,802

Model Description:
Modeled distribution using the set of variables 'Average 30-year Precipitation Coefficient of Variation for July > 55%' AND 'Land Cover class Little Bluestem-Gramma Mixedgrass Prairie > 2.5%' OR 'Average 30-year Precipitation Coefficient of Variation for July > 55%' AND 'Land Cover class Little Bluestem-Gramma Mixedgrass Prairie $\leq$ 2.5%' AND 'Land Cover class Upland Tallgrass Prairie > 10%' OR 'Average 30-year Precipitation Coefficient of Variation for July $\leq$ 55%'and 'Average 30-year Maximum Temperature Coefficient of Variation for June $\leq$ 3.8%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



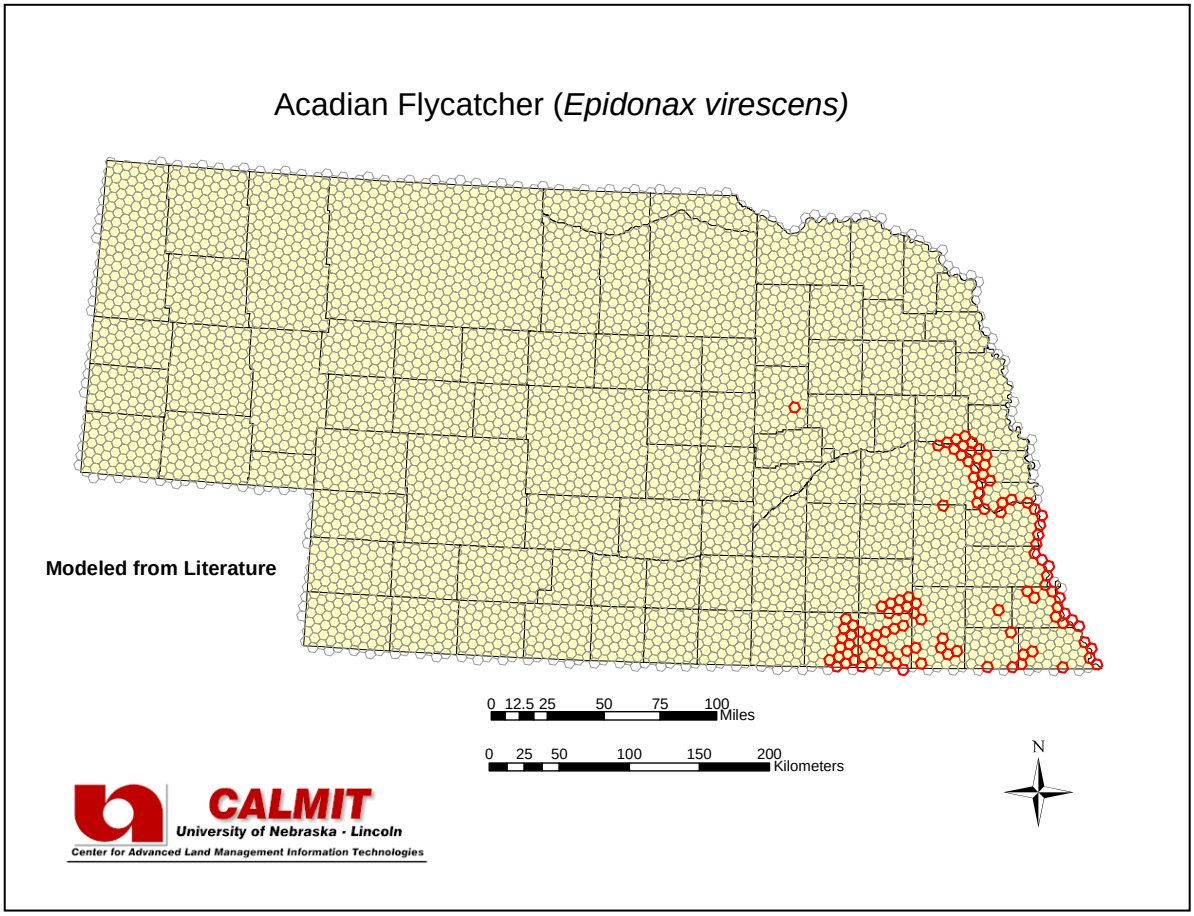
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Acadian Flycatcher**	TNC Global Status:	G5
Scientific Name:	***Empidonax virescens***	Federal Status:	--
TNC Element Code:	ABPAE3302	State (NE) Status:	S4
AOU Code:	04650		

Habitat Description:
Species is a rare regular breeder in the southeast and generally occurs in shady wooded ravines in upland forest, usually near water (Sharpe et al. 2001). Restricted to southeast Nebraska, north and west to Douglas and Lancaster Counties. Other sources also include humid riverbottom forests and forested swamps (Johnsgard 1997), as well as deciduous forests (Walkinshaw and Brewer 1991) in habitat descriptions. The limited distribution in the southeast corner of the state is included in species' accounts from the Cornell Lab of Ornithology (Cornell Lab of Ornithology 2002), 'Ranges of North American Breeding Birds' from the USGS' Northern Prairie Science Center (Price 1995) and the 'North American Breeding Bird Survey Results and Analysis, 1966-2000', compiled by the USGS' Patuxent Wildlife Research Center (Sauer et al. 2001).

Total Area of Modeled Habitat (ha): 413,570

Model Description:
No observational data were available for this species. Modeled from literature using the variable 'Land Cover class Riparian Woodland > 0.05%' AND 'Average 30-year Precipitation for August > 90 mm'.



Nebraska GAP Analysis 2004
Bird Species Atlas

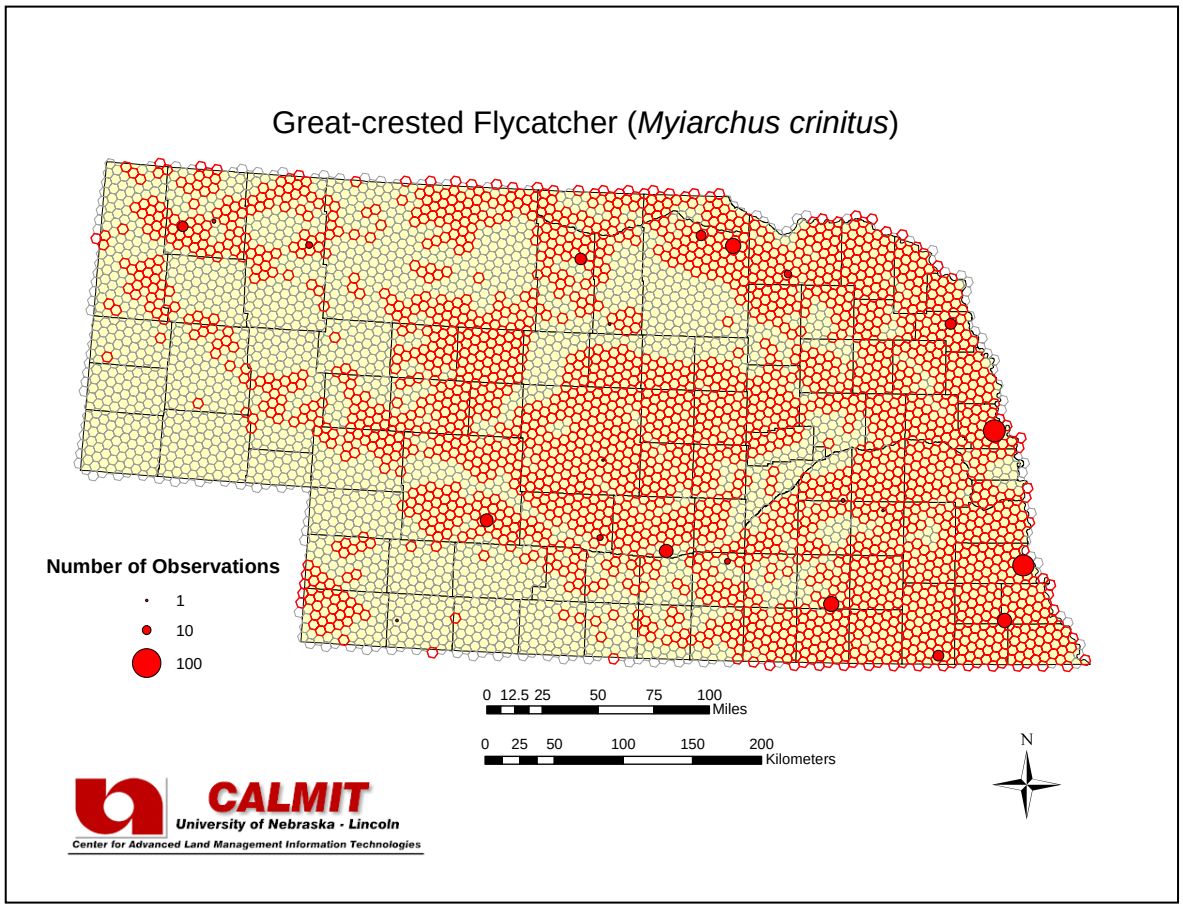
Common Name:	**Great Crested Flycatcher**	TNC Global Status:	G5
Scientific Name:	***Myiarchus crinitus***	Federal Status:	--
TNC Element Code:	ABPAE43070	State (NE) Status:	S4
AOU Code:	04520		

Habitat Description:
This species occurs in mature deciduous woodland especially those with a fairly open canopy, both riverbottom, usually mature cottonwoods, and upland. This species is a cavity nester using woodpecker holes or natural cavities. It is most numerous in the southern and eastern Nebraska and occurs in decreasing numbers westward (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.01×10^7

Model Description:
Modeled distribution using the set of variables 'Land Cover class Emergent Wetland $\leq$ 1%' AND 'Land Cover class Fallow Agricultural Fields $\leq$ 3%' AND 'Land Cover class High Intensity Residential/Commercial/Industrial/ Transportation $\leq$ 2%' AND 'Land Cover class Barren/Sand/Outcrop $\leq$ 0.5%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

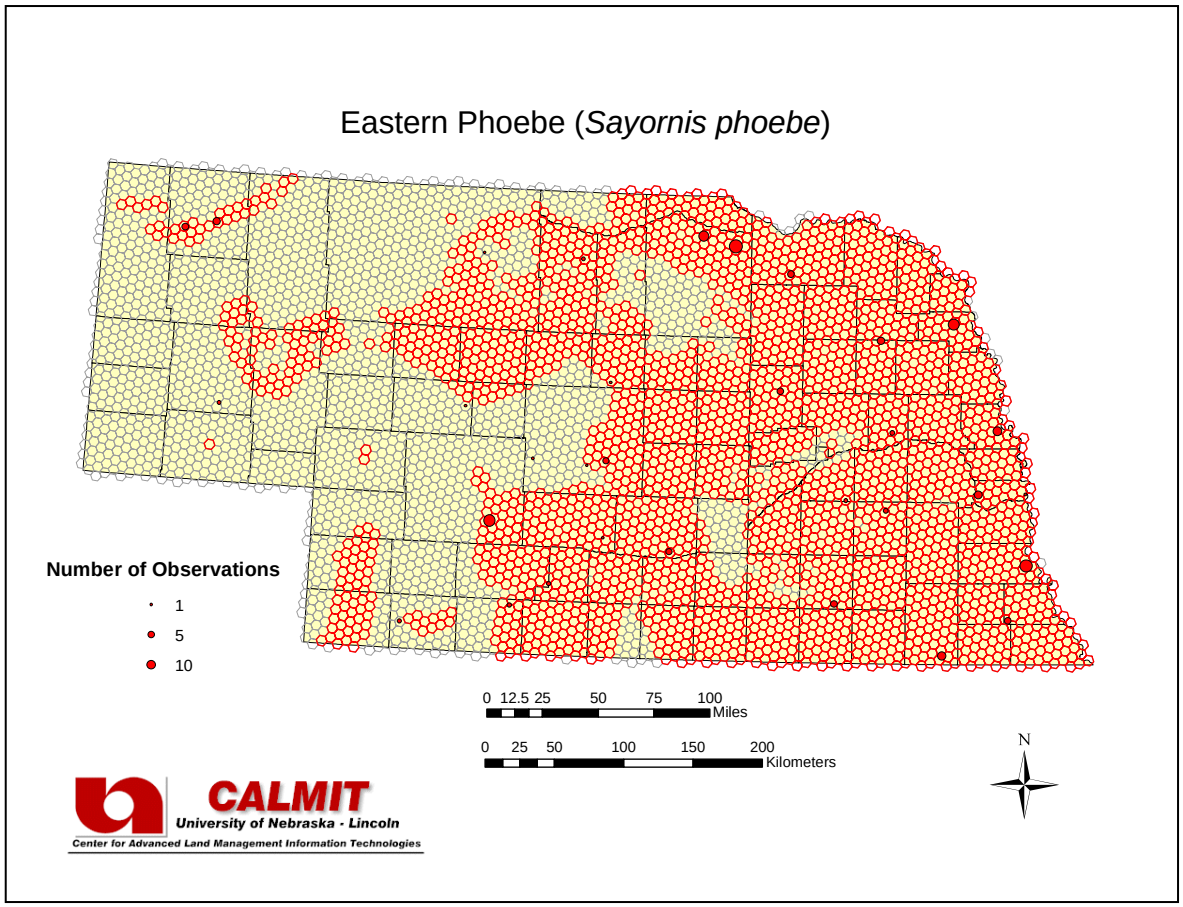
Common Name:	**Eastern Phoebe**	TNC Global Status:	G5
Scientific Name:	***Sayornis phoebe***	Federal Status:	--
TNC Element Code:	ABPAE35020	State (NE) Status:	S4
AOU Code:	04560		

Habitat Description:
BBS data indicate that this species is most common in the north and east. Although there are summer records south of the Plate River, densities are low, especially as far west as Dundy and Chase counties. In the north it is common westward at least to eastern Cherry Co and Valentine. In the Panhandle it breeds in small numbers in Pine Ridge (Sharpe et al. 2001). Found near water in woodlands or partially wooded areas, including farmsteads. Farm buildings, bridges, and other locations providing artificial or natural ledges protected from above are used for nest sites (Johnsgard 1997, Mollhoff 2001).

Total Area of Modeled Habitat (ha): 1.17×10^7

Model Description:
Modeled distribution using the set of variables 'Land Cover class Emergent Wetland $\leq$ 4%' AND 'Average 30-year Maximum Temperature Coefficient of Variation for June $\leq$ 4.2%' OR 'Land Cover class Emergent Wetland $\leq$ 4%' AND 'Average 30-year Maximum Temperature Coefficient of Variation for June > 4.2%' AND 'Land Cover class Ponderosa Pine Forests and Woodlands $\leq$ 17.7%'.

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

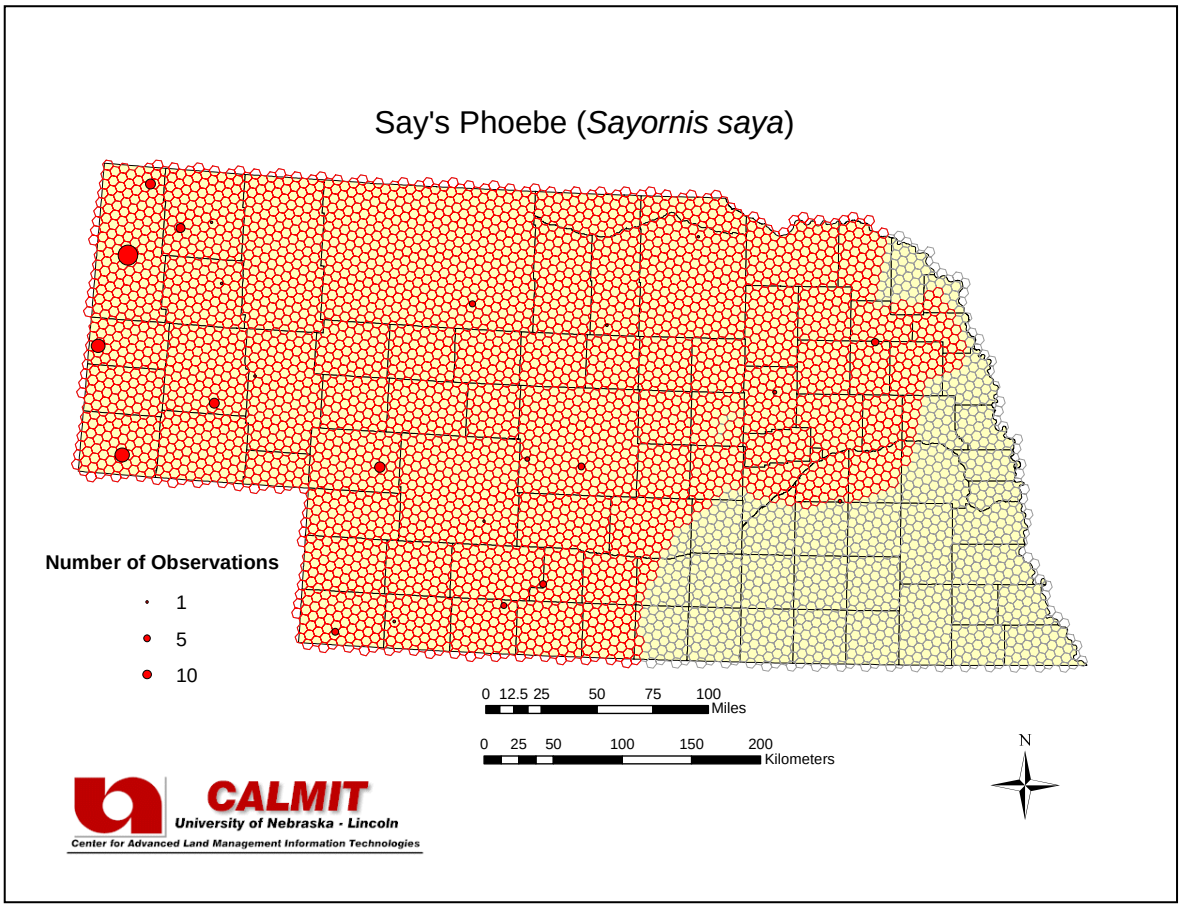
Common Name:	**Say's Phoebe**	TNC Global Status:	G5
Scientific Name:	***Sayornis saya***	Federal Status:	--
TNC Element Code:	ABPAE35030	State (NE) Status:	S4
AOU Code:	04570		

Habitat Description:
Found most frequently in the Panhandle in the short- and mixed-grass areas. In the scattered sites further east it was usually associated with the open, grassy areas (Mollhoff 2001). Breeds commonly throughout the Panhandle, although records in the Sandhills of Sheridan and Garden counties are "scarce" and limited to migrants (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.62×10^7

Model Description:
Modeled distribution using the set of variables 'Average 30-year Precipitation for September $\leq$ 67 mm' OR 'Average 30-year Precipitation for September > 67 mm' AND 'Average 30-year Precipitation Coefficient of Variation for April > 74.5%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



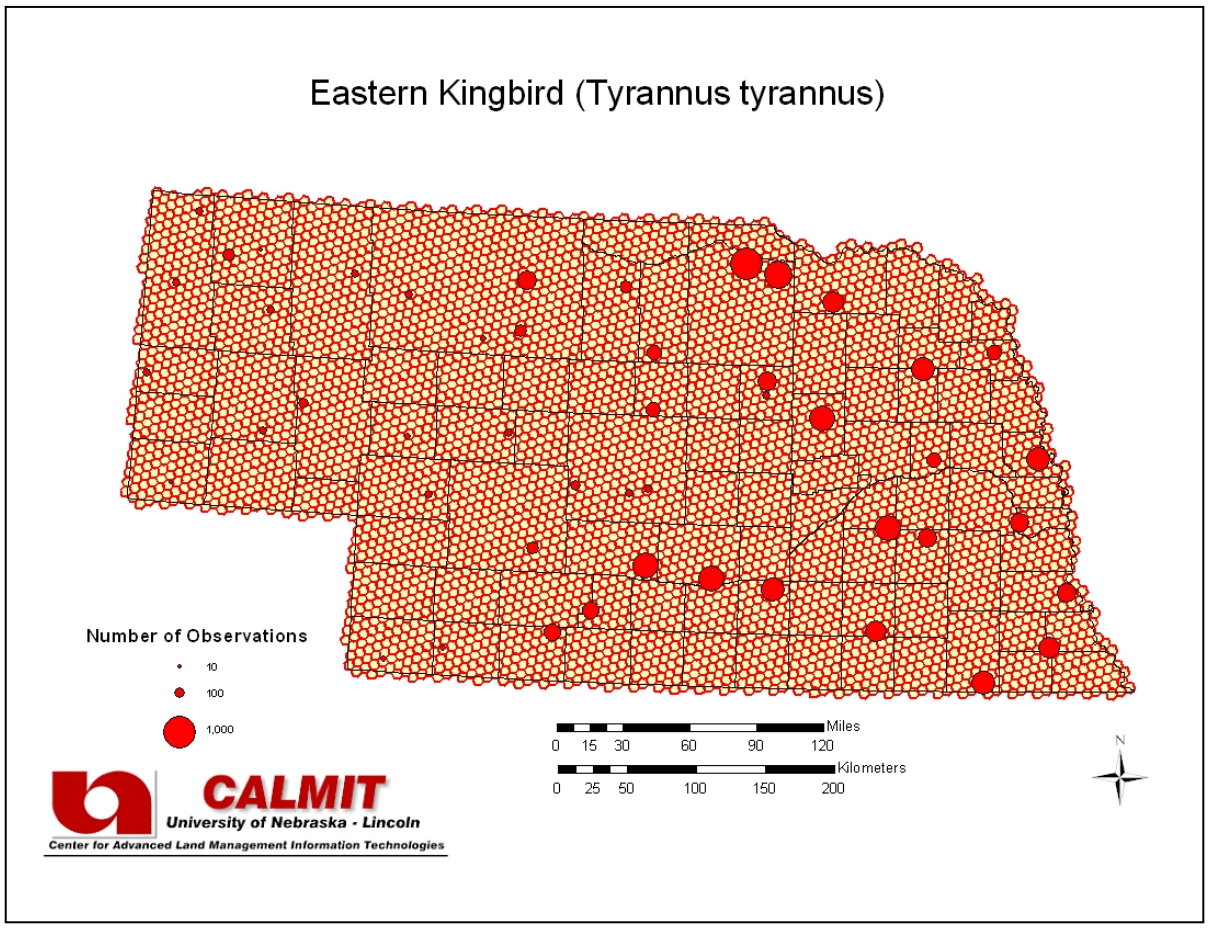
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Eastern Kingbird**	TNC Global Status:	G5
Scientific Name:	***Tyrannus tyrannus***	Federal Status:	--
TNC Element Code:	ABPAE52060	State (NE) Status:	S5
AOU Code:	04440		

Habitat Description:
Occupies open areas having scattered trees or tall shrubs, and forest edges or hedgerows (Johnsgard 1997). Species is found most frequently in open country with occasional trees and windbreaks (Mollhoff 2001). Occurs statewide, with breeding birds found in most types of edge habitats, including roadsides, windbreaks, fencelines, and early successional vegetation along water edges; avoids ponderosa pine woodlands in the Panhandle but may be associated with nearby deciduous habitats (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



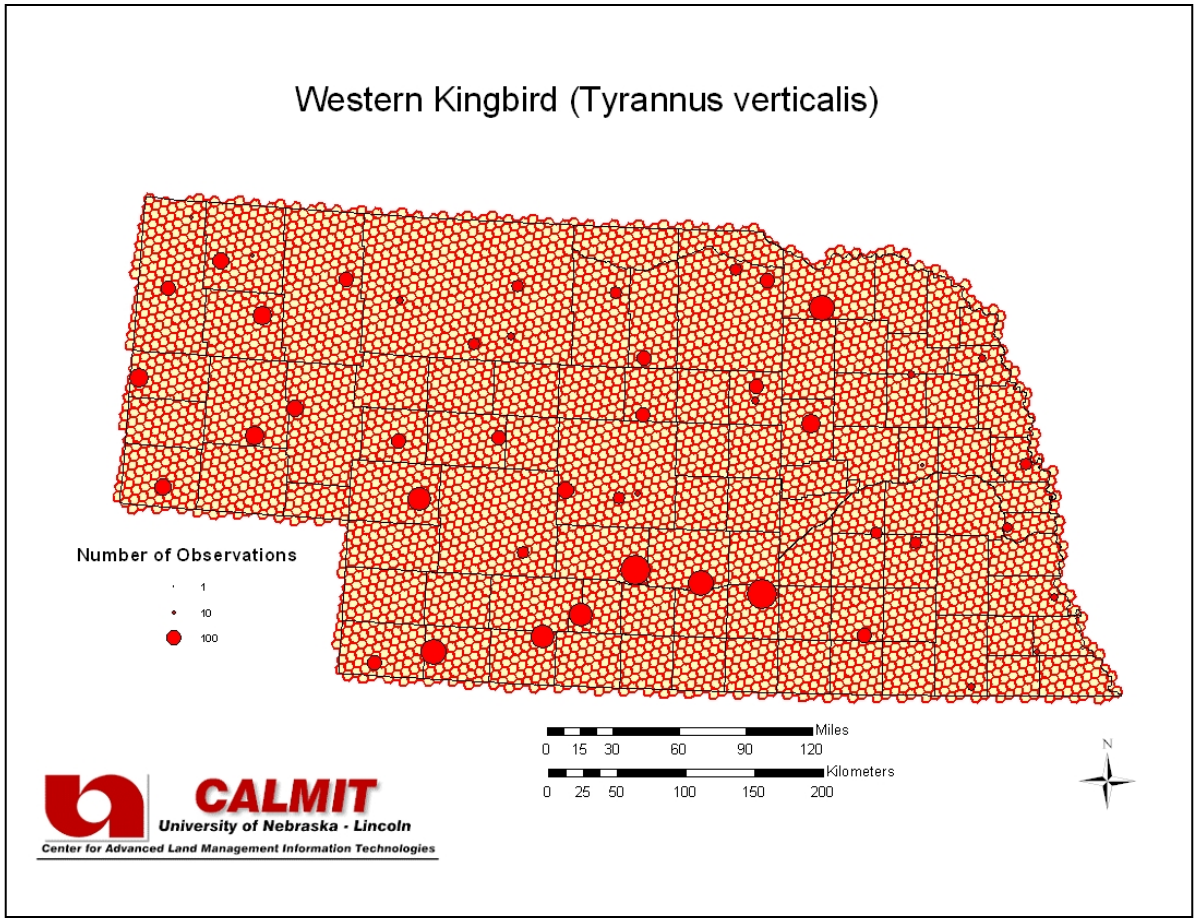
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Western Kingbird**	TNC Global Status:	G5
Scientific Name:	***Tyrannus verticalis***	Federal Status:	--
TNC Element Code:	ABPAE52050	State (NE) Status:	S5
AOU Code:	04470		

Habitat Description:
Summer resident almost statewide, becoming less common eastward (Johnsgard 1997, Mollhoff 2001). Occupies a variety of edge habitats, such as shelterbelts, orchards, woodland margins, and tree-lined residential areas (Johnsgard 1997). Birds of open country with a scattering of trees and brush, but also frequent dry upland field margins and pastures, as well as other habitats, such as riparian woodlands, farmsteads and community parks (Mollhoff 2001). Found statewide in open edge situations, including pines (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



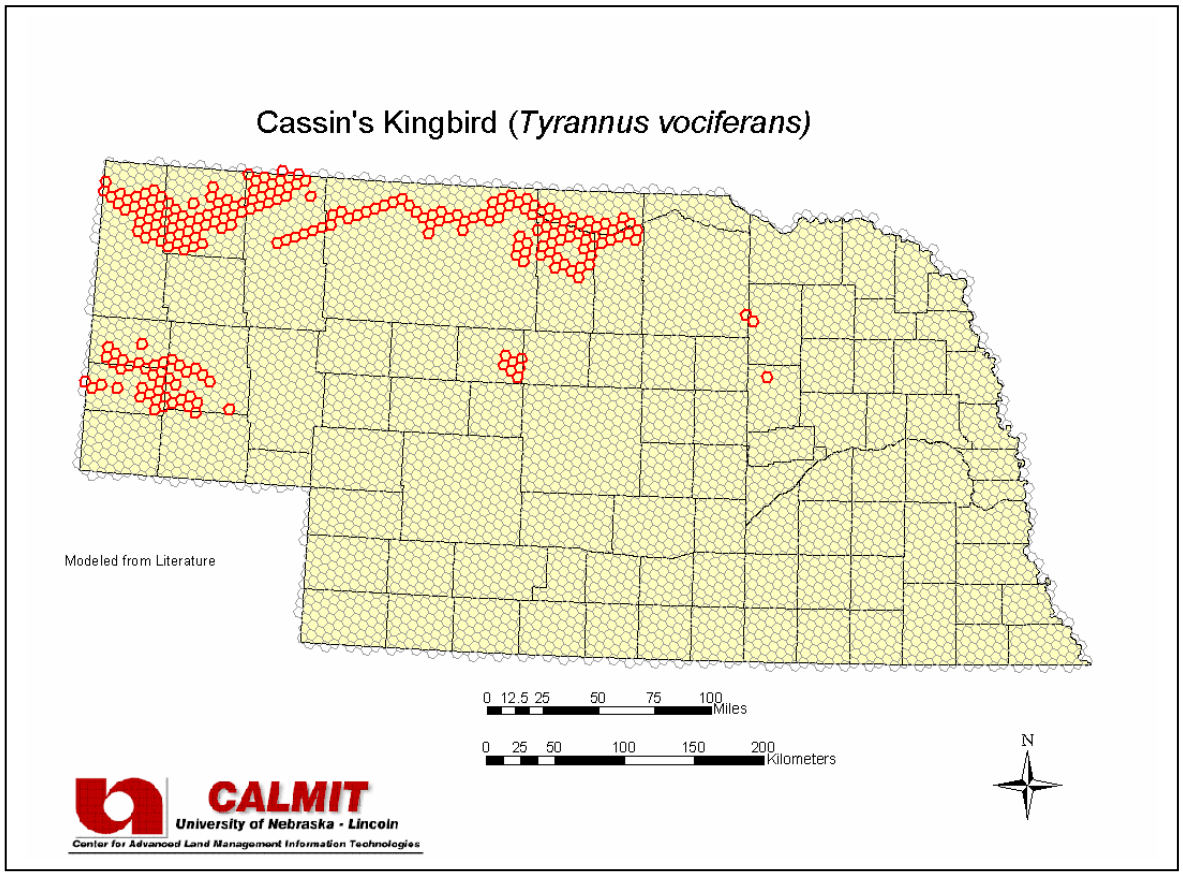
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Cassin's Kingbird**	TNC Global Status:	G5
Scientific Name:	***Tyrannus vociferans***	Federal Status:	--
TNC Element Code:	ABPAE52030	State (NE) Status:	S3
AOU Code:	04480		

Habitat Description:
Associated with dry open country with only scattered tall trees (Johnsgard 1997). Occurs on plains, prairies, mesas, and flats, and around pastures, woodland clearings, ranches, and farms.

Total Area of Modeled Habitat (ha): 956,894

Model Description:
No observational data were available for this species. Distribution was modeled from literature using the variable 'Land Cover class Ponderosa Pine Forests and Woodlands > 1%'.



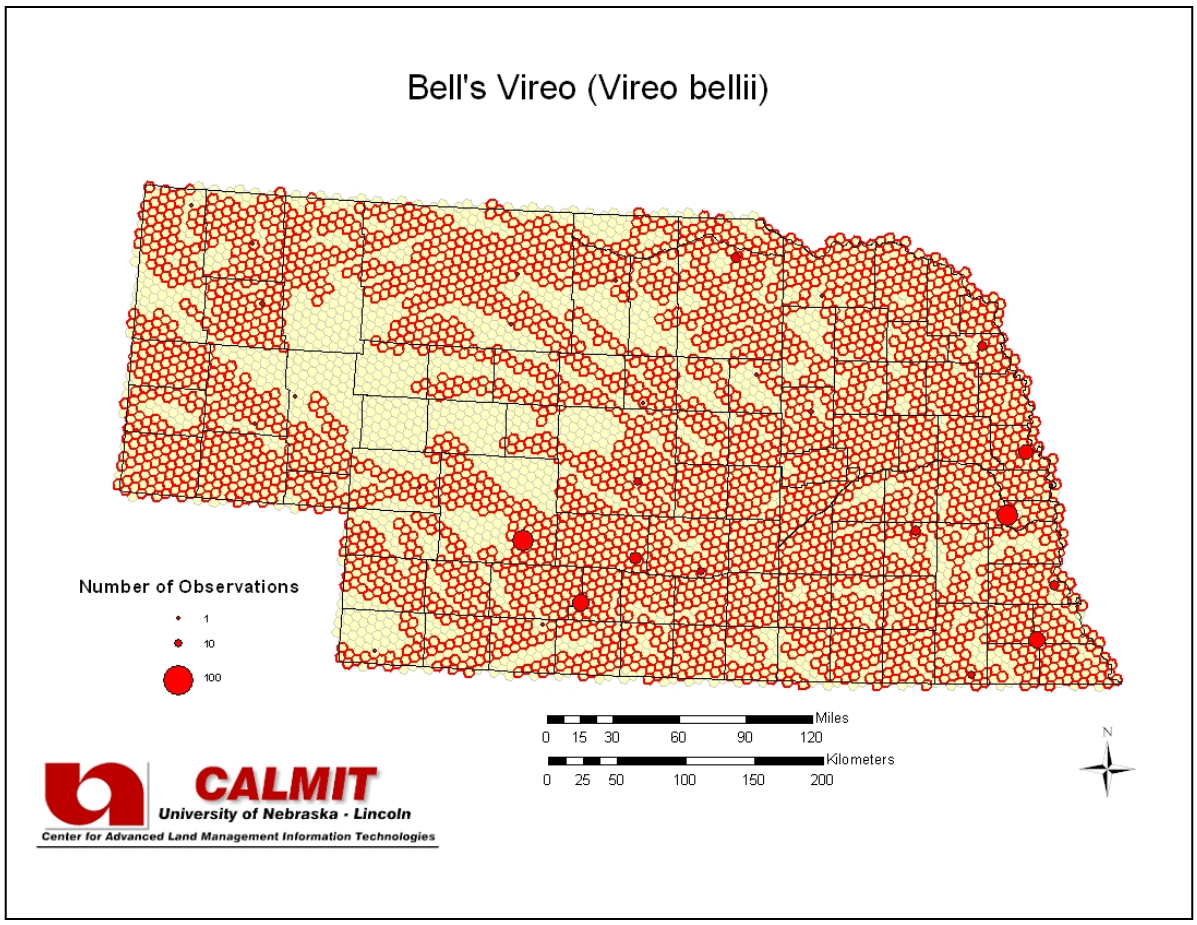
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Bell's Vireo**	TNC Global Status:	G5
Scientific Name:	***Vireo bellii***	Federal Status:	--
TNC Element Code:	ABPBW01110	State (NE) Status:	S4
AOU Code:	06330		

Habitat Description:
Widespread in thickets near streams or rivers, and in second-growth scrub, forest edges and brush patches (Johnsgard 1997). Reported most frequently in areas of scattered brush (Mollhoff 2001). Found statewide in dense thickets and hedgerows, often associated with river or stream valleys (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 12,536,880

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Stream Class is present'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



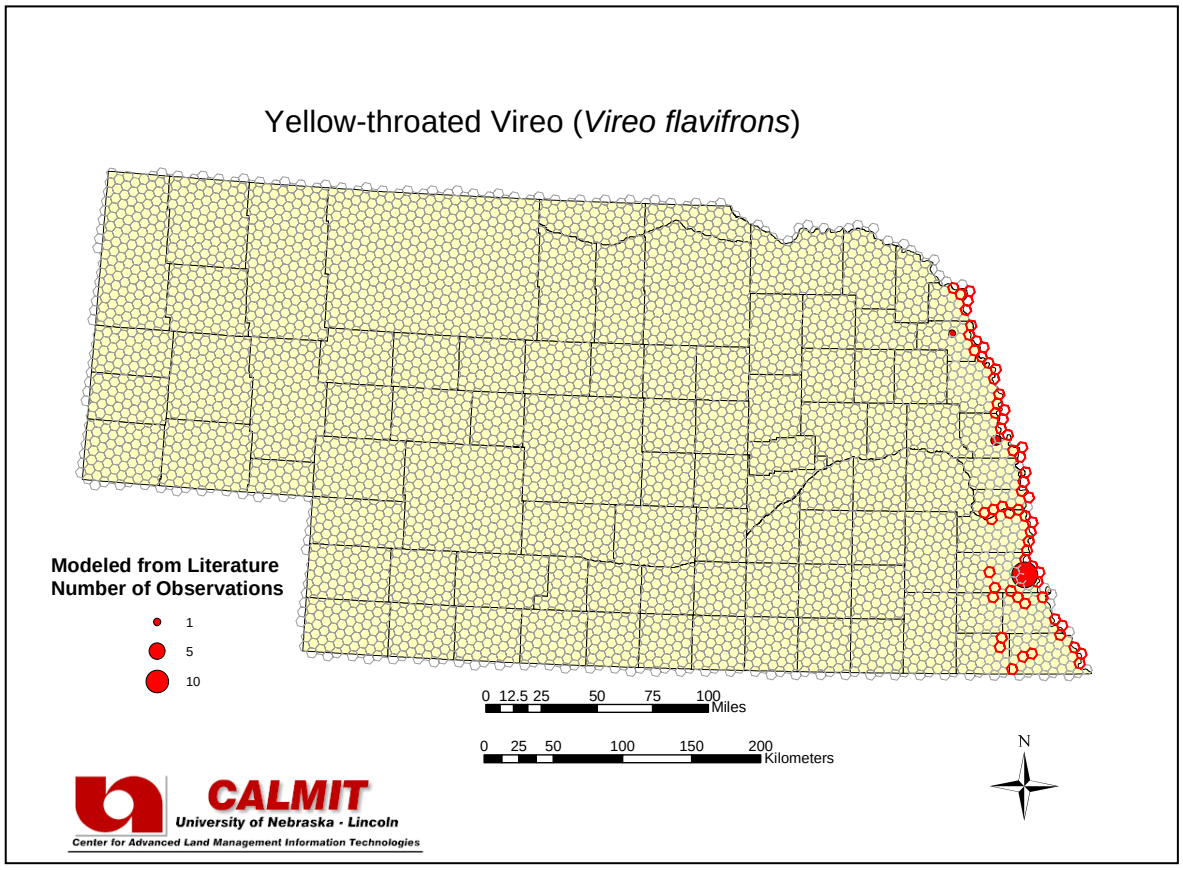
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Yellow-throated Vireo**	TNC Global Status:	G5
Scientific Name:	***Vireo flavifrons***	Federal Status:	--
TNC Element Code:	ABPBW01170	State (NE) Status:	S2
AOU Code:	06280		

Habitat Description:
Associated with mature, moist deciduous forests, especially river bottom forests and shady slopes (Johnsgard 1997). Recorded as most common along the Missouri River in mature deciduous forests in steep-sided deep ravines (Mollhoff 2001). Breeding birds have been recorded in Dakota, Washington, Sarpy, Johnson, Nemaha, Pawnee, and Richardson Counties, and there is no evidence that the species currently breeds anywhere outside the Missouri Valley (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 251,387

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Riparian Shrubland is present', clipped to the area of confirmed recent breeding records along the Missouri River in Dakota, Washington, Sarpy, Johnson, Nemaha, Pawnee, and Richardson Counties (Sharpe et al. 2001).



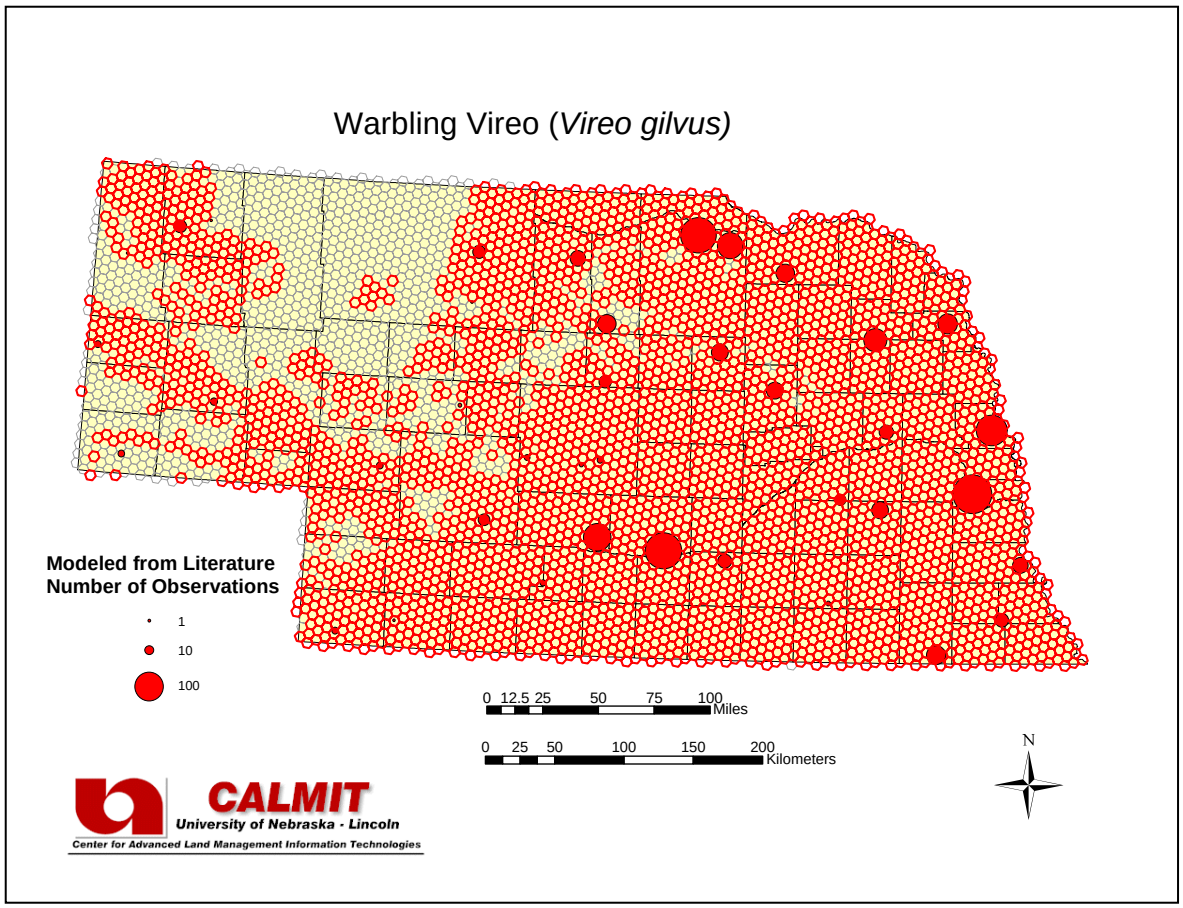
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Warbling Vireo**	TNC Global Status:	G5
Scientific Name:	***Vireo gilvus***	Federal Status:	--
TNC Element Code:	ABPBW01210	State (NE) Status:	S5
AOU Code:	06270		

Habitat Description:
Occurs in open stands of deciduous trees, including streamside vegetation, groves, scrubby hillsides and residential areas, with tall streamside cottonwoods as favored nesting sites (Johnsgard 1997). Most often found in areas of tall mature deciduous trees, including riparian and dry upland forest, planted windbreaks, woodlots and timber claims (Mollhoff 2001). Breeding birds occur statewide in riparian woodland, most commonly cottonwoods (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.57×10^7

Model Description:
Adequate model could not be resolved using QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Deciduous Forests and Woodlands is present'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

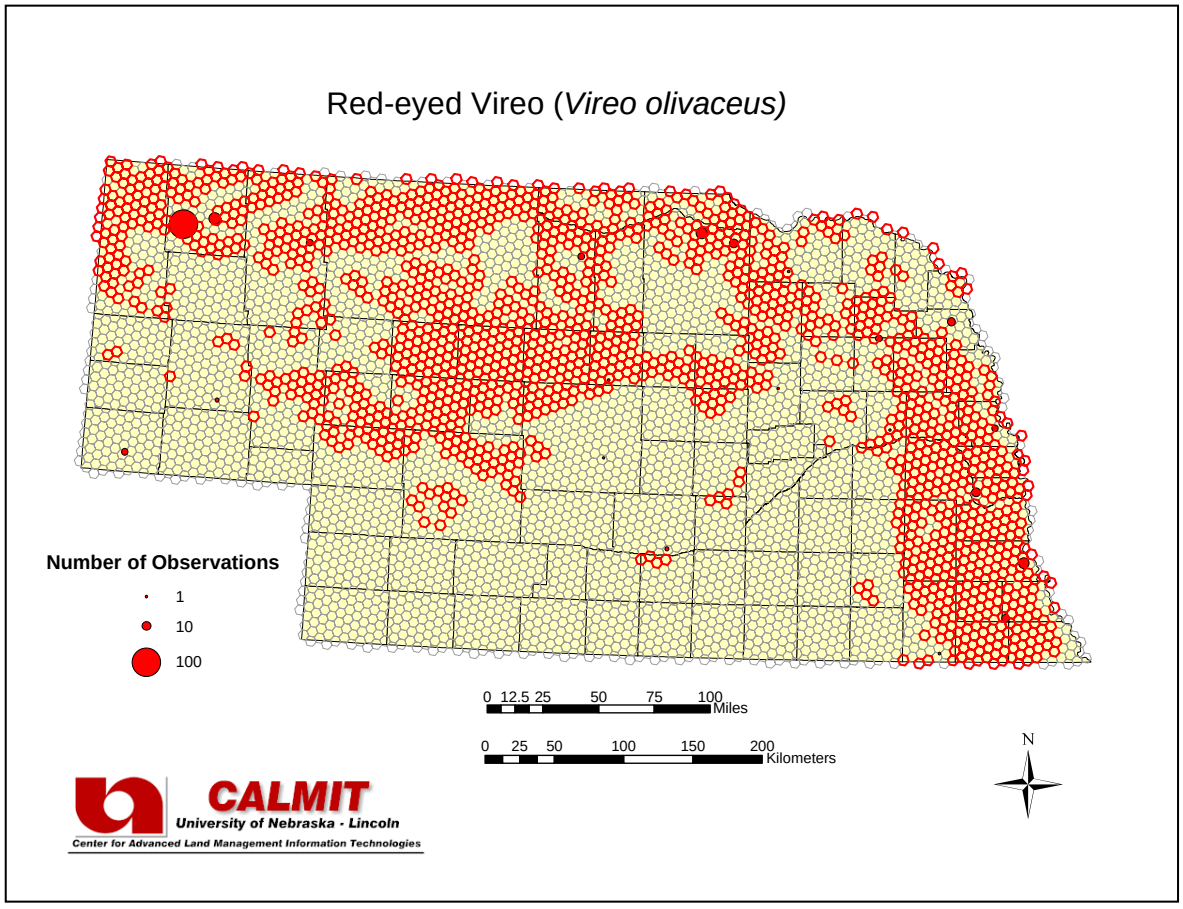
Common Name:	**Red-eyed Vireo**	TNC Global Status:	G5
Scientific Name:	***Vireo olivaceus***	Federal Status:	--
TNC Element Code:	ABPBW01240	State (NE) Status:	S4
AOU Code:	06240		

Habitat Description:
Reported in Nebraska in the major river valleys and the Pine Ridge and Wildcat Hills (Mollhoff 2001). Found in mature deciduous woodland, mostly riparian. Most numerous in the deciduous woodland of the Missouri Valley, but also occurs in deciduous woodlands elsewhere (Sharpe et al. 2001). Least common in the southwest and limited to riparian habitats in the northwest.

Total Area of Modeled Habitat (ha): 6,742,831

Model Description:
Modeled distribution using the set of variables 'Land Cover class Emergent Wetland < 1.2%' AND 'Percentage of Medium-textured Soils < 35%' AND 'Land Cover class Fallow Agricultural Fields < 0.5%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



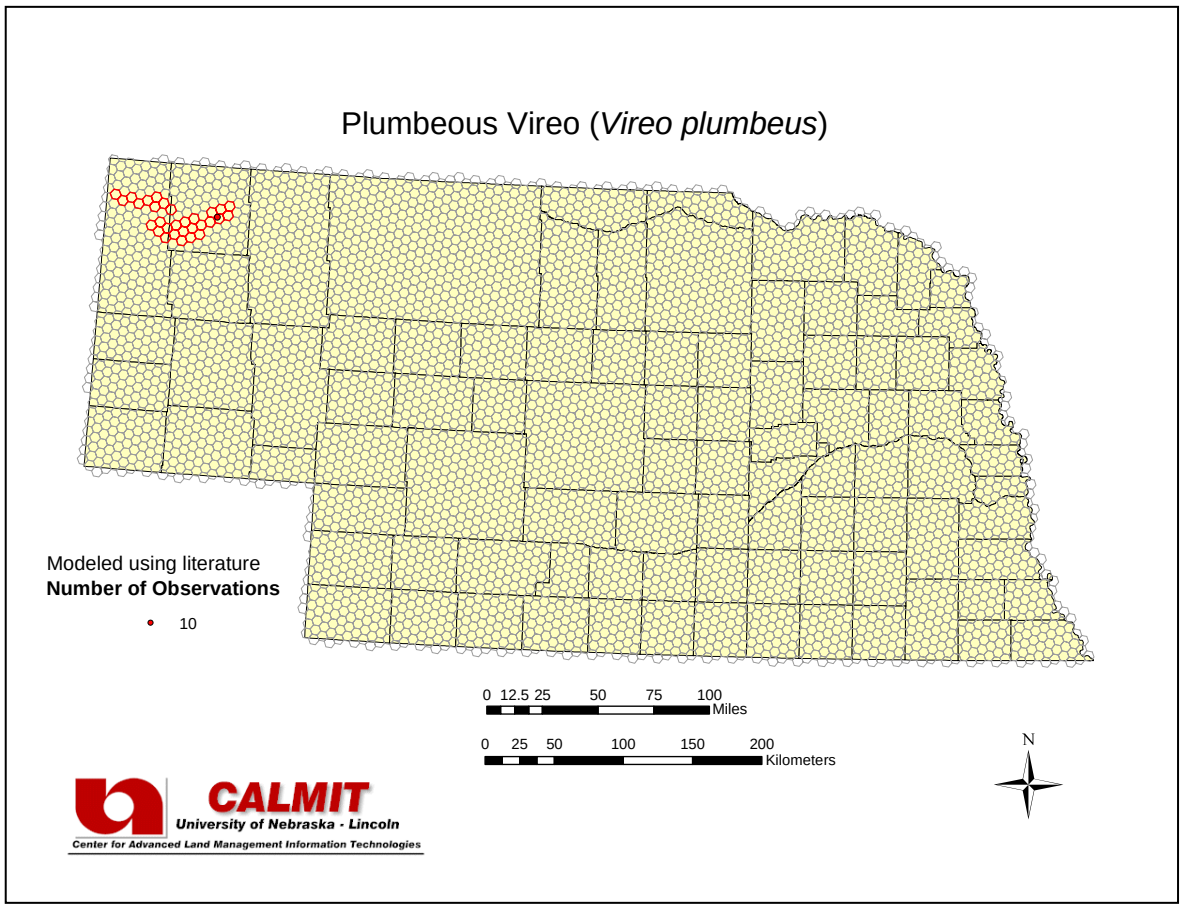
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Plumbeous Vireo**	TNC Global Status:	G5
Scientific Name:	***Vireo plumbeus***	Federal Status:	--
TNC Element Code:	ABPBW01280	State (NE) Status:	S2
AOU Code:	06292		

Habitat Description:
This species occurs in summer in small numbers in northwestern Sioux Co east to Sheridan Co. Primarily breeding habitat is ponderosa pine woodlands with riparian deciduous trees and shrubs adjacent (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001). This species can also be found in the transitional area between the pines and the deciduous trees that mark the water-courses in the canyon bottoms (Mollhoff 2001). Migrants occur in any wooded habitat but are rarely noted away from breeding locations. Breeding occurs in the western Pine Ridge, from the vicinity of Sowbelly Canyon westward (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 121,641

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Ponderosa Pine Forests and Woodlands > 10%'. Extent was clipped to the northwest corner of the state, limited to the Pine Ridge, the only area of known breeding records (Sharpe et al. 2001).



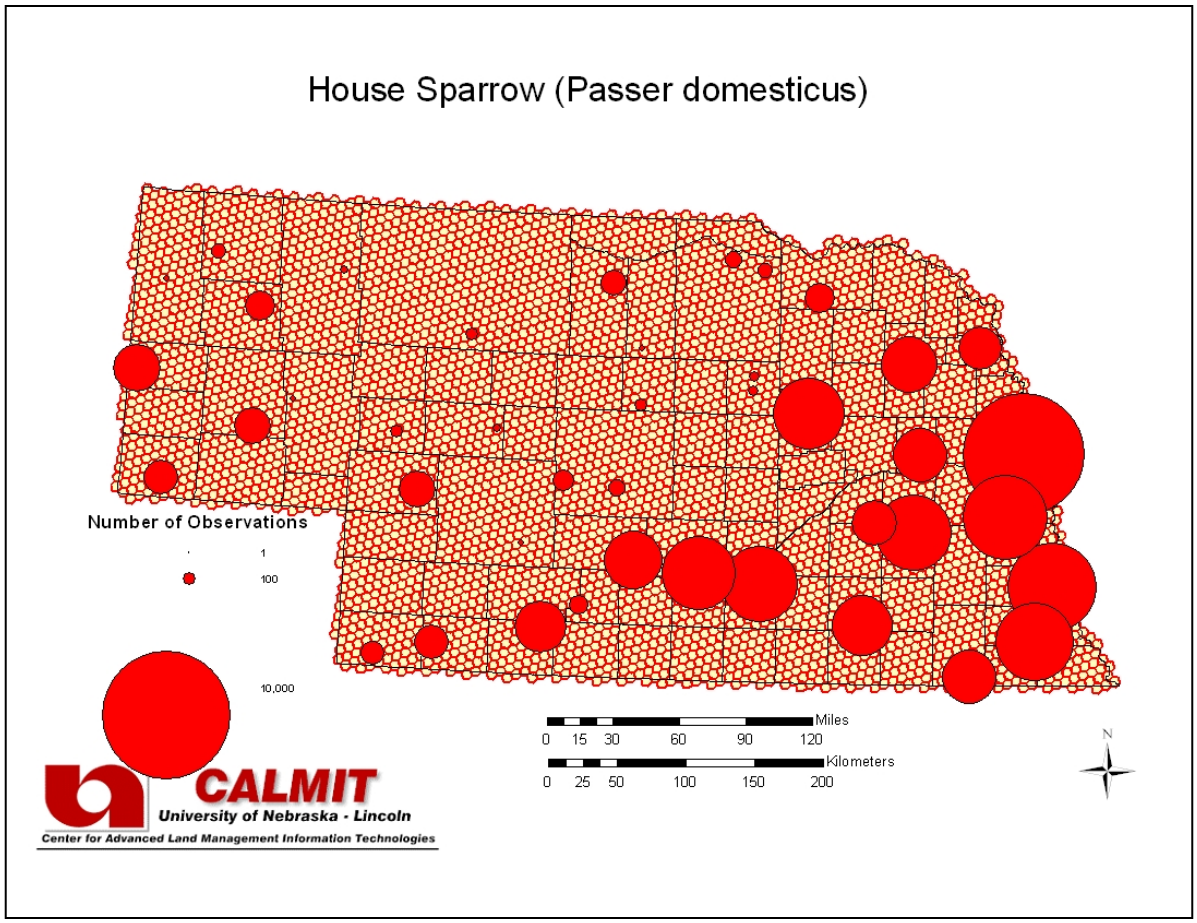
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**House Sparrow**	TNC Global Status:	G5
Scientific Name:	***Passer domesticus***	Federal Status:	--
TNC Element Code:	ABPBZ01010	State (NE) Status:	SE
AOU Code:	06882		

Habitat Description:
An abundant introduced permanent resident throughout Nebraska (Johnsgard 1997). Found in and around both urban and rural human habitation, with highest densities in the south and east (Mollhoff 2001, Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

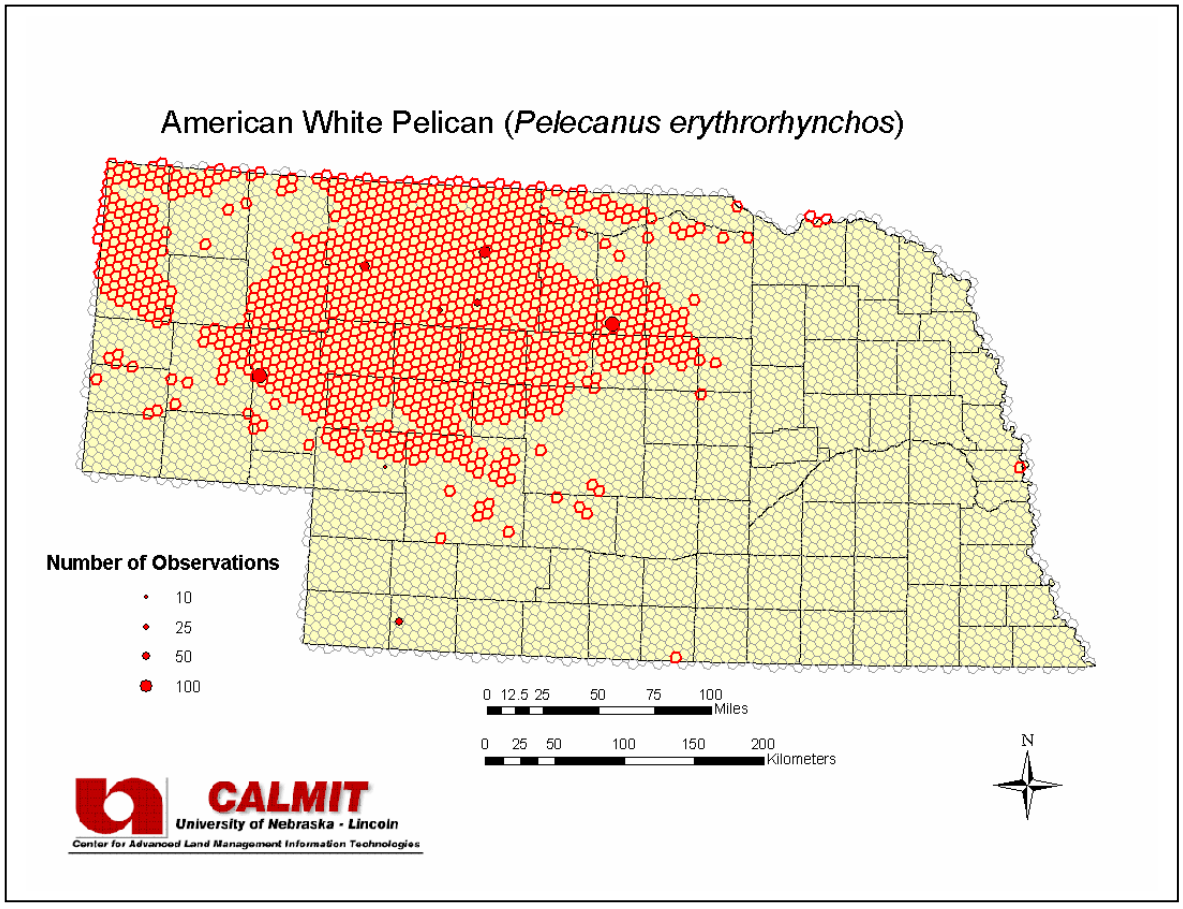
Common Name:	**American White Pelican**	TNC Global Status:	G5
Scientific Name:	***Pelecanus erythrorhynchos***	Federal Status:	--
TNC Element Code:	ABNFC01010	State (NE) Status:	S3
AOU Code:	01250		

Habitat Description:
Deep marshes, lakes and reservoirs are used by both migrating and breeding birds (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 4,902,042

Model Description:
Modeled distribution using the variable 'Land Cover class Agricultural Fields ≤ 4%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

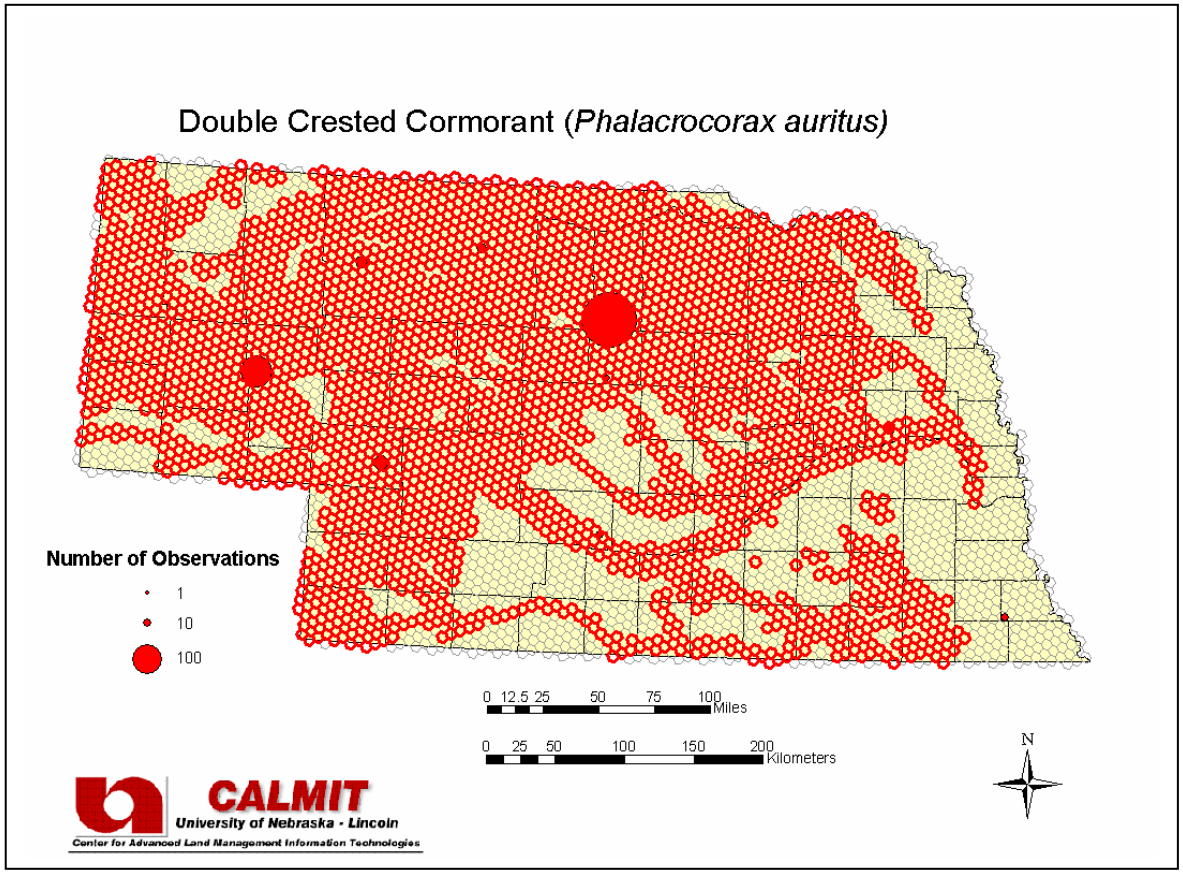
Common Name:	**Double-crested Cormorant**	TNC Global Status:	G5
Scientific Name:	***Phalacrocorax auritus***	Federal Status:	--
TNC Element Code:	ABNFD01020	State (NE) Status:	S3
AOU Code:	01200		

Habitat Description:
Migrating birds use medium-sized to large lakes and reservoirs, as well as rivers such as the Platte and Missouri (Sharpe et al. 2001). Breeding occurs on islands, trees, or cliffs near water, and within 10 miles of an adequate fish source (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 1.30×10^7

Model Description:
Modeled distribution using the set of variables 'Percentage of Medium-textured Soils $\leq$ 97.5%' AND 'Percentage of Moderately Coarse-textured Soils > 0.05%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



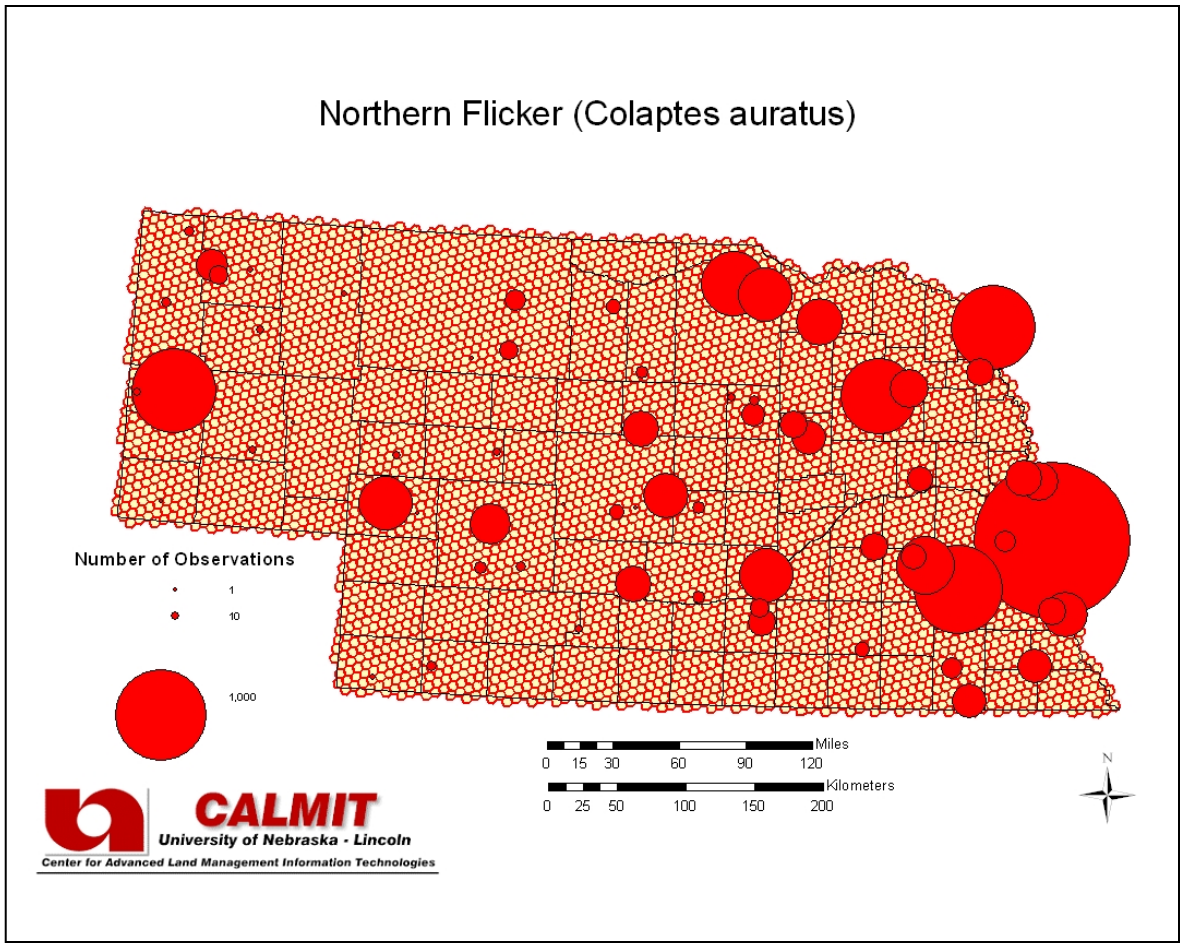
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Northern Flicker**	TNC Global Status:	G5
Scientific Name:	***Colaptes auratus***	Federal Status:	--
TNC Element Code:	ABNYF10020	State (NE) Status:	S5
AOU Code:	04123		

Habitat Description:
Occupies relatively open woodlands, orchards, woodlots, and urban environments; dense forests are avoided (Johnsgard 1997). Found in all available types of woodland (Mollhoff 2001). Breeding birds occur statewide, although numbers are somewhat lower in the Panhandle and extensive areas of the Sandhills (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

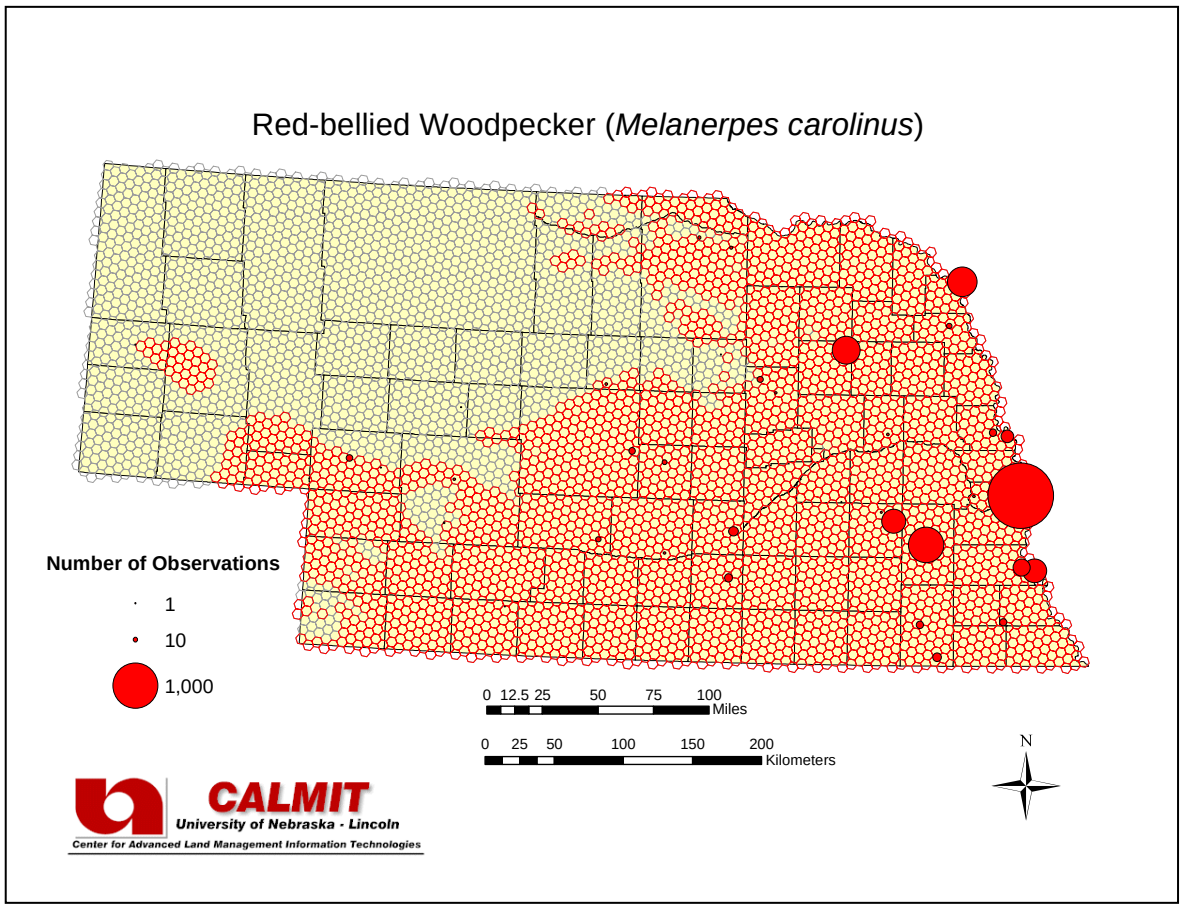
Common Name:	**Red-bellied Woodpecker**	TNC Global Status:	G5
Scientific Name:	***Melanerpes carolinus***	Federal Status:	--
TNC Element Code:	ABNYF04170	State (NE) Status:	S4
AOU Code:	04090		

Habitat Description:
This species is most common in the valleys of the Missouri River and it major tributaries, where it inhabits open woodland, including mixed coniferous woodland in the Niobrara River Valley and cottonwoods westerly (Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.23×10^7

Model Description:
Modeled distribution using variables 'Land Cover class Sandhills Upland Prairie $\leq$ 25%' AND 'Total Growing Degree Days at 0^{o}C through July > 2030'.

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



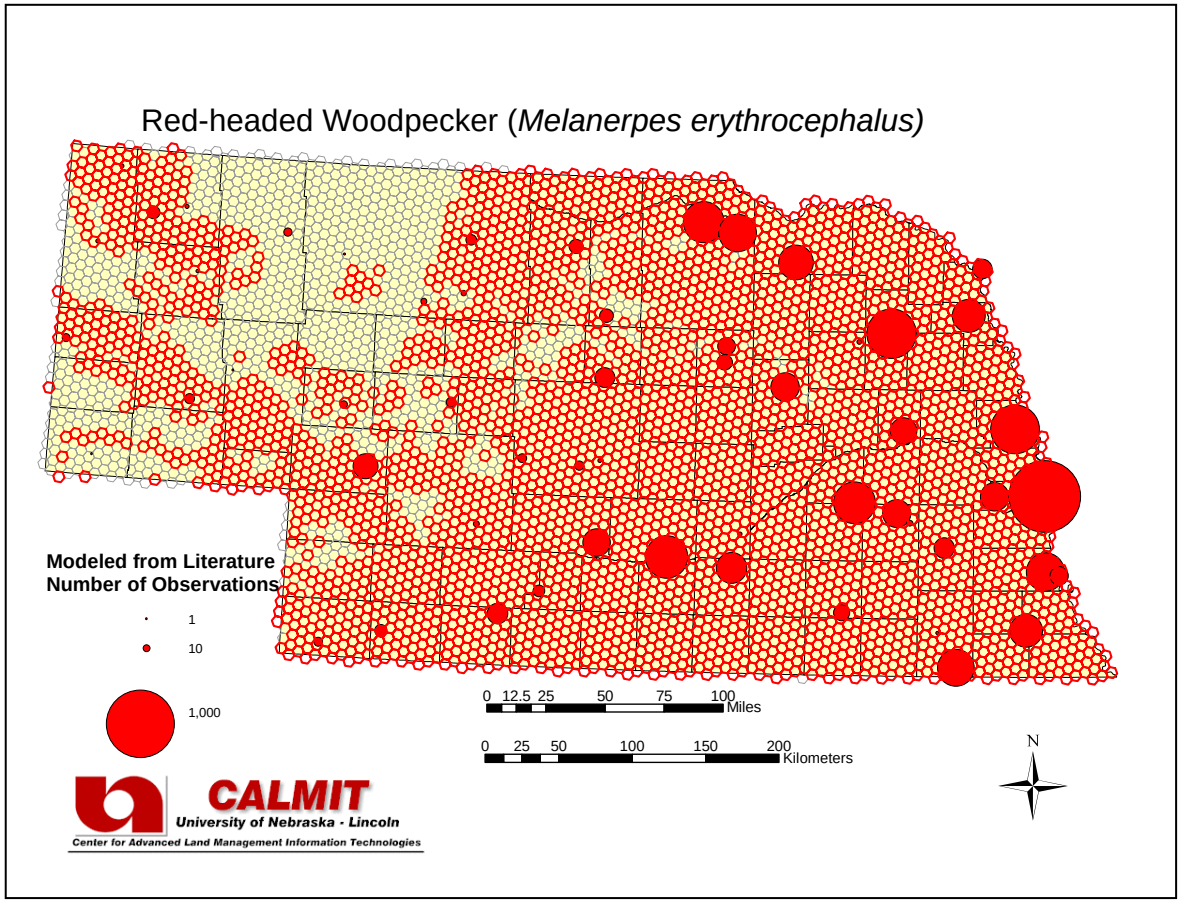
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Red-headed Woodpecker**	TNC Global Status:	G5
Scientific Name:	***Melanerpes erythrocephalus***	Federal Status:	--
TNC Element Code:	ABNYF04040	State (NE) Status:	S5
AOU Code:	04060		

Habitat Description:
Occurs in fairly open forests, woodlots, urban parks and wooded housing areas (Johnsgard 1997). Breeds in all counties; seen in shelterbelts, windbreaks and narrow riparian woodland (Mollhoff 2001). During the breeding season birds occur statewide in areas of open woodland, along roadsides near large isolated trees or clumps of trees, at the edges of farmstead woodlots, and in urban parks with large trees (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.57×10^7

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Deciduous Forests and Woodlands is present'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



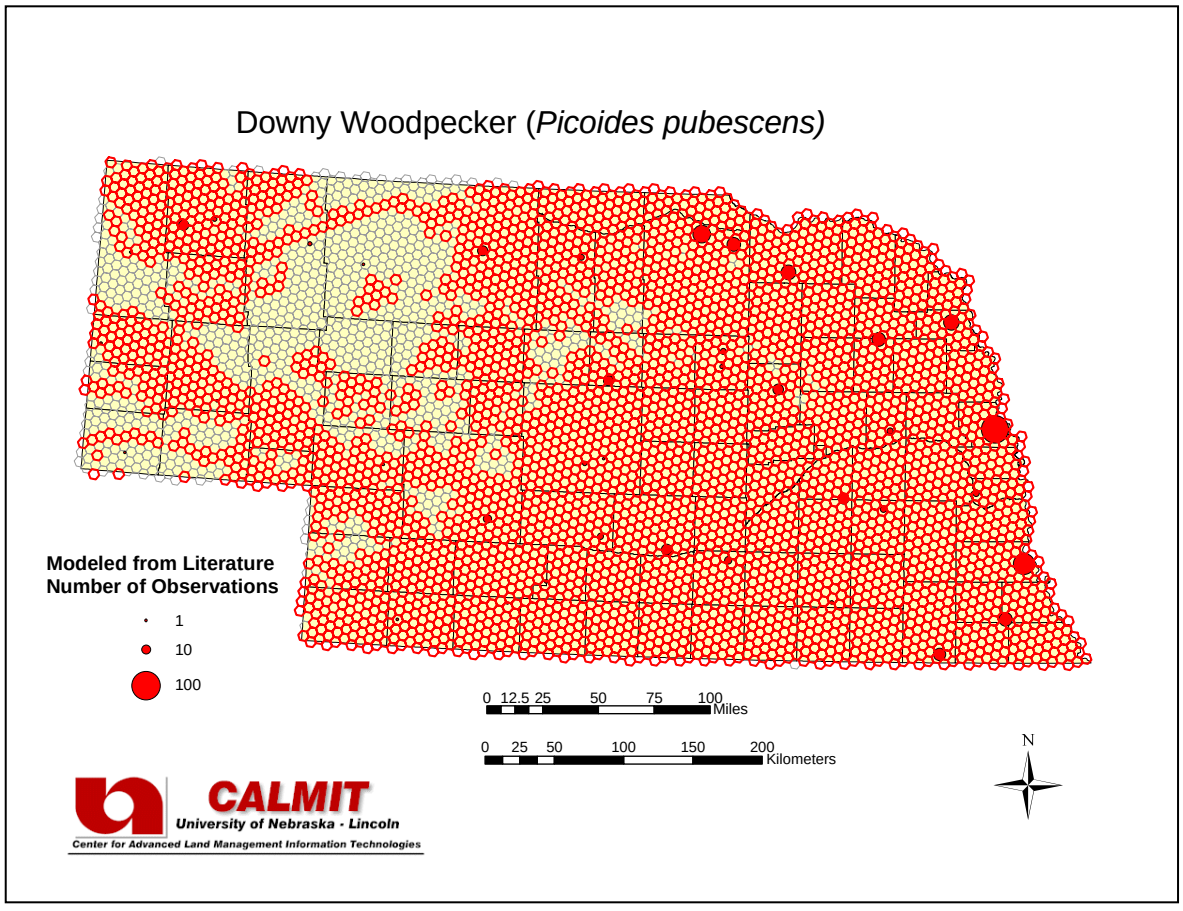
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Downy Woodpecker**	TNC Global Status:	G5
Scientific Name:	***Picoides pubescens***	Federal Status:	--
TNC Element Code:	ABNYF07030	State (NE) Status:	S4
AOU Code:	03940		

Habitat Description:
Found in dense or open forests, but also extends into city parks, gardens, etc. (Johnsgard 1997). Found in nearly every type of wooded habitat (Mollhoff 2001). Species is most common in the east; numbers decrease westward; utilize woody habitats, including coniferous and deciduous forests, upland and riparian habitats (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.64×10^7

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the set of variables 'Land Cover class Deciduous Forests and Woodlands is present' OR 'Land Cover class Ponderosa Pine Forests and Woodlands is present'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



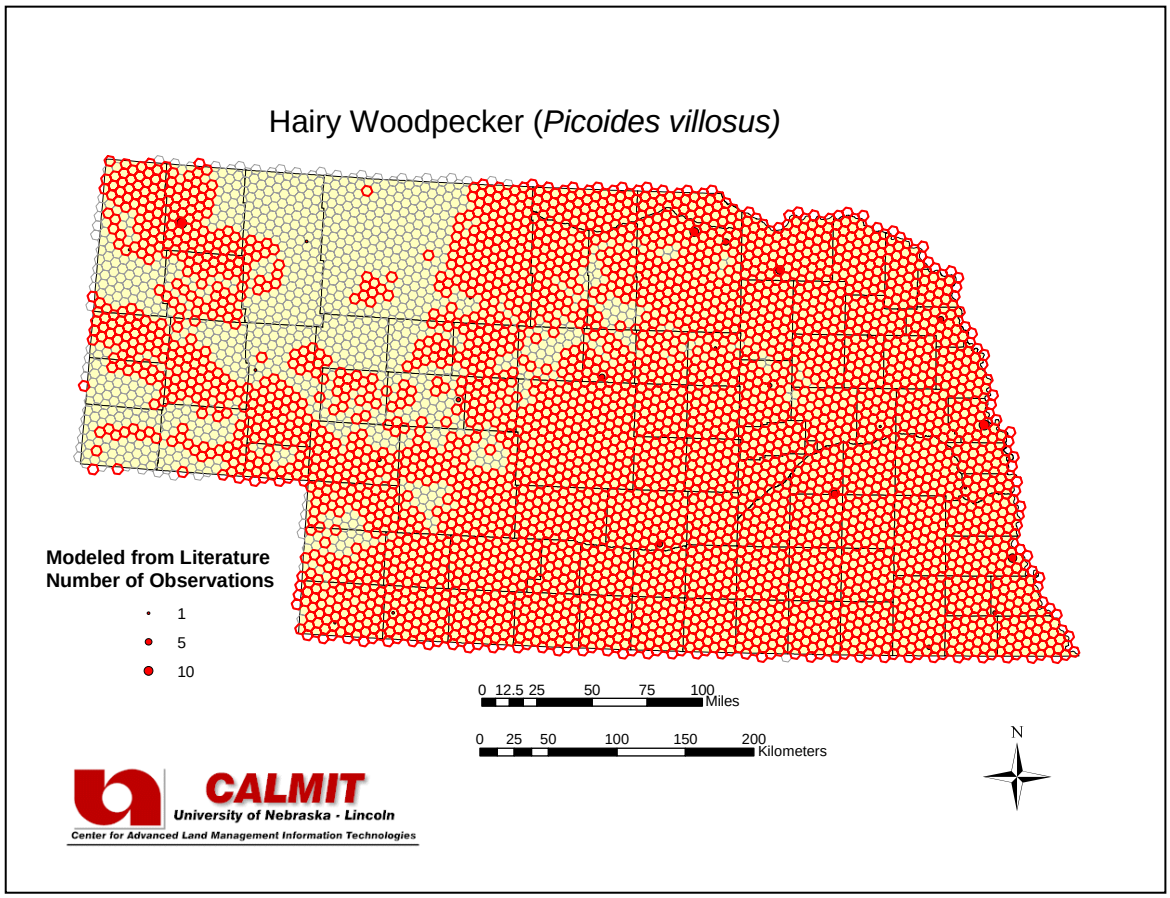
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Hairy Woodpecker**	TNC Global Status:	G5
Scientific Name:	***Picoides villosus***	Federal Status:	--
TNC Element Code:	ABNYF07040	State (NE) Status:	S4
AOU Code:	03930		

Habitat Description:
Species prefers fairly extensive areas of coniferous or deciduous forest, or streamside groves of trees (Johnsgard 1997). Found with most regularity in deciduous, riparian woods and in relict native forest stands in ravines (Mollhoff 2001). Preferred habitat is mature forest; in summer is most numerous in the east, but is distributed over the rest of the state in lesser numbers (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 1.57×10^7

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the set of variables 'Land Cover class Deciduous Forests and Woodlands is present' OR 'Land Cover class Riparian Woodland is present'. Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



Nebraska GAP Analysis 2004
Bird Species Atlas

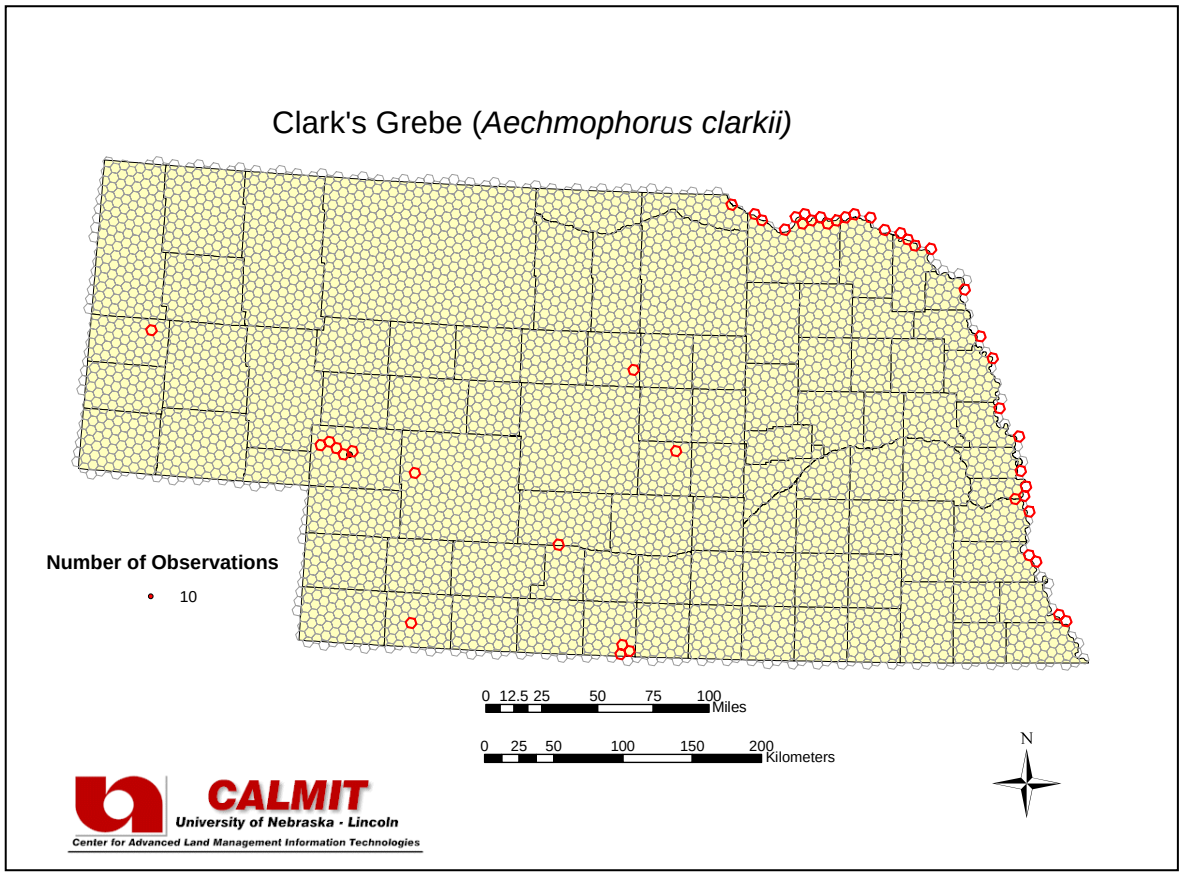
Common Name:	**Clark's Grebe**	TNC Global Status:	G5
Scientific Name:	***Aechmophorus clarkii***	Federal Status:	--
TNC Element Code:	ABNCA04020	State (NE) Status:	SR
AOU Code:	00011		

Habitat Description:
Rare, found in western Nebraska (e.g. Lake McConaughy) (Johnsgard 1997, Sharpe et al. 2001). Found in large lakes with open water for feeding and marshy edges for breeding.

Total Area of Modeled Habitat (ha): 190,566

Model Description:
Modeled distribution using the variable 'Land Cover class Open Water $\geq$ 12.15%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data. Utility of model somewhat uncertain, given the rather low (n=14) number of observations.



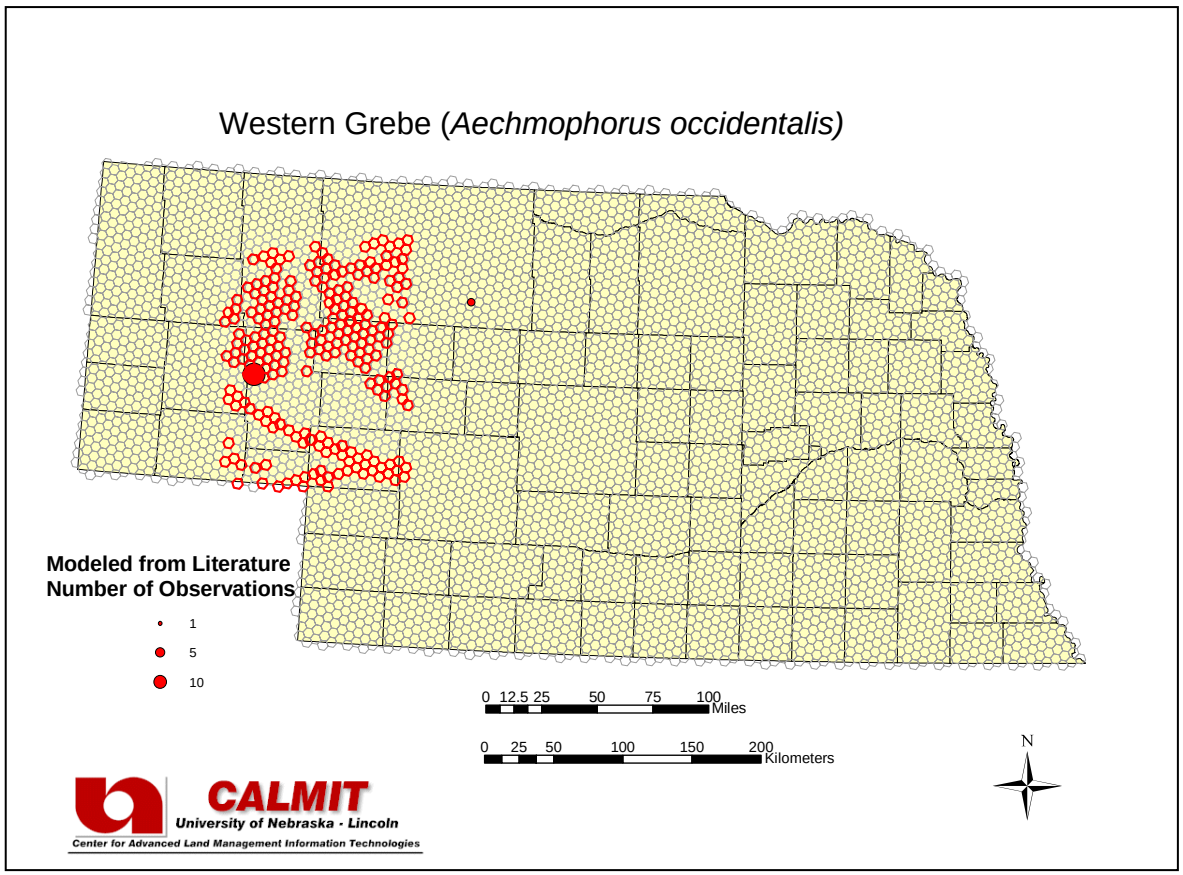
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Western Grebe**	TNC Global Status:	G5
Scientific Name:	***Aechmophorus occidentalis***	Federal Status:	--
TNC Element Code:	ABNCA04010	State (NE) Status:	S4
AOU Code:	000010		

Habitat Description:
Breeds in ponds and lakes that usually have large expanses of open water, and on some marshes that are at least 50 acres in size (Johnsgard 1997). In NE reported mainly in the western Sandhills, concentrated in the northwestern part of the state (Mollhoff 2001). The largest breeding concentrations may be observed on Crescent, Island and Smith Lakes at or near Crescent Lake NWR and on larger lakes north of the refuge in Garden Co (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 952,830

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Open Water > 0.05%'. Extent clipped to limit distribution to areas of the state where breeding reports have been confirmed- at or near Crescent Lake NWR and on larger lakes north of the refuge in Garden Co, as well as in Sheridan, Grant, Arthur, and extreme southwestern Cherry Co, and on Lake McConaughy (Sharpe et al. 2001).



Nebraska GAP Analysis 2004
Bird Species Atlas

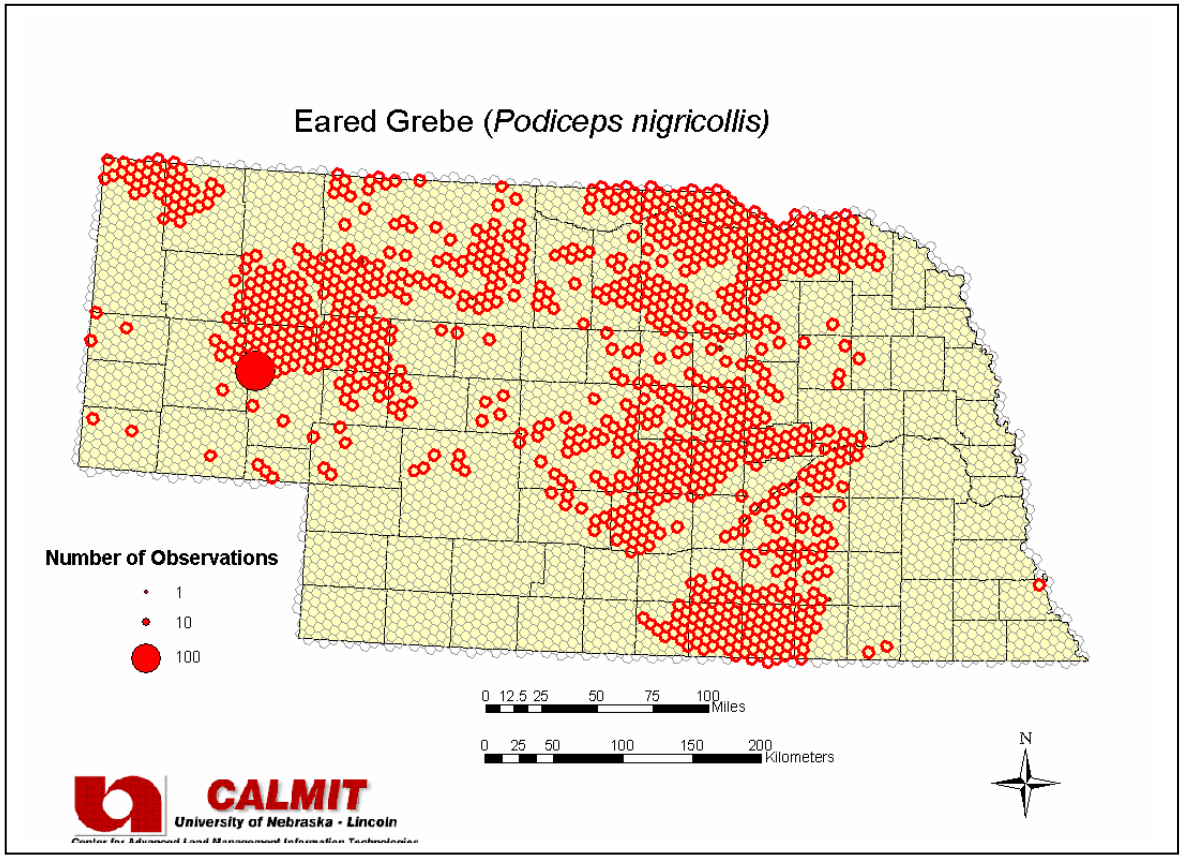
Common Name:	**Eared Grebe**	TNC Global Status:	G5
Scientific Name:	***Podiceps nigricollis***	Federal Status:	--
TNC Element Code:	ABNCA03030	State (NE) Status:	S4
AOU Code:	00040		

Habitat Description:
Breeding occurs on ponds, marshes and shallow river impoundments, as well as on large open ponds with sheltered locations for nesting sites, that are rich in submerged aquatic plants (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 4,322,215

Model Description:
Modeled distribution using the set of variables 'Land Cover class Aquatic Bed Wetland is present' OR 'Land Cover class Aquatic Bed Wetland is not present' AND 'Land Cover class Lowland Tallgrass Prairie > 0.5%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to effectively model the observational data.



Nebraska GAP Analysis 2004
Bird Species Atlas

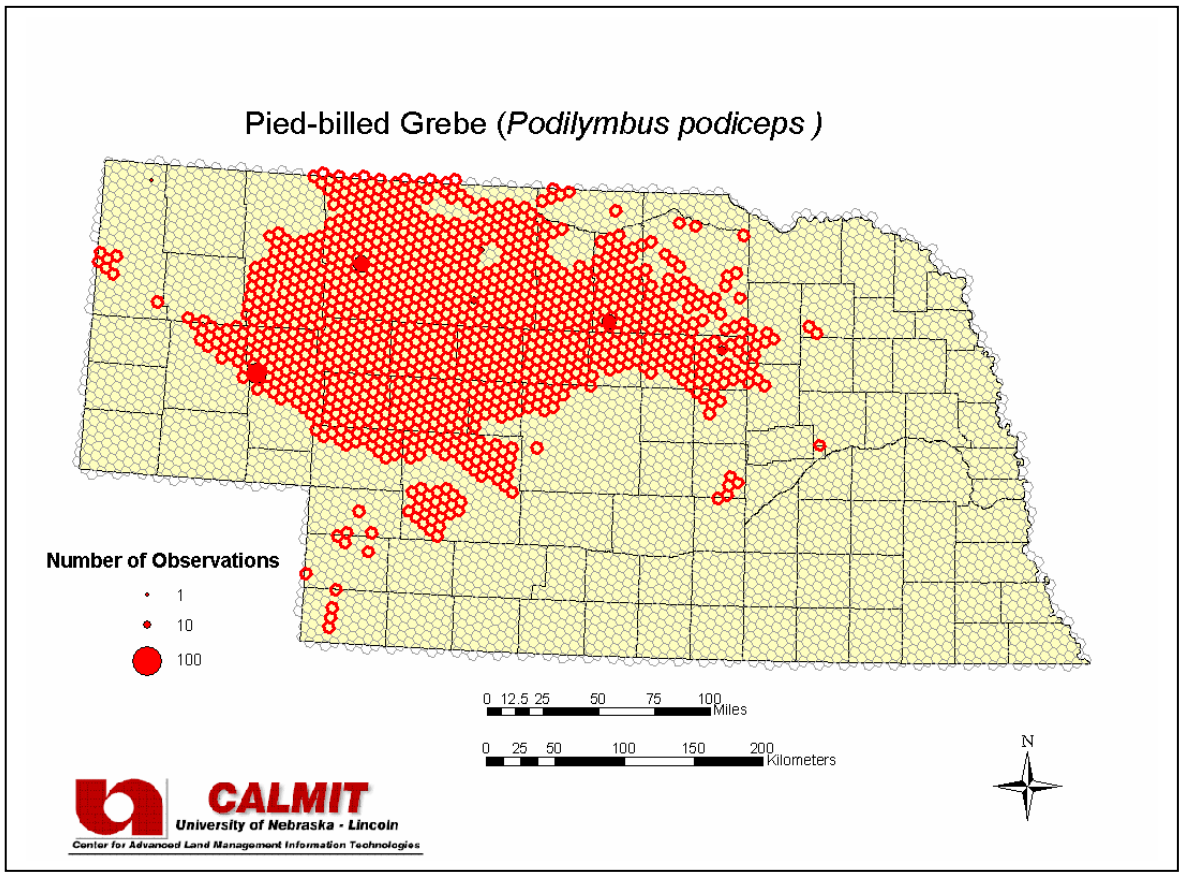
Common Name:	**Pied-billed Grebe**	TNC Global Status:	G5
Scientific Name:	***Podilymbus podiceps***	Federal Status:	--
TNC Element Code:	ABNCA02010	State (NE) Status:	S5
AOU Code:	00060		

Habitat Description:
Breeding occurs on small ponds, river empoundments and lakes, having extensive stands of heavy emergent vegetation and adjacent areas of open water (Johnsgard 1997). The largest breeding concentration is found in Sandhills marshes, and the numbers are fewest in the south and east (Sharpe et al. 2001)

Total Area of Modeled Habitat (ha): 5,027,734

Model Description:
Modeled distribution using the variable 'Percentage of Coarse Textured-soil > 80%'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



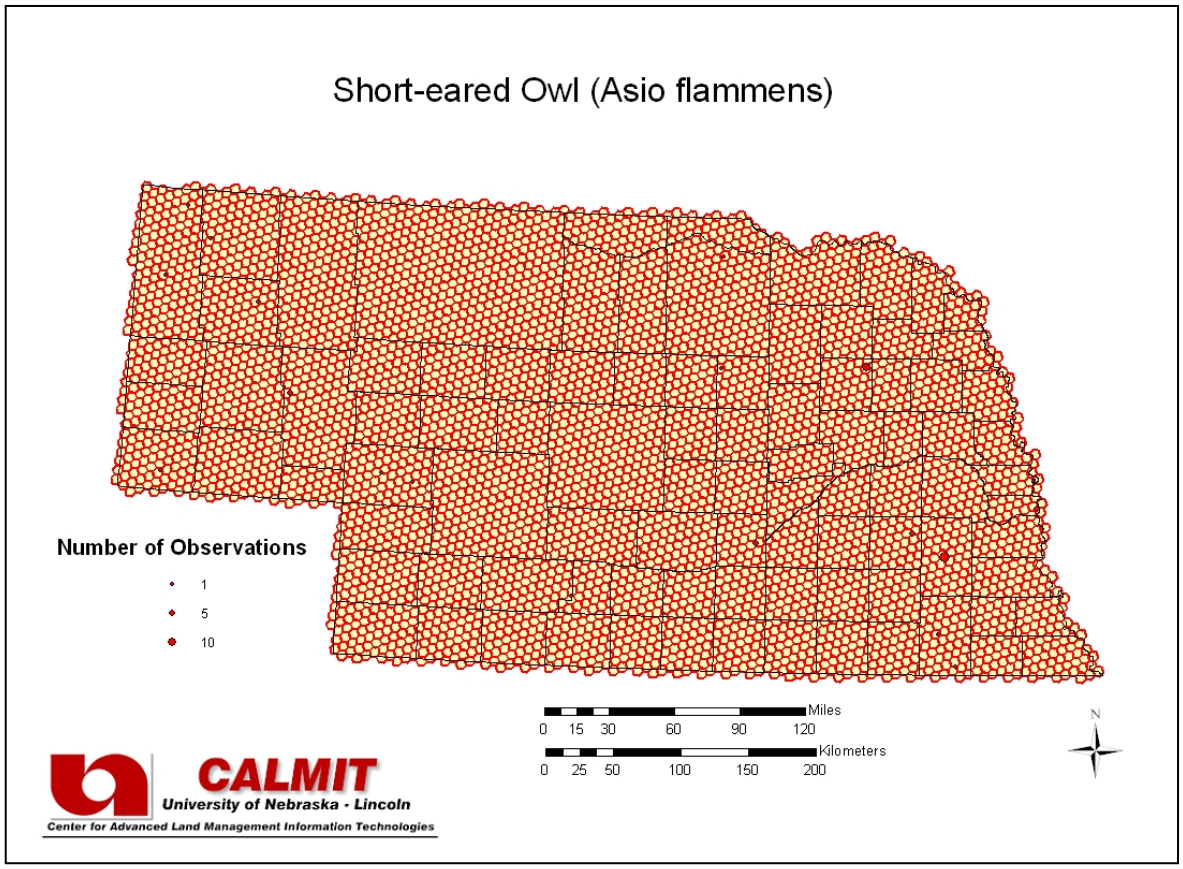
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Short-eared Owl**	TNC Global Status:	G5
Scientific Name:	***Asio flammeus***	Federal Status:	--
TNC Element Code:	ABNSB13040	State (NE) Status:	S2
AOU Code:	03670		

Habitat Description:
The Sandhills prairie and other natural grasslands are favored habitats (Johnsgard 1997). Status uncertain, probably an irregular breeder (Mollhoff 2001). Breeding birds may occur in grassland areas anywhere in the state, particularly in damper situations (Sharpe et al. 2001). Few current reports of breeding (Mollhoff 2001, Sharpe et al. 2001).

Total Area of Modeled Habitat (ha):

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



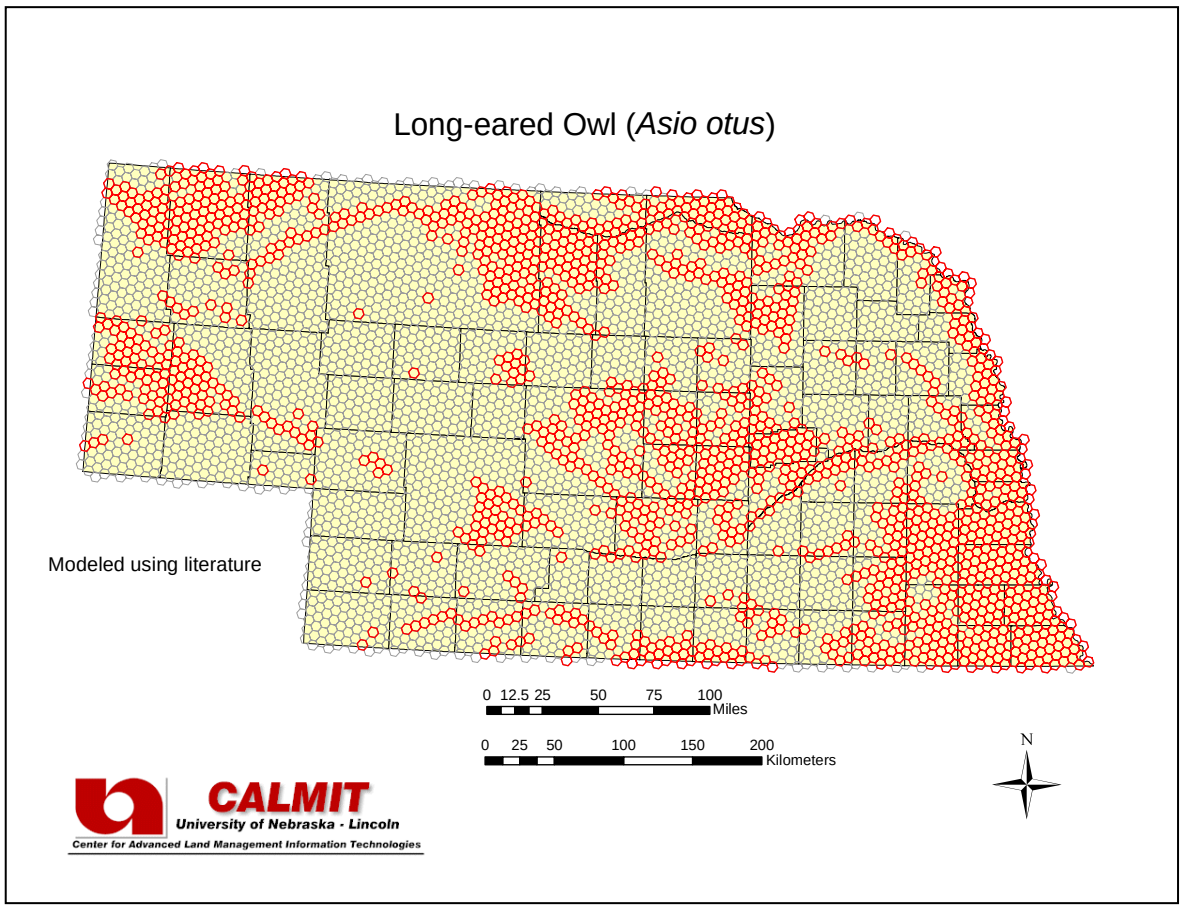
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Long-eared Owl**	TNC Global Status:	G5
Scientific Name:	***Asio otus***	Federal Status:	--
TNC Element Code:	ABNSB13010	State (NE) Status:	S4
AOU Code:	03660		

Habitat Description:
This species prefers dense coniferous forest for nesting usually near open country, however where this habitat is not available it also uses deciduous woodlands of varying size. Various habitats can include river-bottom forests, parks, orchards, isolated woodlots, reservoir shorelines, and even low-growing scrub if it is in the form of dense, tangled thickets (DeGraff and Rappole 1995; Johnsgard 1997; Mollhoff 2001; Sharpe et al. 2001). Rarely constructs own nest, they most often use old nests of large birds but will use squirrel nests and natural tree cavities; dependent on dwarf-mistletoe brooms in douglas-fir (DeGraff and Rappole 1995, Johnsgard 1997). This species is a regular breeder but is not a predictable repeat nester at any known location (Mollhoff 2001, Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 6,925,289

Model Description:
No observational data were available for this species. Modeled from literature using the set of variables ‘Land Cover class Deciduous Forests and Woodlands > 2.5%’ AND ‘Land Cover class Ponderosa Pine Forests and Woodlands is present’.



Nebraska GAP Analysis 2004
Bird Species Atlas

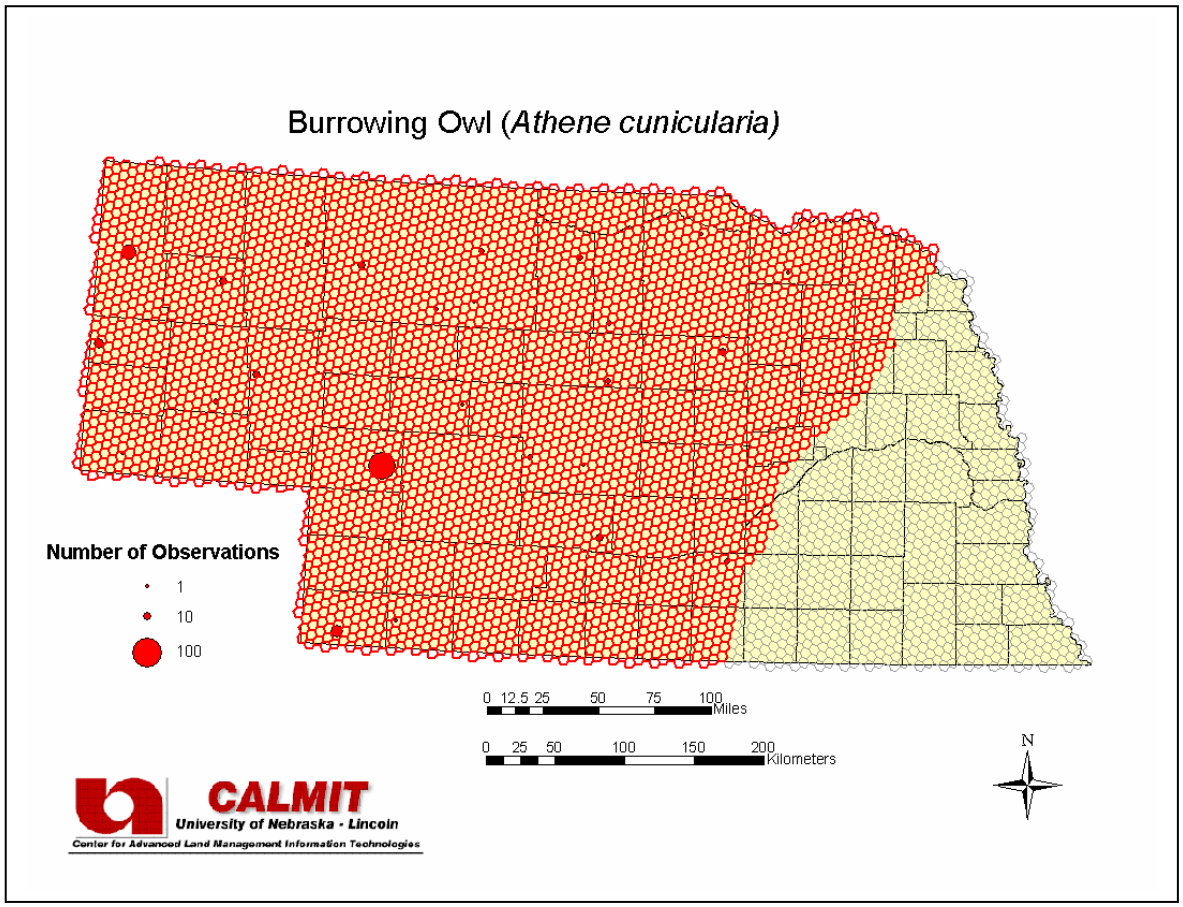
Common Name:	**Burrowing Owl**	TNC Global Status:	G4
Scientific Name:	***Athene cunicularia***	Federal Status:	--
TNC Element Code:	ABNSB10010	State (NE) Status:	S3
AOU Code:	03780		

Habitat Description:
Normally associated with heavily-grazed grasslands, especially those supporting colonies of large rodents, such as prairie dogs (Johnsgard 1997).

Total Area of Modeled Habitat (ha): 1.62×10^7

Model Description:
Modeled distribution using the variable 'Summed Average 30-year Precipitation for Sept., Oct., and Nov. $\leq$ 150 mm'.

Breeding Bird Survey data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



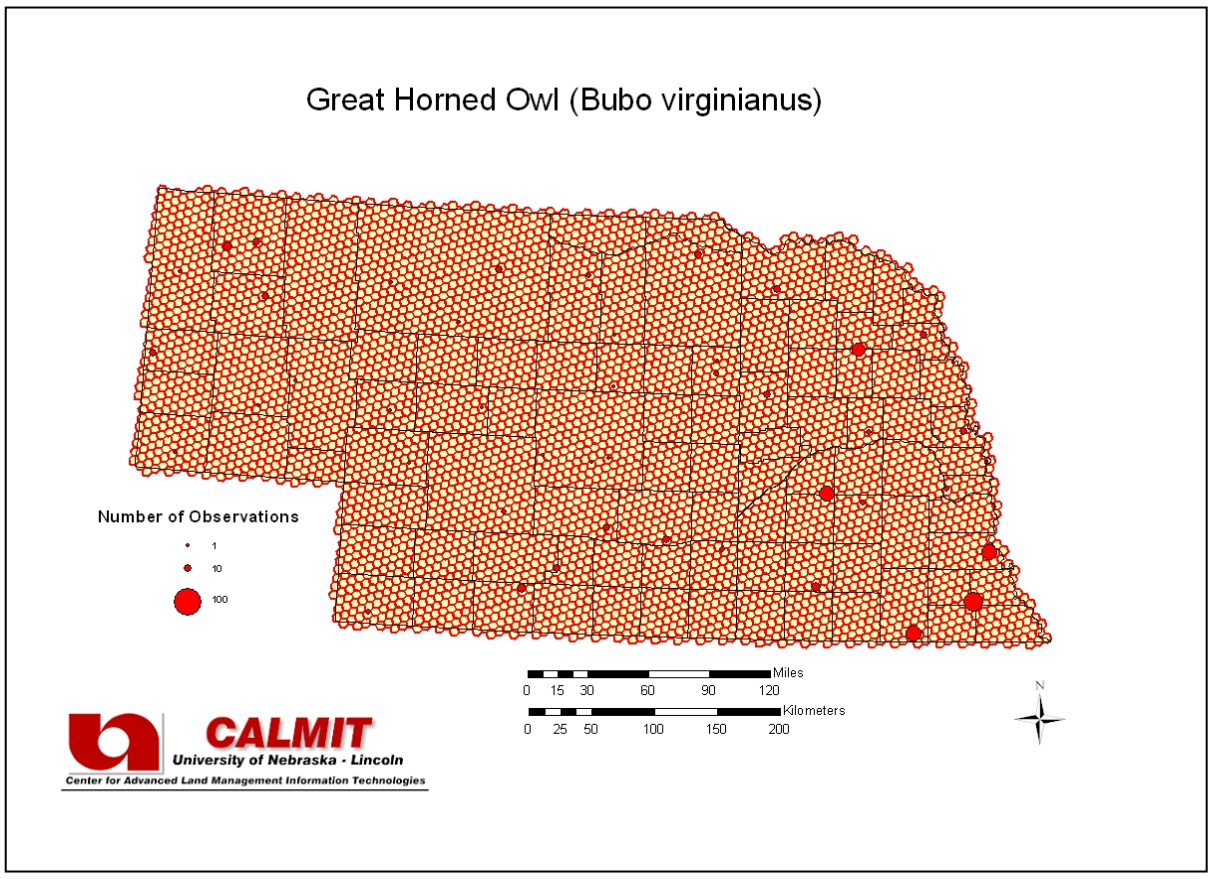
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Great Horned Owl**	TNC Global Status:	G5
Scientific Name:	***Bubo virginianus***	Federal Status:	--
TNC Element Code:	ABNSB05010	State (NE) Status:	S5
AOU Code:	03750		

Habitat Description:
Occurs in a variety of habitat types, ranging from dense forests to city parks and farm woodlands to non-woody environments in rocky canyons and gullies (Johnsgard 1997). Utilizes virtually every terrestrial habitat available in the state (Mollhoff 2001). Statewide resident, occupying the edge of both deciduous and coniferous forest and open savannah (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of the QUEST (Loh and Shih 1997, Shih 2000). Distribution was supported by Breeding Bird Survey and Christmas Bird Count observations.



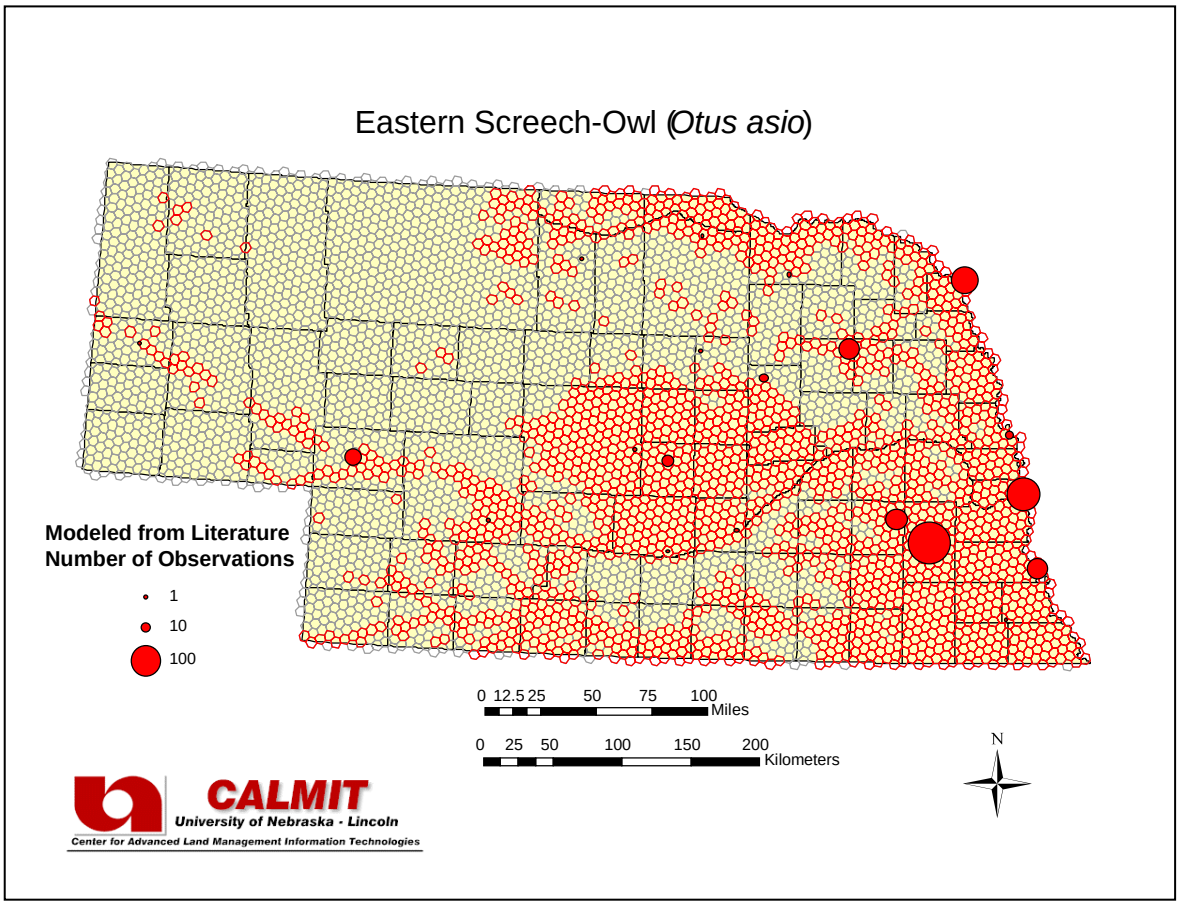
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Eastern Screech-Owl**	TNC Global Status:	G5
Scientific Name:	***Otus asio***	Federal Status:	--
TNC Element Code:	ABNSB01030	State (NE) Status:	S4
AOU Code:	03730		

Habitat Description:
This species was found in a variety of habitat that could be described as open, patchy woodland, or as the ecotone, between woodland and grassland. The wooded habitats used include: riparian woodlands, windbreaks, ravines, canyons, farmstead woodlots, and human-made habitats (Johnsgard 1997, Mollhoff 2001). Although it occurs statewide, it becomes local in the west due to its habitat preference of edge woodlands that include mature or dead larger trees that have developed natural cavities suitable for nest sites. Such habitat is more common and widely distributed in eastern and central NE, including urban areas, but the species occurs only rarely in deep woods, where it tends to become prey for larger owls (Sharpe et al. 2001).

Total Area of Modeled Habitat (ha): 8,040,317

Model Description:
Adequate model could not be resolved using QUEST (Loh and Shih 1997, Shih 2000). Modeled from literature using the variable 'Land Cover class Deciduous Forests and Woodlands > 1%'.



Nebraska GAP Analysis 2004
Bird Species Atlas

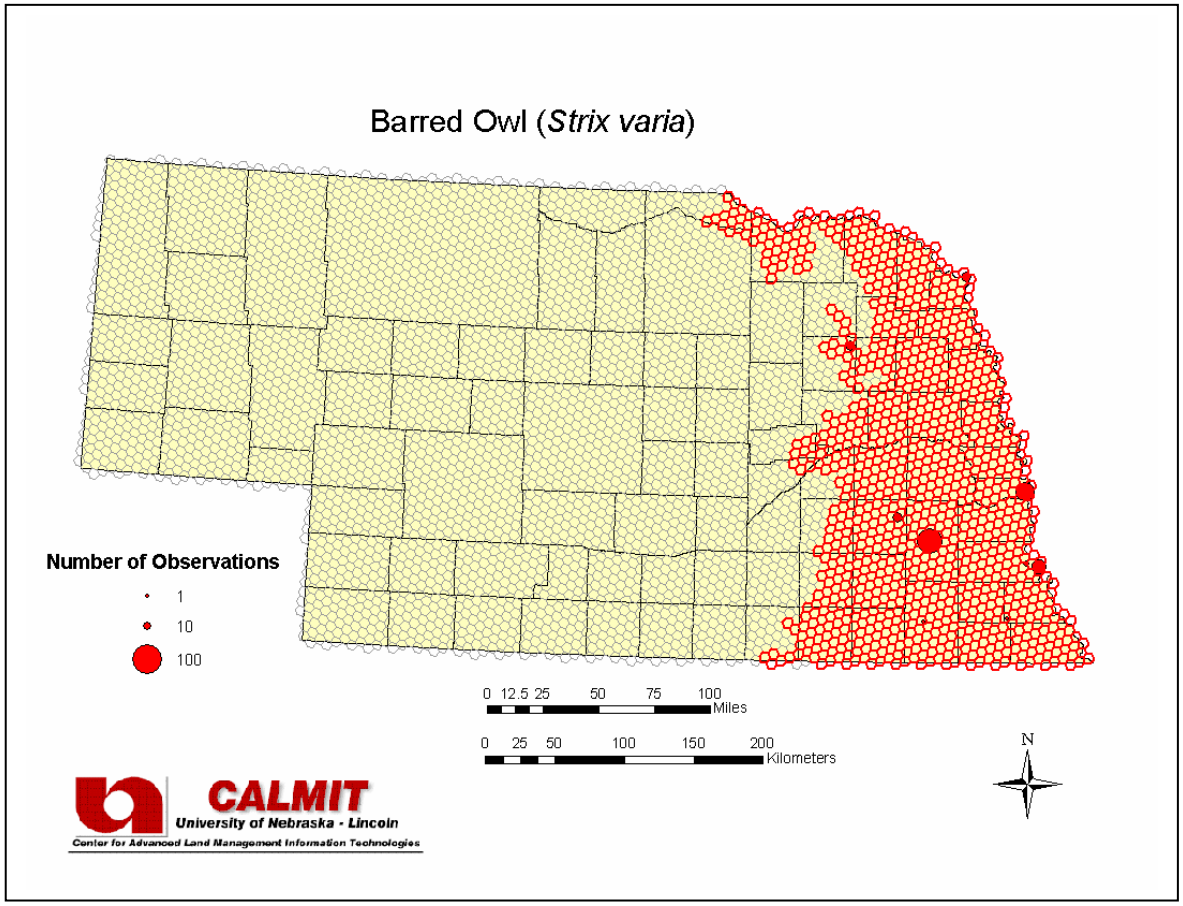
Common Name:	**Barred Owl**	TNC Global Status:	G5
Scientific Name:	***Strix varia***	Federal Status:	--
TNC Element Code:	ABNSB12020	State (NE) Status:	S2
AOU Code:	03680		

Habitat Description:
Species found in dense river bottom woods, typically hardwoods (Johnsgard 1997). Coniferous forests used when available and seem to be preferred.

Total Area of Modeled Habitat (ha): 4,443,851

Model Description:
Modeled distribution using the variable 'Elevation $\leq$ 500 m'.

Breeding Bird Survey and Christmas Bird Count data were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the variable indicated above was determined to effectively model the observational data.



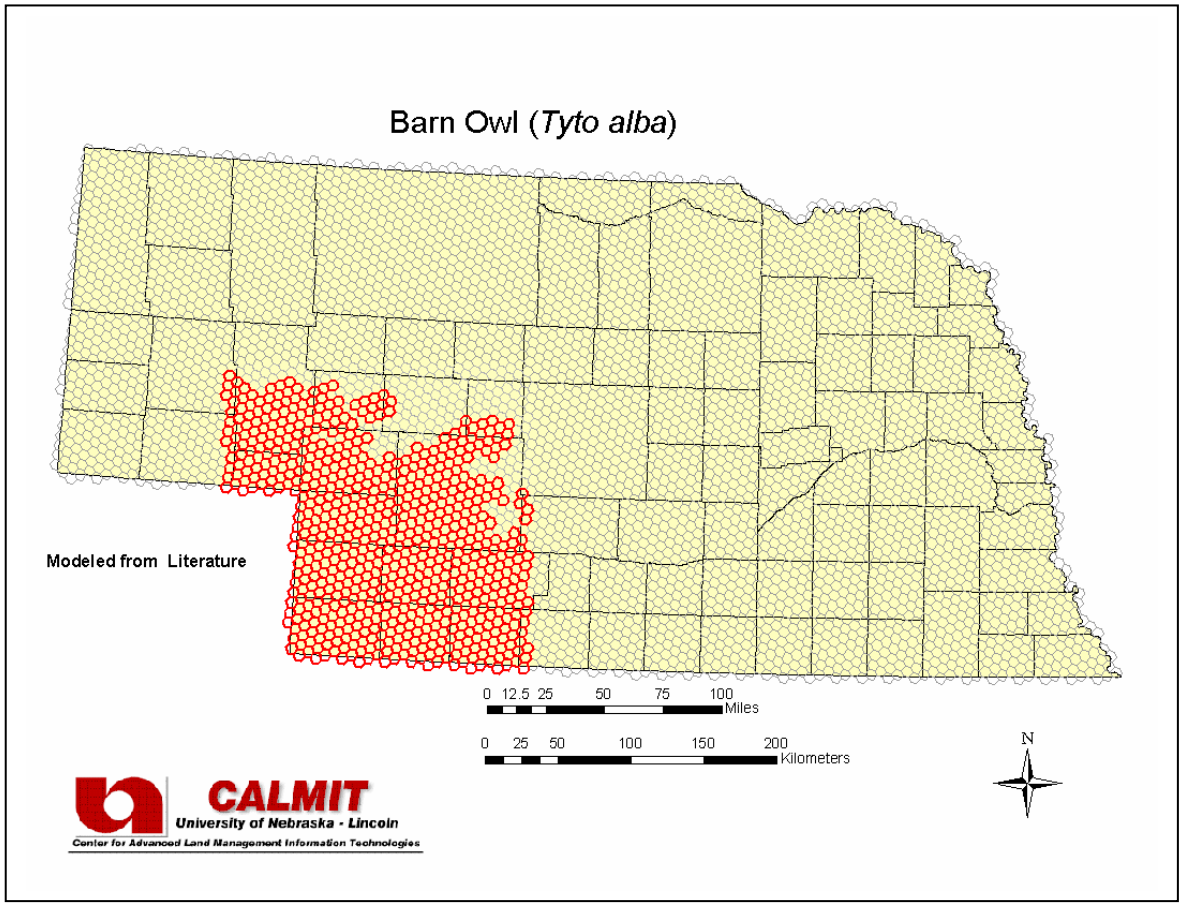
Nebraska GAP Analysis 2004
Bird Species Atlas

Common Name:	**Barn Owl**	TNC Global Status:	G5
Scientific Name:	***Tyto alba***	Federal Status:	--
TNC Element Code:	ABNSA01010	State (NE) Status:	S3
AOU Code:	03650		

Habitat Description:
Inhabits open to semi-open habitats year-round, where small rodents are abundant and tree hollows, old buildings, or caves are available to provide roosting and nesting sites (Johnsgard 1997). Prefers upland grassland, but also occupies lowland sedge meadows and marshes (Lerg 1991).

Total Area of Modeled Habitat (ha): 2,850,391

Model Description:
No observational data were available for this species. Distribution was modeled from literature using the set of variables 'Land Cover class Fallow Agricultural Fields > 0.5%'. Extent was clipped to southwest Nebraska, the only area of known breeding records (Sharpe et al. 2001).



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Center for Advanced Land Management Information Technologies

CALMIT

University of Nebraska

Species Models of Nebraska Reptiles and Amphibians

Nebraska Gap Analysis Project

2005

GAP

University of Nebraska Lincoln

Modeled Nebraska Reptiles and Amphibians

Common Name	Scientific Name	Order	Family	Page
Small-Mouthed Salamander	*Ambystoma texanum*	Anura	Ambystomatidae	1
Eastern Tiger Salamander	*Ambystoma tigrinum*	Anura	Ambystomatidae	2
American Toad	*Bufo americanus*	Anura	Bufonidae	3
Great Plains Toad	*Bufo cognatus*	Anura	Bufonidae	4
Woodhouse's Toad	*Bufo woodhousii*	Anura	Bufonidae	5
Northern Cricket Frog	*Acris crepitans*	Anura	Hylidae	6
Cope's Gray Treefrog	*Hyla chrysoscelis*	Anura	Hylidae	7
Gray Treefrog	*Hyla versicolor*	Anura	Hylidae	8
Western Chorus Frog	*Pseudacris triseriata*	Anura	Hylidae	9
Great Plains Narrowmouth Toad	*Gastrophryne olivacea*	Anura	Microhylidae	10
Plains Spadefoot	*Spea bombifrons*	Anura	Pelobatidae	11
Plains Leopard Frog	*Rana blairi*	Anura	Ranidae	12
Bullfrog	*Rana catesbeiana*	Anura	Ranidae	13
Northern Leopard Frog	*Rana pipiens*	Anura	Ranidae	14
Eastern Glossy Snake	*Arizona elegans*	Squamata	Colubridae	15
Western Worm Snake	*Carphophis vermis*	Squamata	Colubridae	16
Eastern Racer	*Coluber constrictor*	Squamata	Colubridae	17
Ringneck Snake	*Diadophis punctatus*	Squamata	Colubridae	18
Great Plains Rat Snake	*Elaphe emoryi*	Squamata	Colubridae	19
Western Rat Snake	*Elaphe obsoleta*	Squamata	Colubridae	20
Western Fox Snake	*Elaphe vulpina*	Squamata	Colubridae	21
Western Hognose Snake	*Heterodon nasicus*	Squamata	Colubridae	22
Eastern Hognose Snake	*Heterodon platirhinos*	Squamata	Colubridae	23
Prairie Kingsnake	*Lampropeltis calligaster*	Squamata	Colubridae	24
Common Kingsnake	*Lampropeltis getula*	Squamata	Colubridae	25
Milk Snake	*Lampropeltis triangulum*	Squamata	Colubridae	26
Smooth Green Snake	*Liochlorophis vernalis*	Squamata	Colubridae	27
Coachwhip	*Masticophis flagellum*	Squamata	Colubridae	28
Northern Water Snake	*Nerodia sipedon*	Squamata	Colubridae	29
Gopher Snake	*Pituophis catenifer*	Squamata	Colubridae	30
Graham's Crayfish Snake	*Regina grahamii*	Squamata	Colubridae	31
Brown Snake	*Storeria dekayi*	Squamata	Colubridae	32
Redbelly Snake	*Storeria occipitomaculata*	Squamata	Colubridae	33
Plains Blackhead Snake	*Tantilla nigriceps*	Squamata	Colubridae	34
Western Terrestrial Garter Snake	*Thamnophis elegans*	Squamata	Colubridae	35
Western Ribbon Snake	*Thamnophis proximus*	Squamata	Colubridae	36
Plains Garter Snake	*Thamnophis radix*	Squamata	Colubridae	37
Common Garter Snake	*Thamnophis sirtalis*	Squamata	Colubridae	38
Lined Snake	*Tropidoclonion lineatum*	Squamata	Colubridae	39
Lesser Earless Lizard	*Holbrookia maculata*	Squamata	Phrynosomatidae	40
Short-Horned Lizard	*Phrynosoma douglasii*	Squamata	Phrynosomatidae	41
Sagebrush Lizard	*Sceloporus graciosus*	Squamata	Phrynosomatidae	42
Fence Lizard	*Sceloporus undulatus*	Squamata	Phrynosomatidae	43
Five-Lined Skink	*Eumeces fasciatus*	Squamata	Scincidae	44
Many-Lined Skink	*Eumeces multivirgatus*	Squamata	Scincidae	45
Great Plains Skink	*Eumeces obsoletus*	Squamata	Scincidae	46

Northern Prairie Skink	*Eumeces septentrionalis*	Squamata	Scincidae	47
Six-Lined Racerunner	*Cnemidophorus sexlineatus*	Squamata	Teiidae	48
Copperhead	*Agkistrodon contortrix*	Squamata	Viperidae	49
Timber Rattlesnake	*Crotalus horridus*	Squamata	Viperidae	50
Prairie Rattlesnake	*Crotalus viridus*	Squamata	Viperidae	51
Massasauga	*Sistrurus catenatus*	Squamata	Viperidae	52
Common Snapping Turtle	*Chelydra serpentina*	Testudines	Chelydridae	53
Painted Turtle	*Chrysemys picta*	Testudines	Emydidae	54
Blanding's Turtle	*Emydoidea blandingii*	Testudines	Emydidae	55
False Map Turtle	*Graptemys pseudogeographica*	Testudines	Emydidae	56
Ornate Box Turtle	*Terrapene ornata*	Testudines	Emydidae	57
Slider	*Trachemys scripta*	Testudines	Emydidae	58
Yellow Mud Turtle	*Kinosternon flavescens*	Testudines	Kinosternidae	59
Smooth Softshell	*Apalone mutica*	Testudines	Trionychidae	60
Spiny Softshell Turtle	*Apalone spinifera*	Testudines	Trionychidae	61

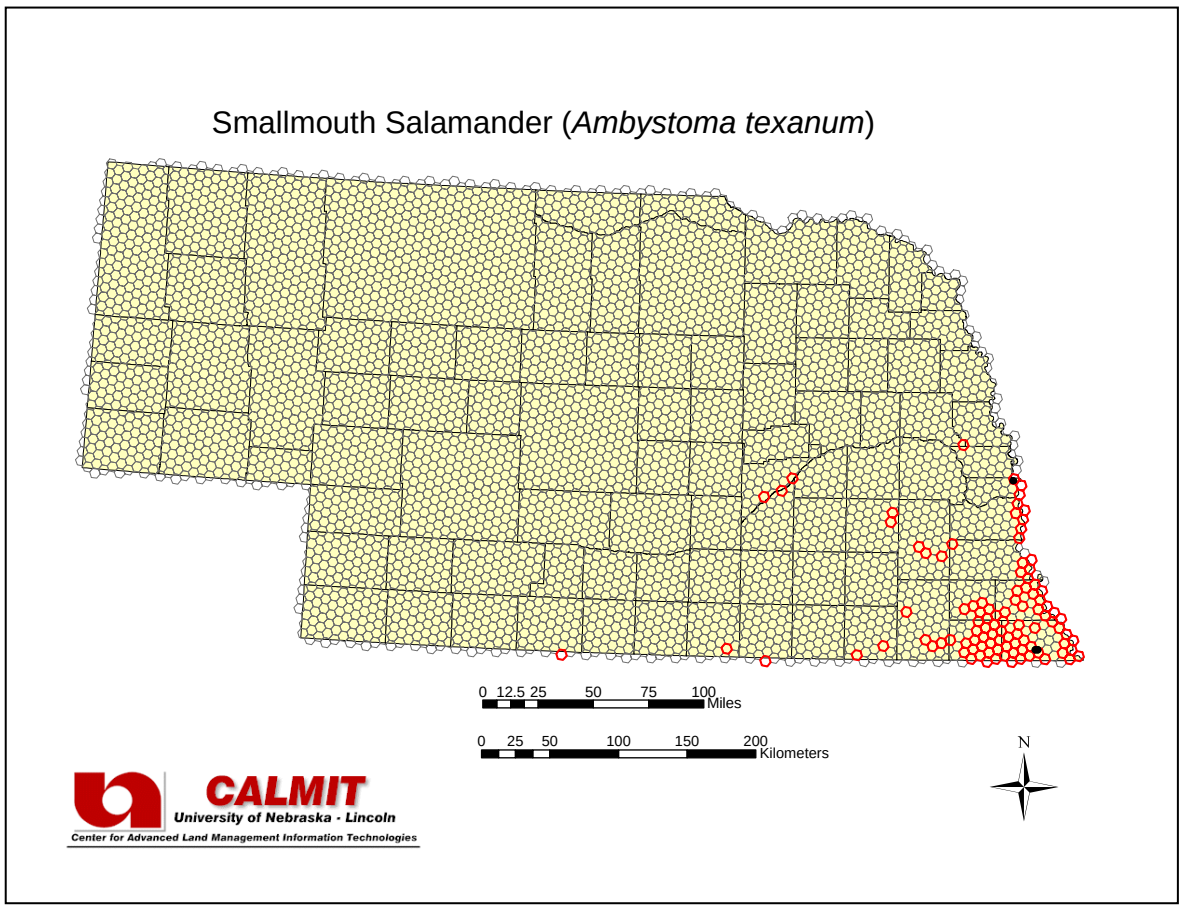
Nebraska GAP Analysis 2004
Amphibian Species Atlas

Common Name:	**Smallmouth Salamander**	TNC Global Status:	G5
Scientific Name:	***Ambystoma texanum***	Federal Status:	-
TNC Element Code:	AAAAA01130	State (NE) Status:	S1

Habitat Description:
The species is abundant in bottomland forests and associated wetlands or adjoining floodplains (Bragg 1949). Breed in ephemeral lentic habitats (woodland pond, flooded fields, etc) (Bailey 1943; Petranka 1982; Ramsey and Forsyth 1950). Found under logs, boards, or other debris near ponds or swamps, in river bottoms, or other situations where moisture is abundant (Conant and Collins 1998). Based on observational data, the species appears to be at its range limit within southeastern Nebraska.

Total Area of Modeled Habitat (ha): 409,520

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Total Growing Degree Days at 0°C through April > 440 days' AND 'Land Cover class Deciduous Forests and Woodlands > 7.5%'.



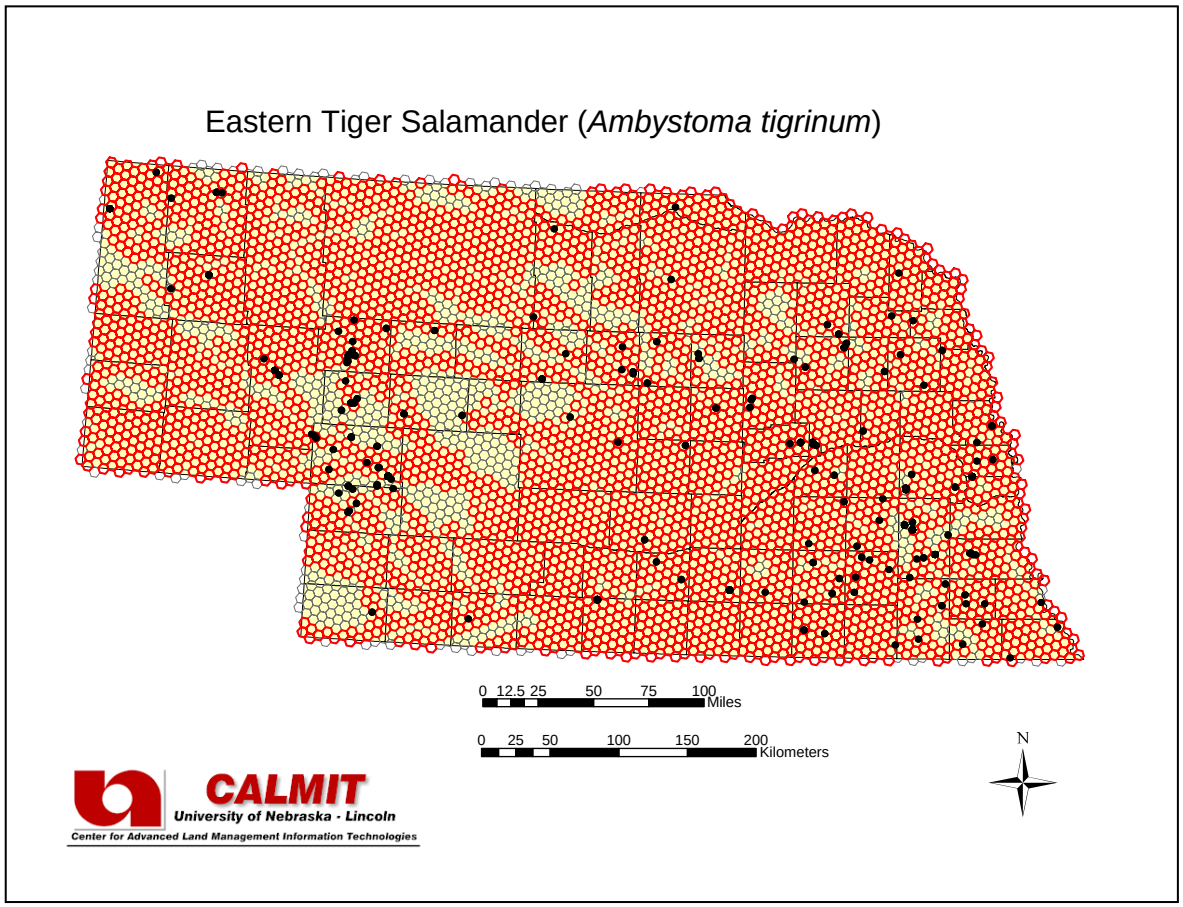
Nebraska GAP Analysis 2004
Amphibian Species Atlas

Common Name:	**Eastern Tiger Salamander**	TNC Global Status:	G5
Scientific Name:	***Ambystoma tigrinum***	Federal Status:	-
TNC Element Code:	AAAAA01140	State (NE) Status:	S5

Habitat Description:
Breeds in permanent shallow lakes, ponds, ditches, or backwater pools along rivers in open prairie and wooded regions. Generally spends much of the summer and winter beneath the ground in caves or burrows to avoid extremes in temperature and moisture (Collins 1993).

Total Area of Modeled Habitat (ha): 14,819,630

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Stream class is present' OR 'Land Cover class Aquatic Bed Wetland is present'.



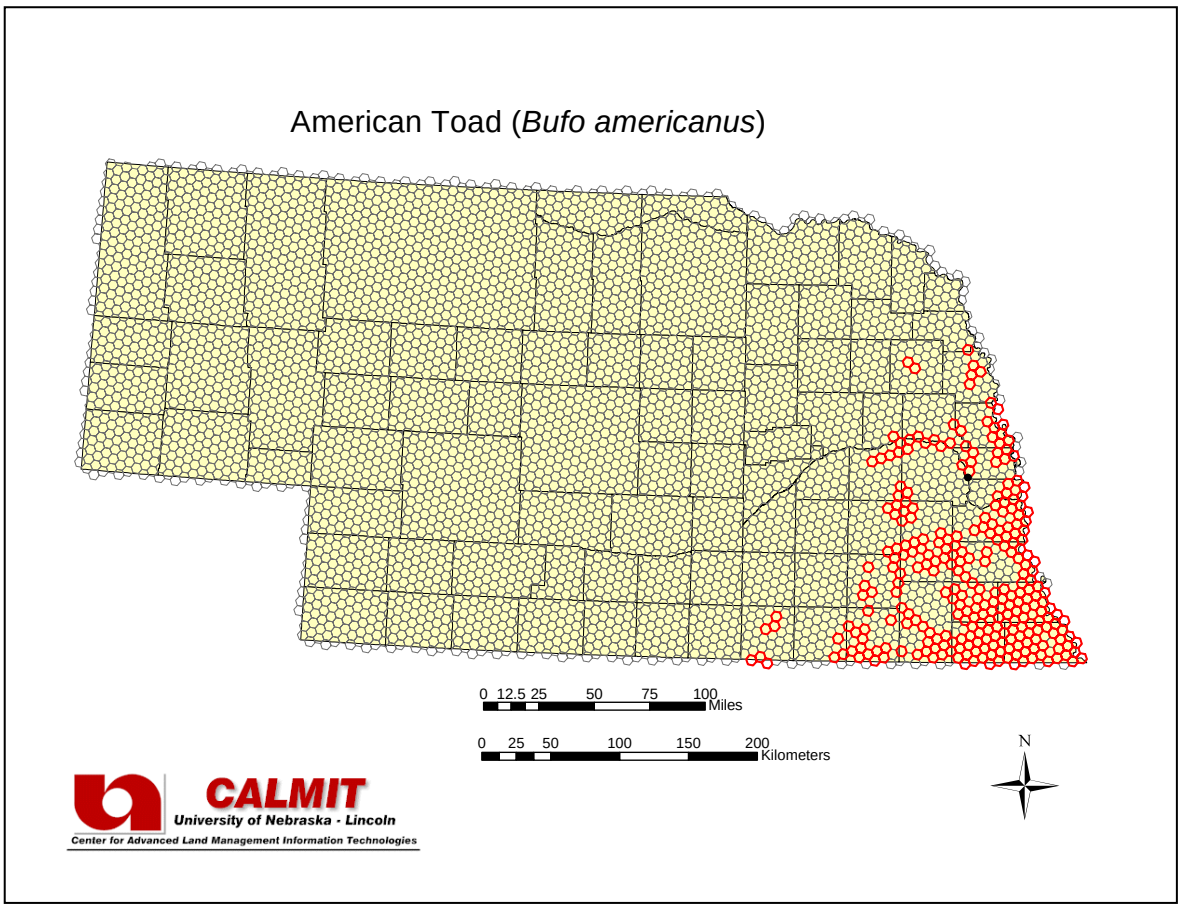
Nebraska GAP Analysis 2004
Amphibian Species Atlas

Common Name:	**American Toad**	TNC Global Status:	G5
Scientific Name:	***Bufo americanus***	Federal Status:	-
TNC Element Code:	AAABB01020	State (NE) Status:	S1

Habitat Description:
Habitat ranges from suburban back yards to mountain wildernesses. Requisites seem to be shallow bodies of water in which to breed, hiding places where there is some moisture, and an abundant supply of insects and other invertebrates for food (Conant and Collins 1998). Optimal habitat for this species is rocky situations in open woods or woodland edge, where the toads are found under large, flat rocks having loose, damp soil beneath them. They avoid open fields with dense vegetation (Fitch 1958). The species appears to be restricted to hardwood forest habitats along the Missouri River but may have extended its range in Nebraska (McLeod et al. 2001). Based on observational data, the species appears to be at its range limit within eastern Nebraska.

Total Area of Modeled Habitat (ha): 1,127,187

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables '30-year Average Precipitation for March > 52.5 mm' AND 'Land Cover class Deciduous Forests and Woodlands > 5%'.



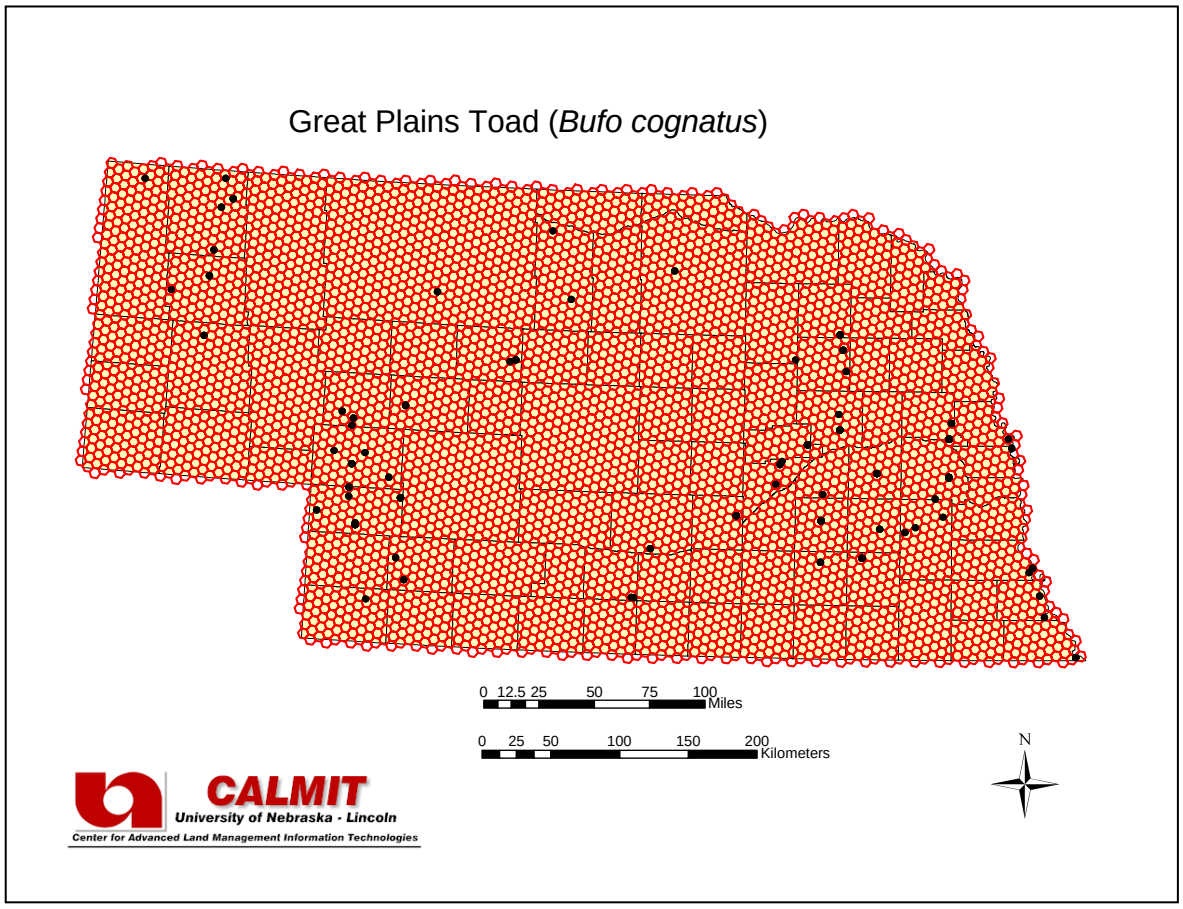
Nebraska GAP Analysis 2004
Amphibian Species Atlas

Common Name:	**Great Plains Toad**	TNC Global Status:	G5
Scientific Name:	***Bufo cognatus***	Federal Status:	-
TNC Element Code:	AAABB01050	State (NE) Status:	S5

Habitat Description:
The toad breeds in temporary bodies of water rather than more permanent ponds and lakes. The toadlets then disperse into the adjacent grasslands (Lynch 1985). Ephemeral pond types are used for breeding (McLeod et al. 2001). Resident of upland mixed-grass and short-grass prairies. Rarely occurs in woodland regions and also frequents floodplains (Collins 1993).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Habitat descriptions from literature were broad and general, resulting in no available variables for modeling.



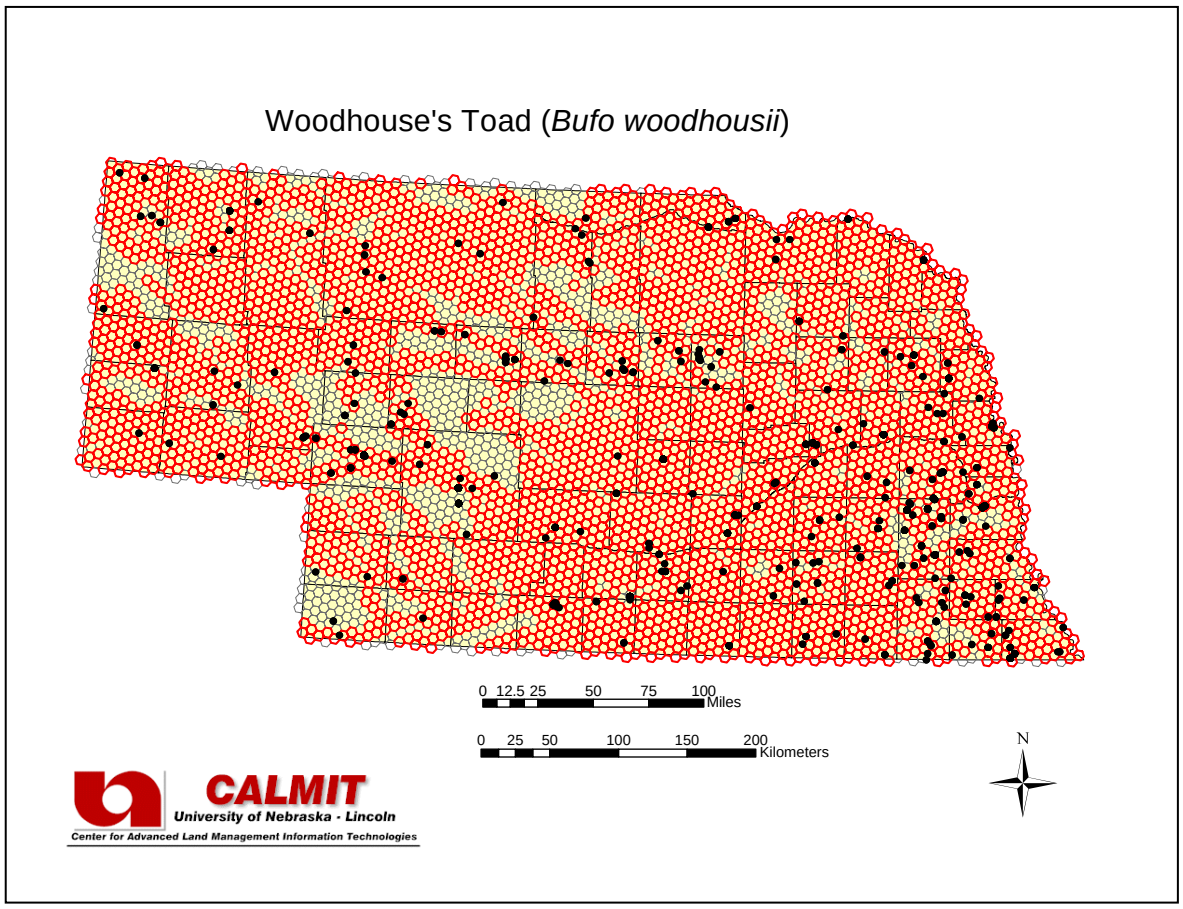
Nebraska GAP Analysis 2004
Amphibian Species Atlas

Common Name:	**Woodhouse's Toad**	TNC Global Status:	G5
Scientific Name:	***Bufo woodhousii***	Federal Status:	-
TNC Element Code:	AAABB01180	State (NE) Status:	S5

Habitat Description:
Occurs anywhere that suitable habitat exists and appears to prefer lowlands and sandy areas and is generally the only toad found on the floodplains of larger streams and rivers (Collins 1993). The toad breeds in pools created with the fall of water levels following spring flooding of rivers. It also utilizes stock ponds and lakes (Lynch 1985). The species was commonly observed near streams and ponds and in grassland, shrubby, and forested habitats within the Konza Prairie Research Natural Area, Kansas (Heinrich and Kaufman 1985).

Total Area of Modeled Habitat (ha): 14,819,630

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Stream class is present' OR 'Land Cover class Aquatic Bed Wetland is present'.



Nebraska GAP Analysis 2004
Amphibian Species Atlas

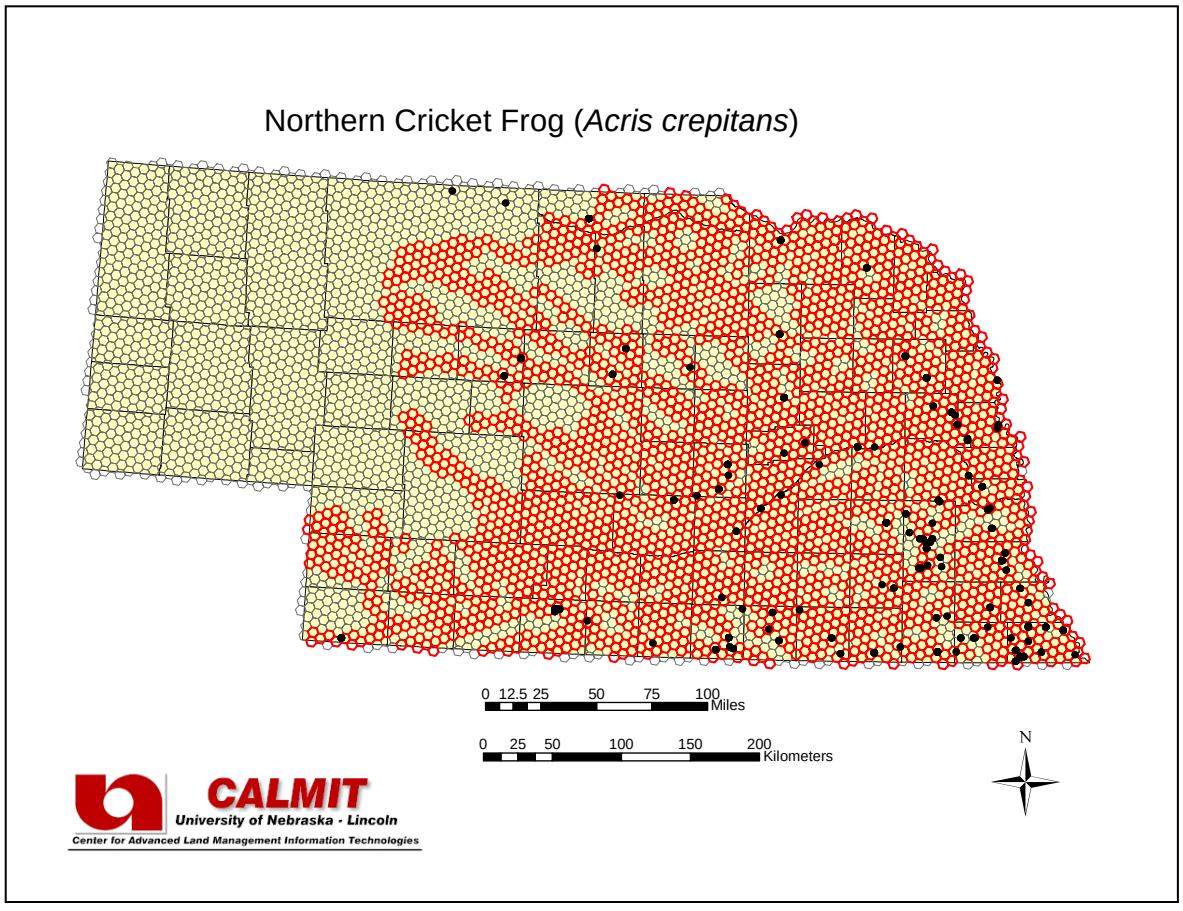
Common Name:	**Northern Cricket Frog**	TNC Global Status:	G5
Scientific Name:	***Acris crepitans***	Federal Status:	-
TNC Element Code:	AAABC01010	State (NE) Status:	S5

Habitat Description:
Occurs in ponds and lakes in eastern Nebraska and distributed westerly along rivers (Lynch 1985). Preferred habitat is muddy, beach-like edges of small, shallow streams and ponds, avoids deep water (Collins 1993).

Total Area of Modeled Habitat (ha): 9,431,057

Model Description:
Modeled distribution using the set of variables '30-year Average Maximum Temperature Coefficient of Variation for April $\leq$ 6.4%' AND 'Stream class is present' OR '30-year Average Maximum Temperature Coefficient of Variation for April > 6.4%' AND '30-year Average Precipitation for April > 50 mm' AND 'Stream class is present'.

396 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



Nebraska GAP Analysis 2004
Amphibian Species Atlas

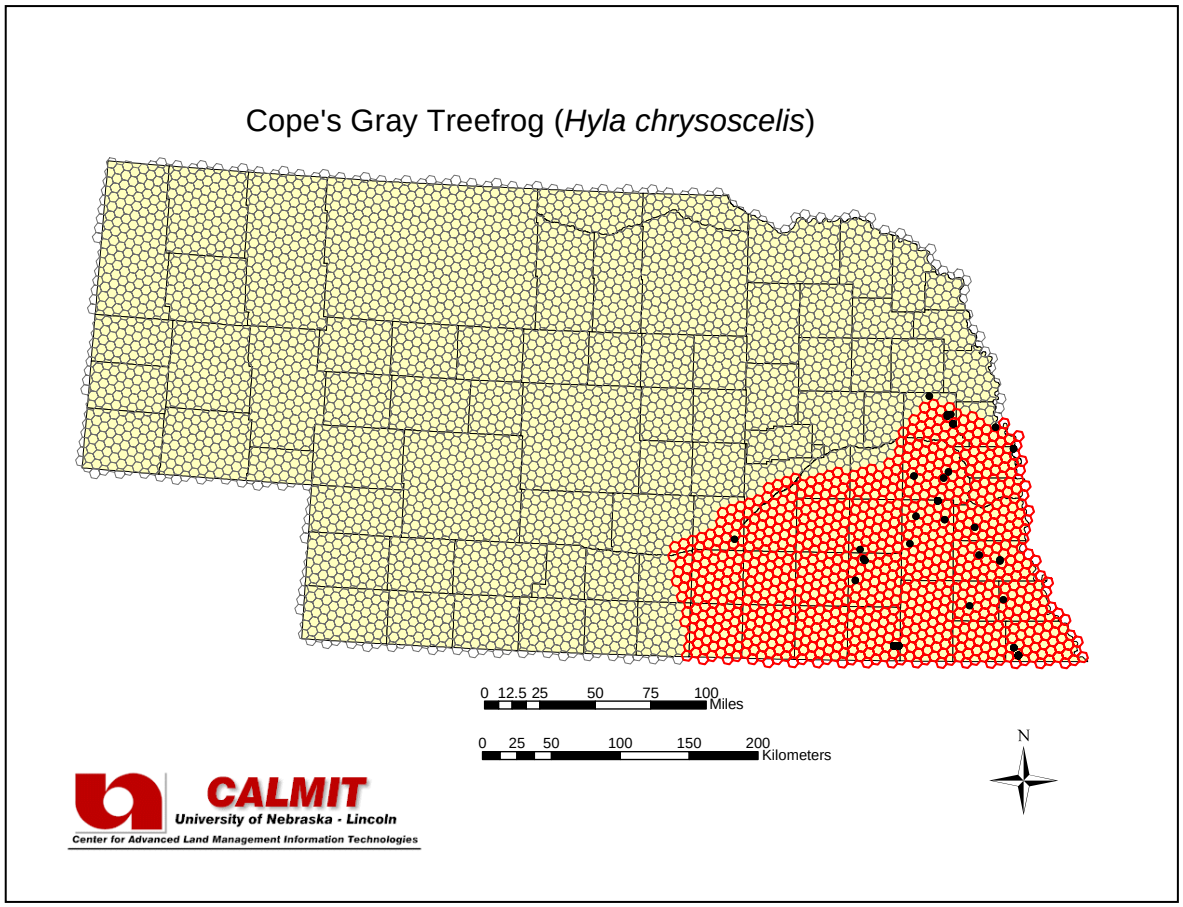
Common Name:	**Cope's Gray Treefrog**	TNC Global Status:	G5
Scientific Name:	***Hyla chrysoscelis***	Federal Status:	-
TNC Element Code:	AAABC02050	State (NE) Status:	S5

Habitat Description:
Inhabits the trees and low shrubs of woodland and woodland edge areas and are more arboreal than other frogs (Collins 1993, Fitch 1958).

Total Area of Modeled Habitat (ha): 3,872,171

Model Description:
Modeled distribution using the set of variables '30-year Average Maximum Temperature Coefficient of Variation for April $\leq$ 6.7%' AND '30-year Average Precipitation for March > 47.5 mm'.

101 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



Nebraska GAP Analysis 2004
Amphibian Species Atlas

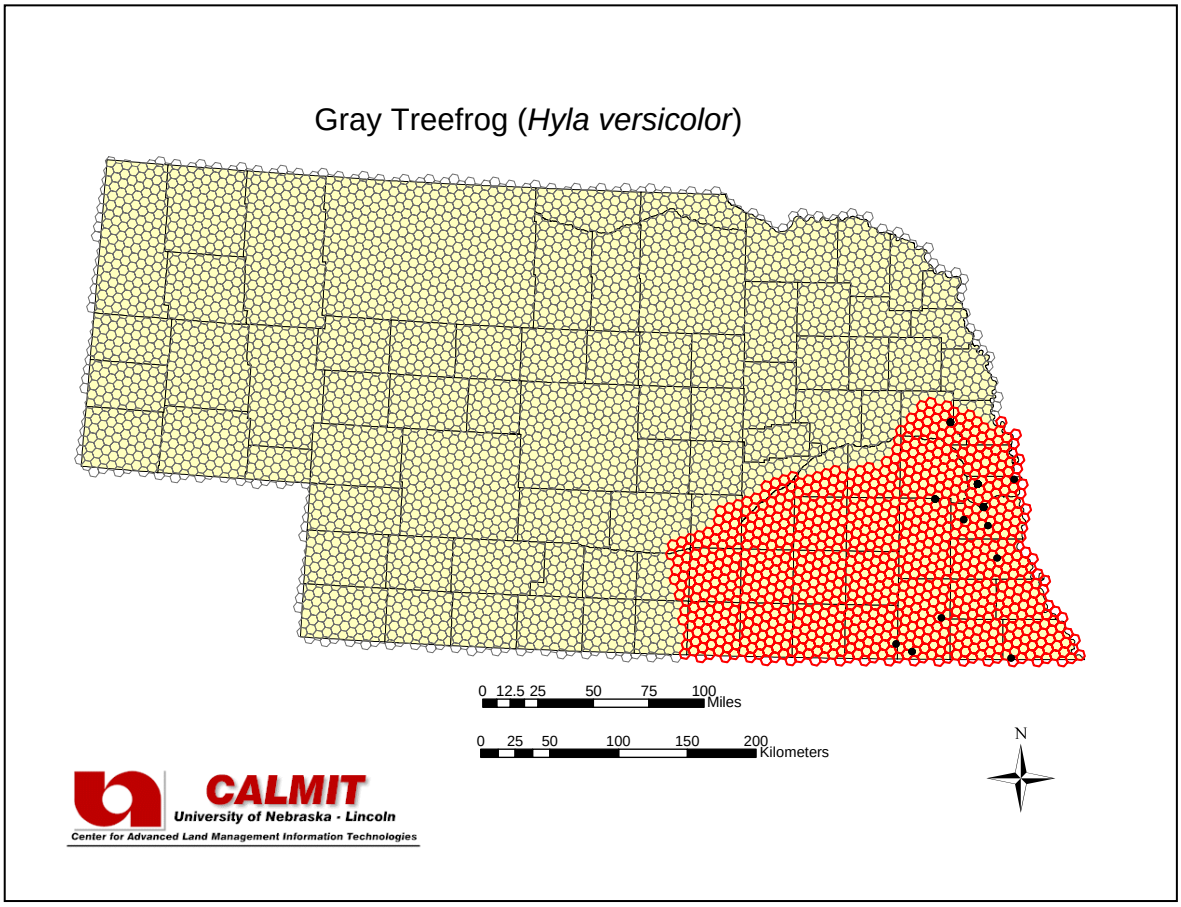
Common Name:	**Gray Treefrog**	TNC Global Status:	G5
Scientific Name:	***Hyla versicolor***	Federal Status:	-
TNC Element Code:	AAABC02130	State (NE) Status:	-

Habitat Description:
Inhabits trees and low shrubs of woodland and woodland edge areas and are more arboreal than other frogs (Collins 1993, Fitch 1958).

Total Area of Modeled Habitat (ha): 3,872,171

Model Description:
Modeled distribution using the set of variables '30-year Average Maximum Temperature Coefficient of Variation for April $\leq$ 6.7%' AND '30-year Average Precipitation for March > 47.5 mm'.

55 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



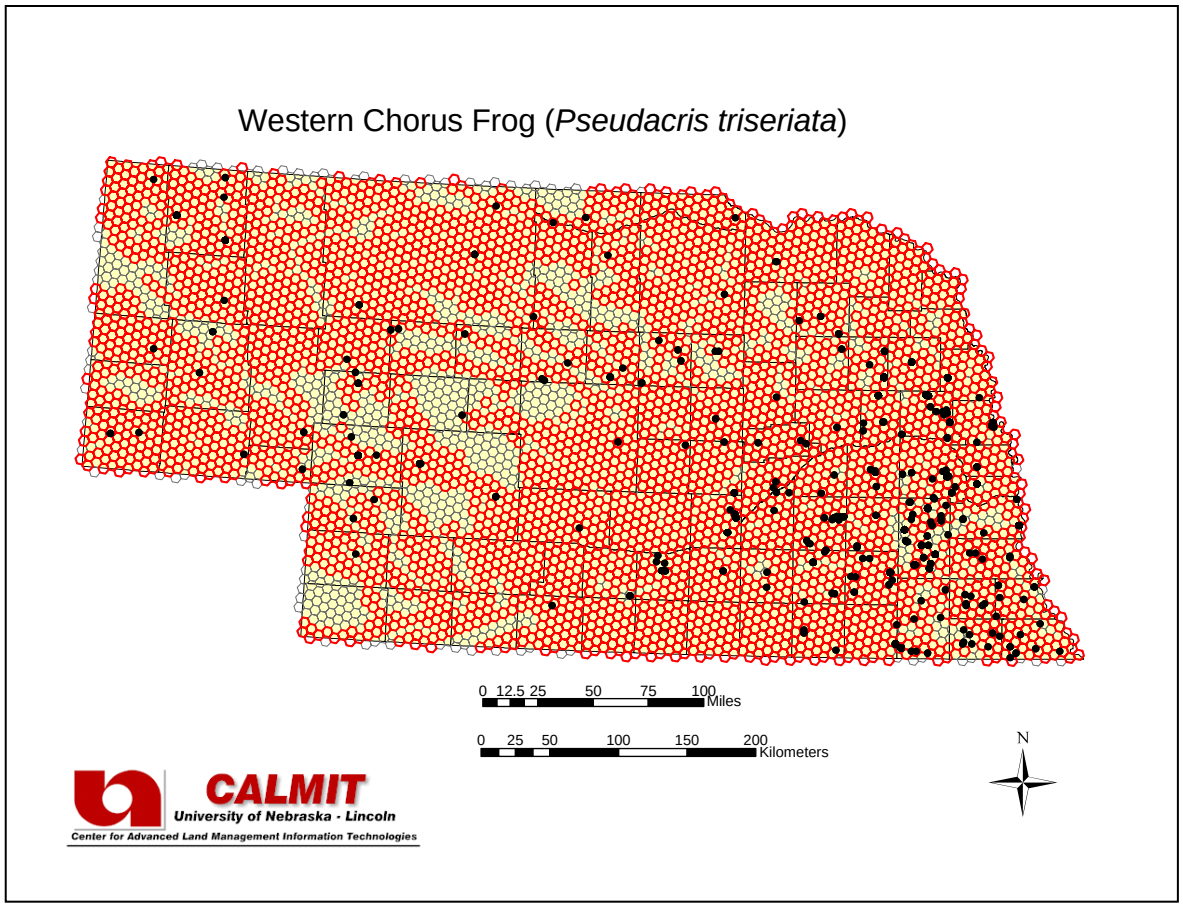
Nebraska GAP Analysis 2004
Amphibian Species Atlas

Common Name:	**Western Chorus Frog**	TNC Global Status:	G5
Scientific Name:	***Pseudacris triseriata***	Federal Status:	-
TNC Element Code:	AAABC05070	State (NE) Status:	S5

Habitat Description:
Found in a wide variety of habitats: damp meadows and pastures, along streams and ditches, around the edges of temporary or permanent ponds and lakes, on floodplains, and in moist woods (Collins 1993). Breeding occurs in roadside ditches and marshes, individuals are also heard calling in the flooded areas adjacent to permanent bodies of water (Lynch 1985). Found in a variety of habitats from grasslands to forested areas where moist conditions exist. Also abundant in ponds and slow-moving water of spring-fed streams during early spring (Heinrich and Kaufman 1985).

Total Area of Modeled Habitat (ha): 14,819,630

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Stream class is present' OR 'Land Cover class Aquatic Bed Wetland is present'.



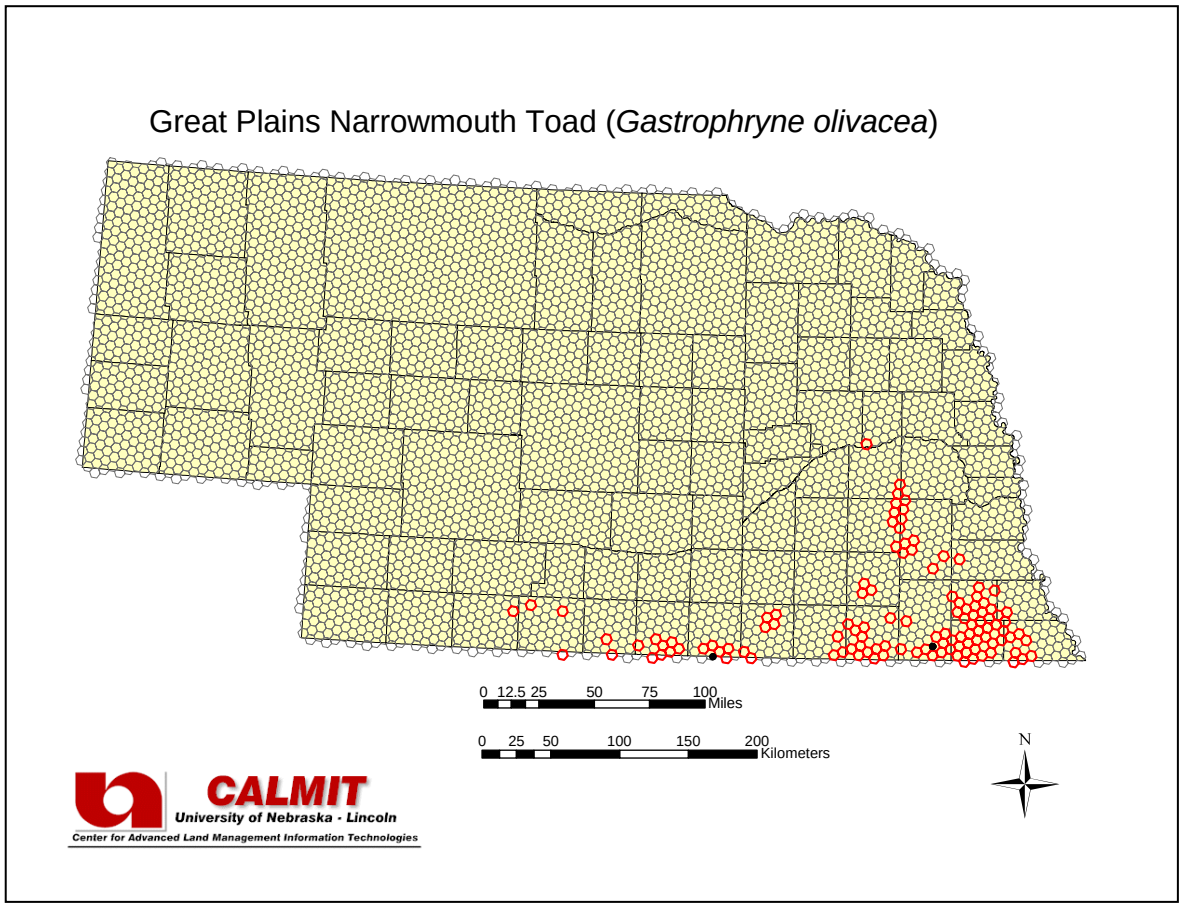
Nebraska GAP Analysis 2004
Amphibian Species Atlas

Common Name:	**Great Plains Narrowmouth Toad**	TNC Global Status:	G5
Scientific Name:	***Gastrophryne olivacea***	Federal Status:	-
TNC Element Code:	AAABE01020	State (NE) Status:	S2

Habitat Description:
Found in semi-wooded pastures under rocks or bark (Lynch 1985). The species thrives in an open-woodland habitat in the northern part of its range, but it seems to be essentially a grassland species. Prefers a dry, rocky upland area in open woods or woodland edge but is tolerant of a wide variety of habitats, including river floodplains and cultivated fields (Fitch 1956). Prefers rocky slopes in open woods where they spend most of their time underground (Heinrich and Kaufman 1985). Based on observational data, the species appears to be at its range limit within southeastern Nebraska.

Total Area of Modeled Habitat (ha): 478,450

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Total Growing Degree Days at 0°C through October > 3950 days' AND 'Land Cover class Deciduous Forests and Woodlands > 5%' AND 'Land Cover class Upland Tallgrass Prairie > 30%' OR 'Total Growing Degree Days at 0°C through October > 3950 days' AND 'Land Cover class Deciduous Forests and Woodlands > 5%' AND 'Land Cover class Little Bluestem-Gramma Mixedgrass Prairie > 25%'.



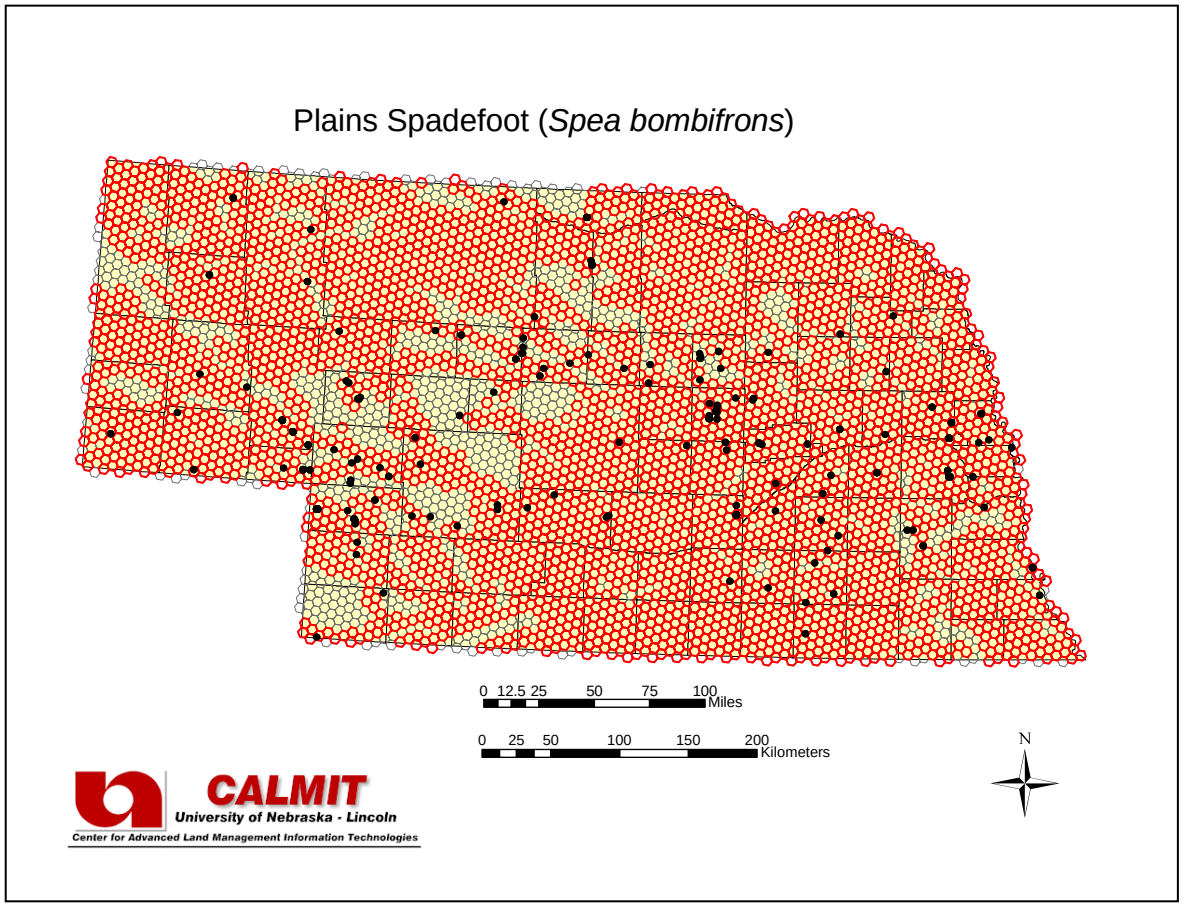
Nebraska GAP Analysis 2004
Amphibian Species Atlas

Common Name:	**Plains Spadefoot**	TNC Global Status:	G5
Scientific Name:	***Spea bombifrons***	Federal Status:	-
TNC Element Code:	AAABF02010	State (NE) Status:	S5

Habitat Description:
Utilizes ephemeral ponds for breeding (Lynch 1985, Ballinger et al. 2000). Inhabits prairies and open floodplains. It requires areas of loose soil or sand for burrowing purposes. (Collins 1993).

Total Area of Modeled Habitat (ha): 14,819,630

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Stream class is present' OR 'Land Cover class Aquatic Bed Wetland is present'.



Nebraska GAP Analysis 2004
Amphibian Species Atlas

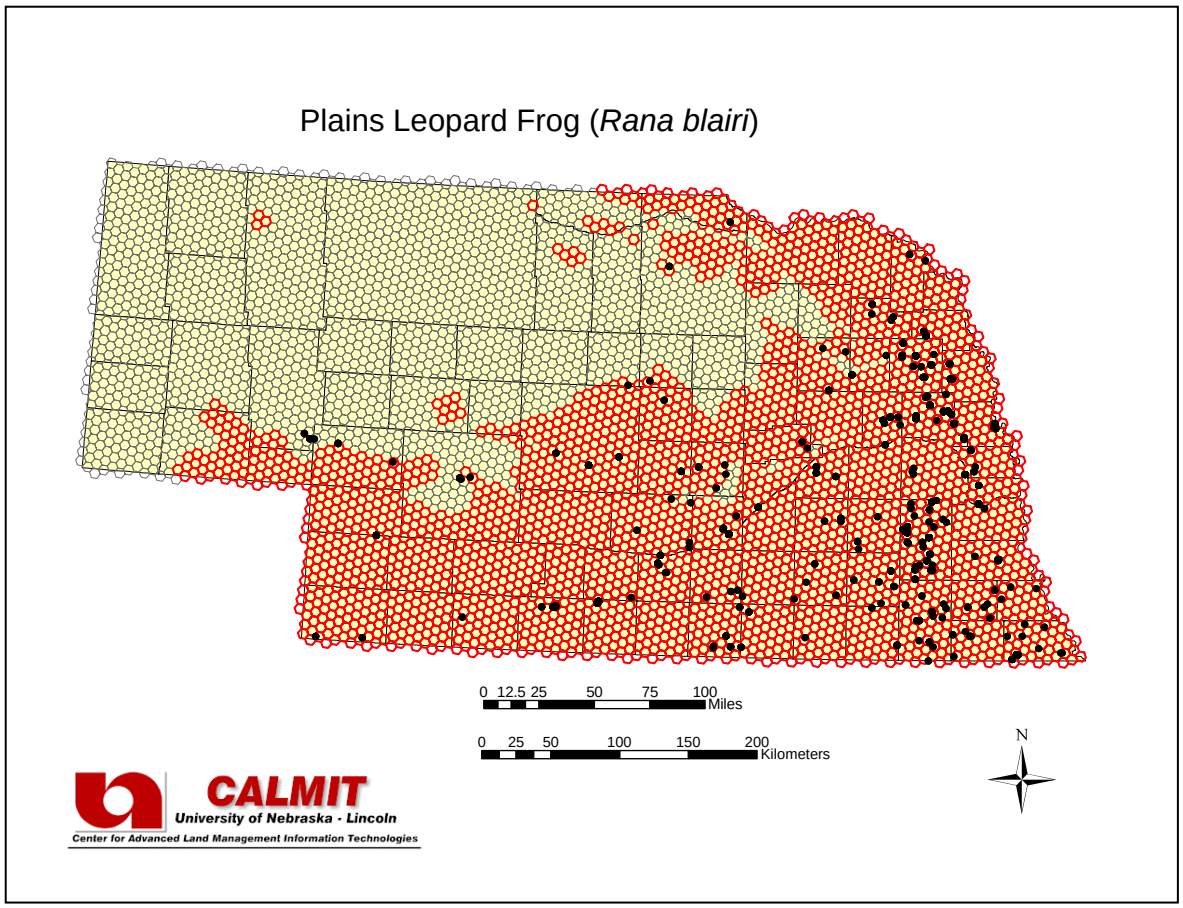
Common Name:	**Plains Leopard Frog**	TNC Global Status:	G5
Scientific Name:	***Rana blairi***	Federal Status:	-
TNC Element Code:	AAABH01040	State (NE) Status:	S5

Habitat Description:
The species is distributed in areas having loess soils rather than those having predominately sandy soils (Lynch 1978). Found in every aquatic situation, both permanent and temporary, and wanders great distances from water (Collins 1993).

Total Area of Modeled Habitat (ha): 11,519,186

Model Description:
Modeled distribution using the set of variables '30-year Average Maximum Temperature Coefficient of Variation for April $\leq$ 6.5%' OR '30-year Average Maximum Temperature Coefficient of Variation for April > 6.5%' AND 'Percentage of Coarse-textured Soils $\leq$ 40%' AND '30-year Average Precipitation for March > 30 mm'.

922 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



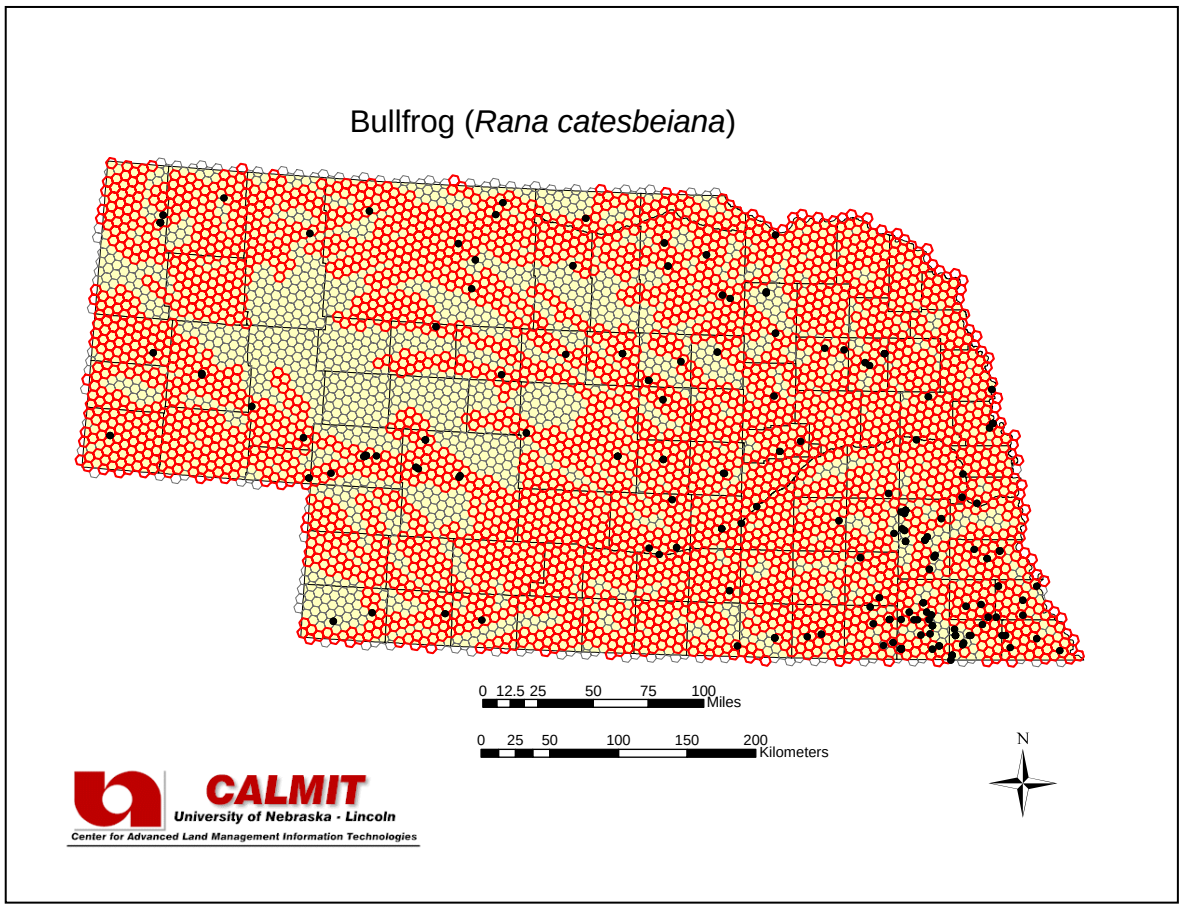
Nebraska GAP Analysis 2004
Amphibian Species Atlas

Common Name:	**Bullfrog**	TNC Global Status:	G5
Scientific Name:	***Rana catesbeiana***	Federal Status:	-
TNC Element Code:	AAABH01070	State (NE) Status:	S5

Habitat Description:
This species is aquatic and requires a permanent source of water. Preferred habitats are vegetated shoals, sluggish river backwaters and oxbows, farm ponds, reservoirs, marshes, and still water with tules, dead trees, snags, and twisted roots (Bury and Whelan 1984). It is restricted to permanent lakes, rivers, streams, and swamps where deep water is available and may also live near permanently filled stock tanks (Collins 1993). Absent from many areas of the Sand Hills away from rivers (Lynch 1985).

Total Area of Modeled Habitat (ha): 12,536,875

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the variable 'Stream class is present'.



Nebraska GAP Analysis 2004
Amphibian Species Atlas

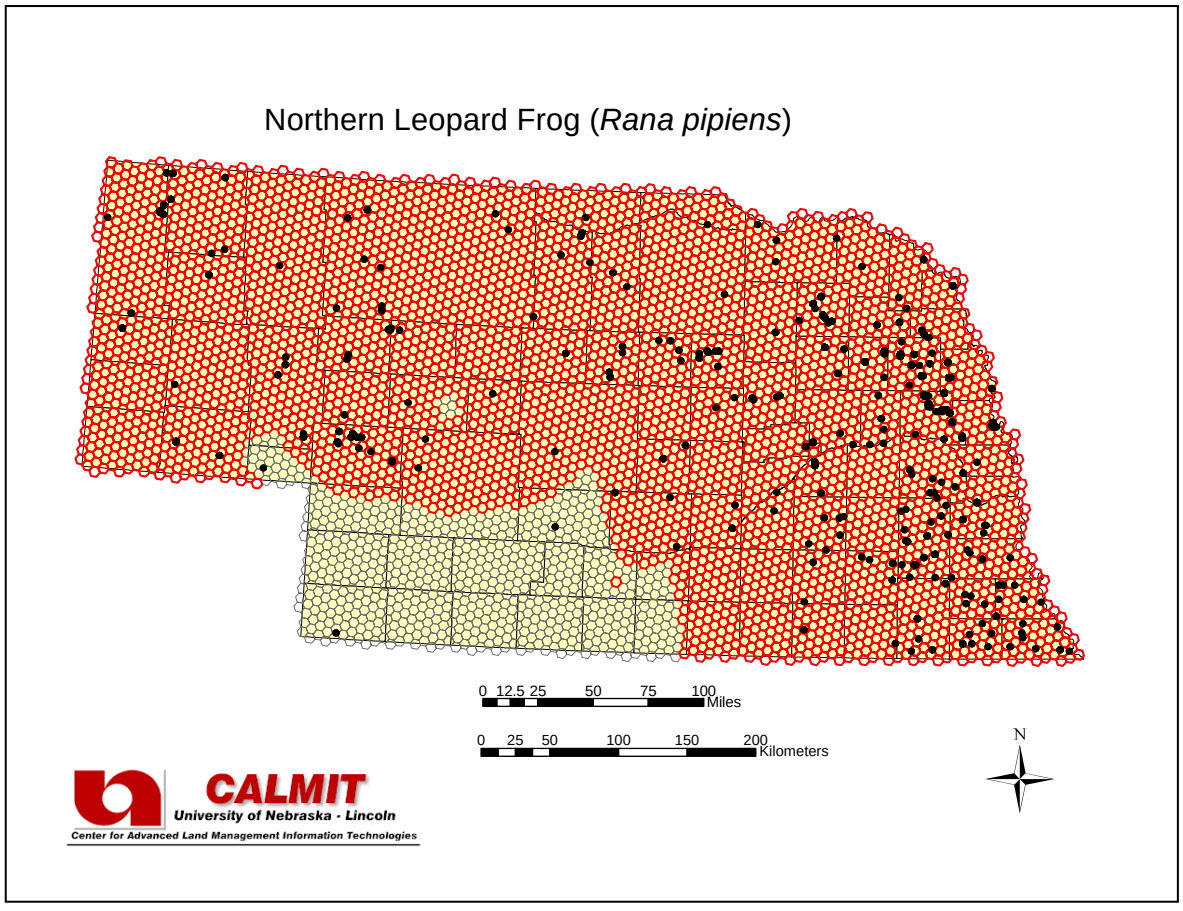
Common Name:	**Northern Leopard Frog**	TNC Global Status:	G5
Scientific Name:	***Rana pipiens***	Federal Status:	-
TNC Element Code:	AAABH01170	State (NE) Status:	S5

Habitat Description:
Occurs in the Panhandle, throughout the Sand Hills in the sandy streams and marshes and extends easterly to the Missouri River (Lynch 1985).

Total Area of Modeled Habitat (ha): 17,637,555

Model Description:
Modeled distribution using the set of variables '30-year Average Maximum Temperature Coefficient of Variation for April > 6.5%' OR '30-year Average Maximum Temperature Coefficient of Variation for April ≤ 6.5%' AND '30-year Average Precipitation for March > 47.5 mm'.

1023 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



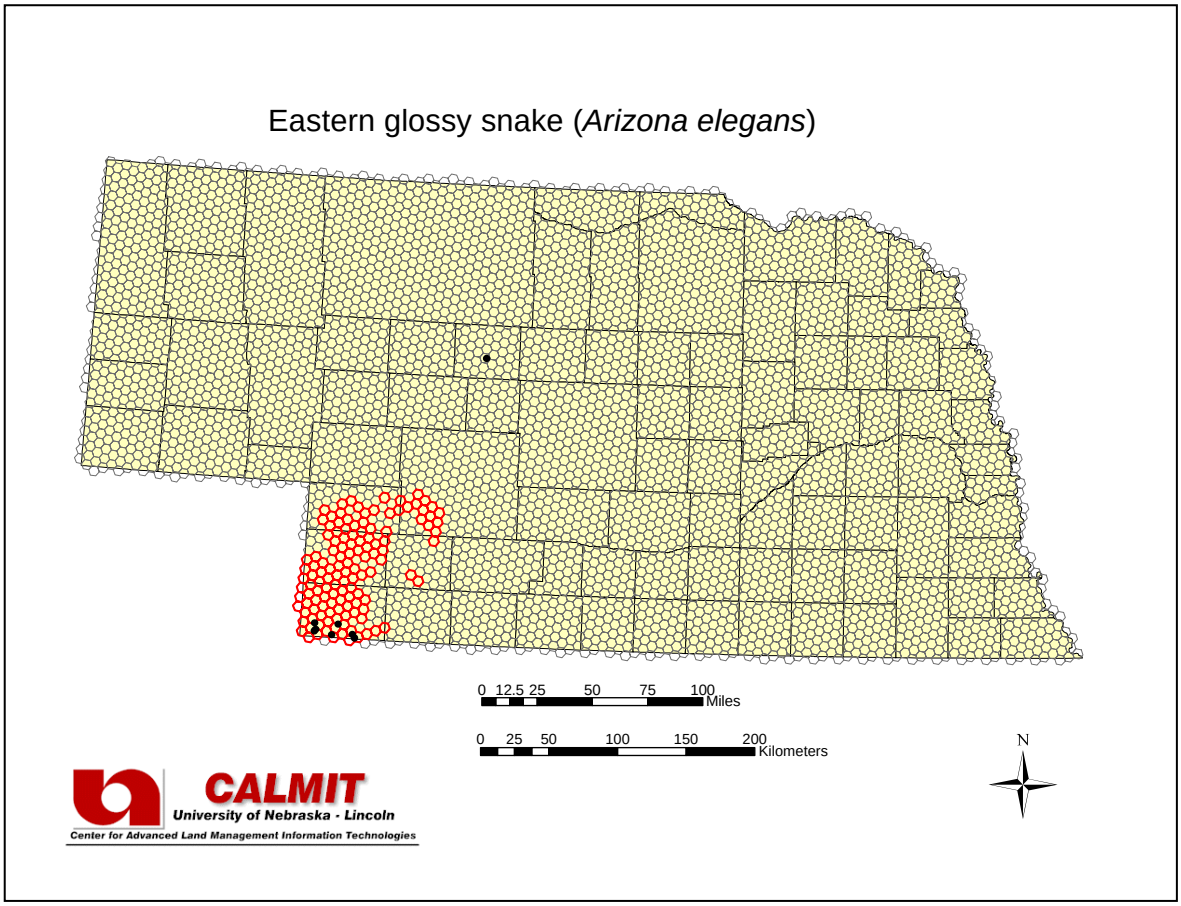
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Eastern Glossy Snake**	TNC Global Status:	G5
Scientific Name:	***Arizona elegans***	Federal Status:	-
TNC Element Code:	ARADB01010	State (NE) Status:	S2

Habitat Description:
Found in dry, open sandy areas, coastal chaparral, creosote-mesquite desert, sagebrush flats, and oak-hickory woodlands (Brown 1997). Found in dry, open, sandy areas (Collins 1993). The species may extend into the Sandhills based upon voucher specimen distribution. Based on observational data, the species appears to be at its range limit within southwestern Nebraska.

Total Area of Modeled Habitat (ha): 518,996

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Percentage of Coarse-textured Soils > 2%' AND 'Land Cover class Sandsage Shrubland > 0.5%'.



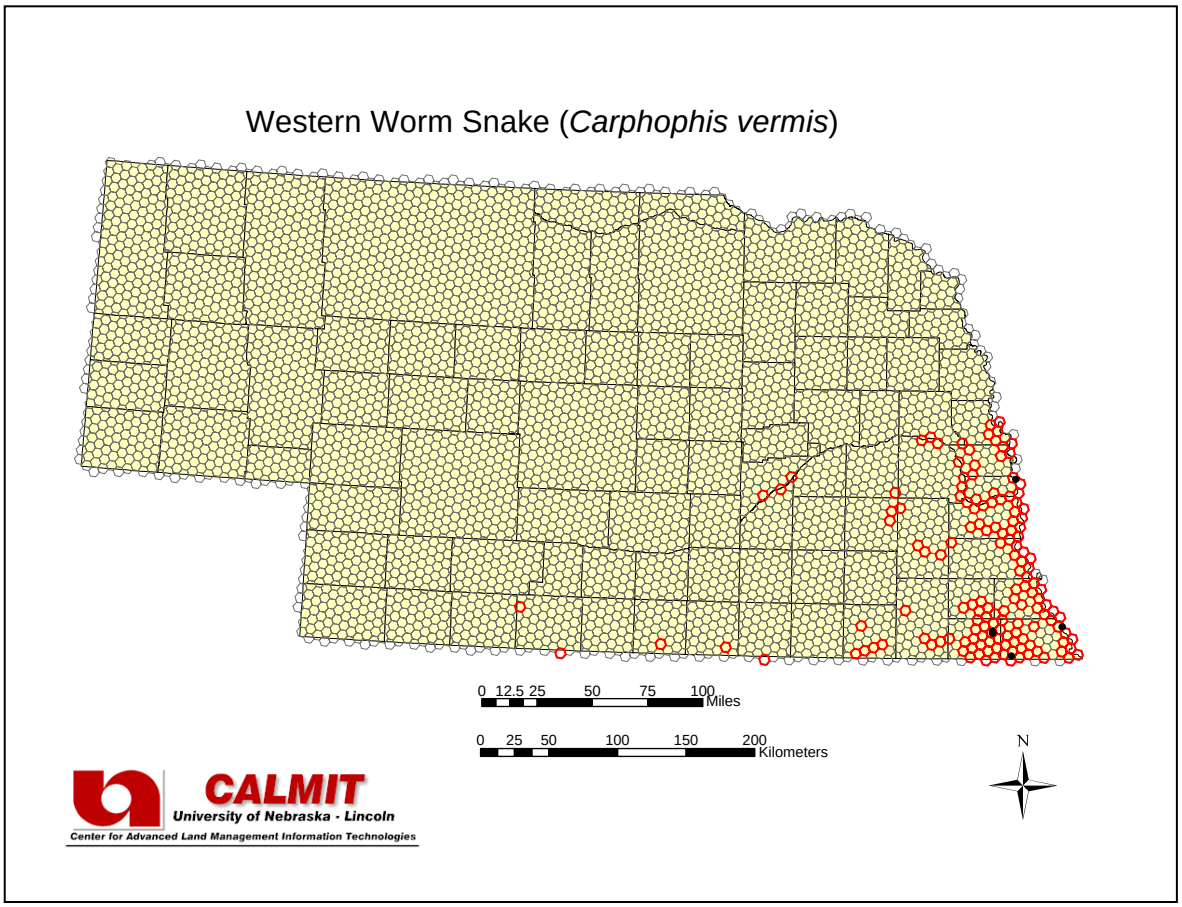
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Western Worm Snake**	TNC Global Status:	G5
Scientific Name:	***Carphophis vermis***	Federal Status:	-
TNC Element Code:	ARADB02010	State (NE) Status:	-

Habitat Description:
Occurs only in areas having forests and burrows into the soil during summer (Lynch 1985). Found beneath limestone rocks or in the loose, damp soil of wooded or partly wooded hillsides and some have been observed at woodland edge (Collins 1993, Clark 1970). Based on observational data, the species appears to be at its range limit within southeastern Nebraska.

Total Area of Modeled Habitat (ha): 596,030

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Total Growing Degree Days at 0°C through April > 410 days' AND 'Land Cover class Deciduous Forests and Woodlands > 7.5%'.



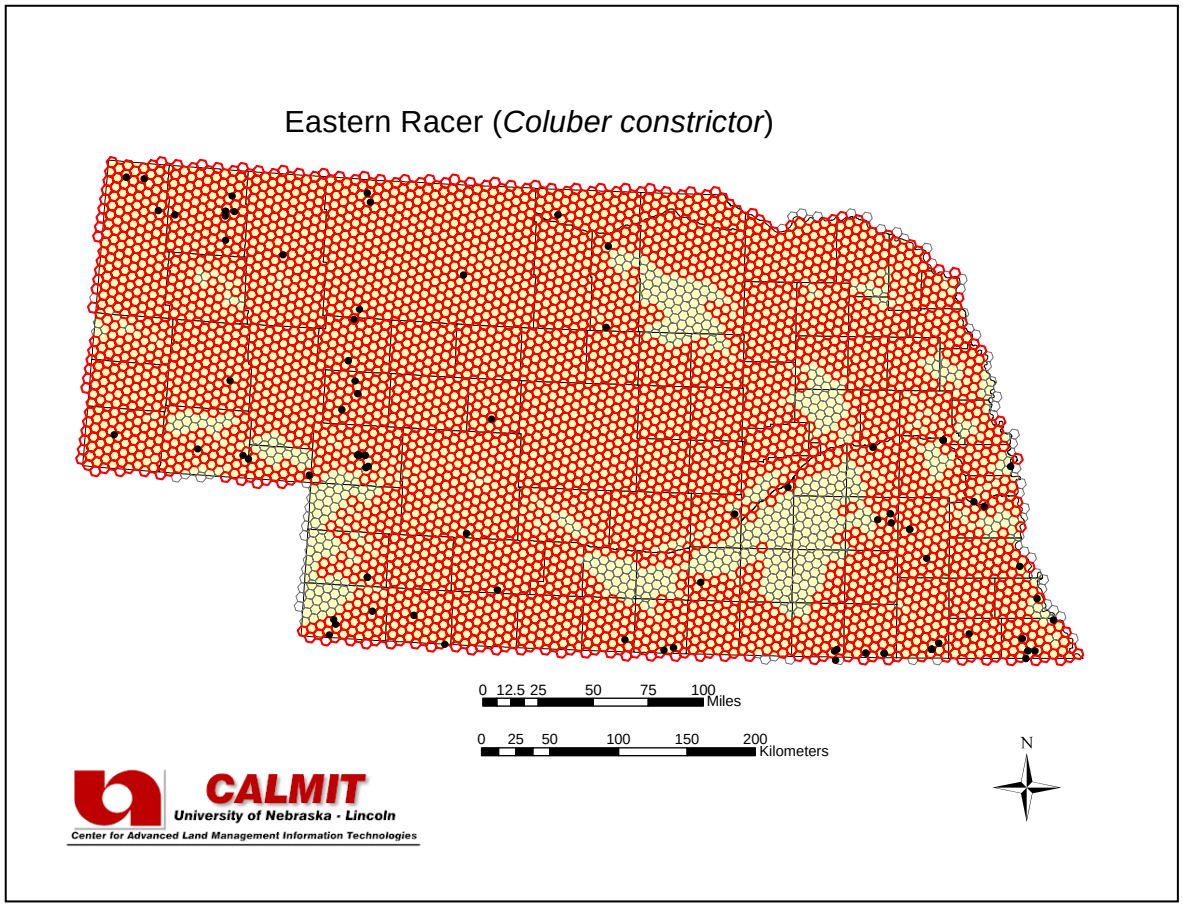
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Eastern Racer**	TNC Global Status:	G5
Scientific Name:	***Coluber constrictor***	Federal Status:	-
TNC Element Code:	ARADB07010	State (NE) Status:	-

Habitat Description:
A snake of open grassland, pasture, and prairie areas during the summer and generally is found on rocky wooded hillsides only in spring and fall (Fitch 1963, Collins 1993). Utilized old fields and prairie restorations and avoided agricultural fields and forests (Keller and Heske 2000). Found throughout Kansas in open grasslands, riparian thickets, weedy fields, and open woodlands, but rarely in forested areas (Heinrich and Kaufman 1985). Abundant snake species within Scotts Bluff National Monument, Nebraska (Cox and Franklin 1989).

Total Area of Modeled Habitat (ha): 17,276,728

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Land Cover class Sandhills Upland Prairie > 50%' OR 'Land Cover class Upland Tallgrass Prairie > 10%' OR 'Land Cover class Little Bluestem-Gramma Mixedgrass Prairie > 10%' OR 'Land Cover class Western Shortgrass Prairie > 15%'.



Nebraska GAP Analysis 2004
Reptile Species Atlas

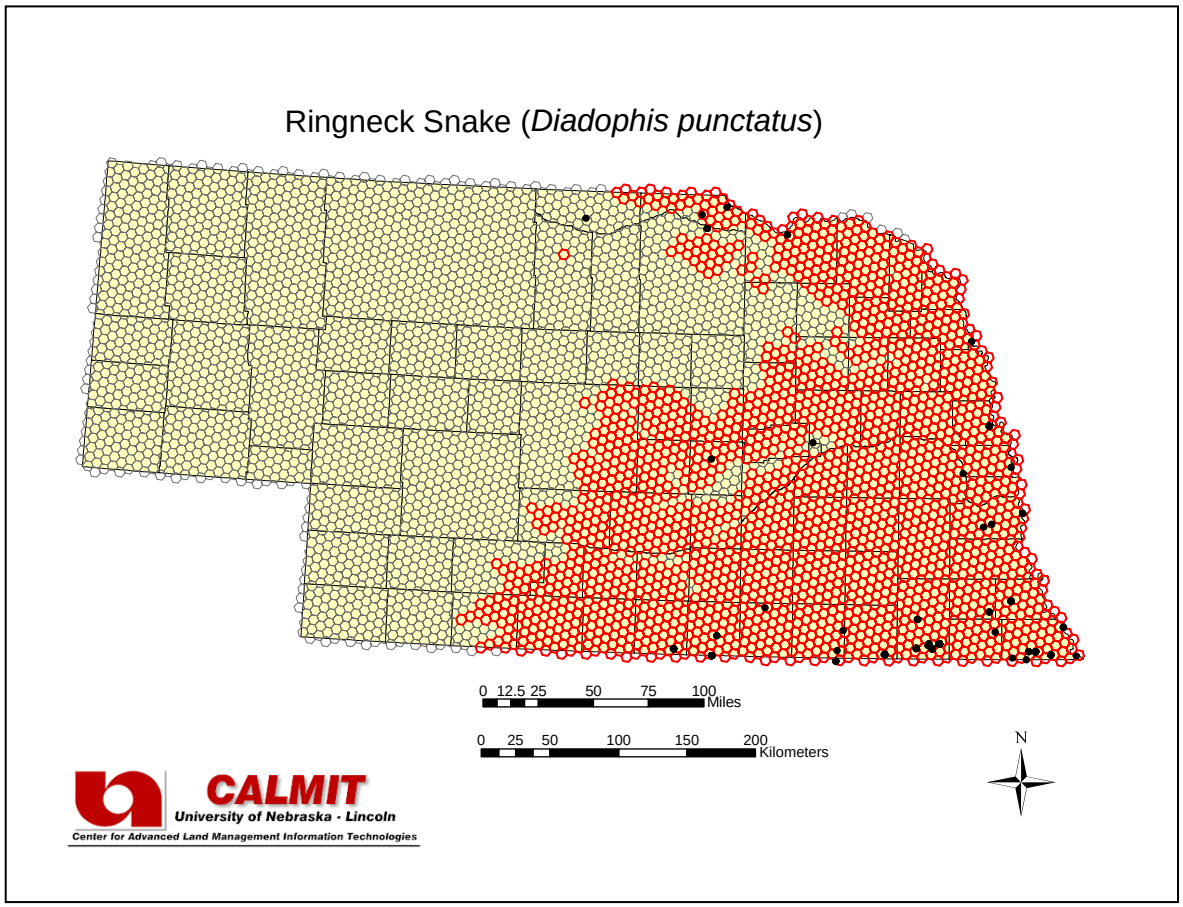
Common Name:	**Ringneck Snake**	TNC Global Status:	G5
Scientific Name:	***Diadophis punctatus***	Federal Status:	-
TNC Element Code:	ARADB10010	State (NE) Status:	S5

Habitat Description:
Snakes are common in mesic eastern Nebraska in deciduous forests (Lynch 1985). Rests on moist soils under large rocks during the day (Collins 1993).

Total Area of Modeled Habitat (ha): 8,295,766

Model Description:
Modeled distribution using the set of variables 'Elevation $\leq$ 780 m' AND 'Percentage of Coarse-textured Soils $\leq$ 20%'

162 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



Nebraska GAP Analysis 2004
Reptile Species Atlas

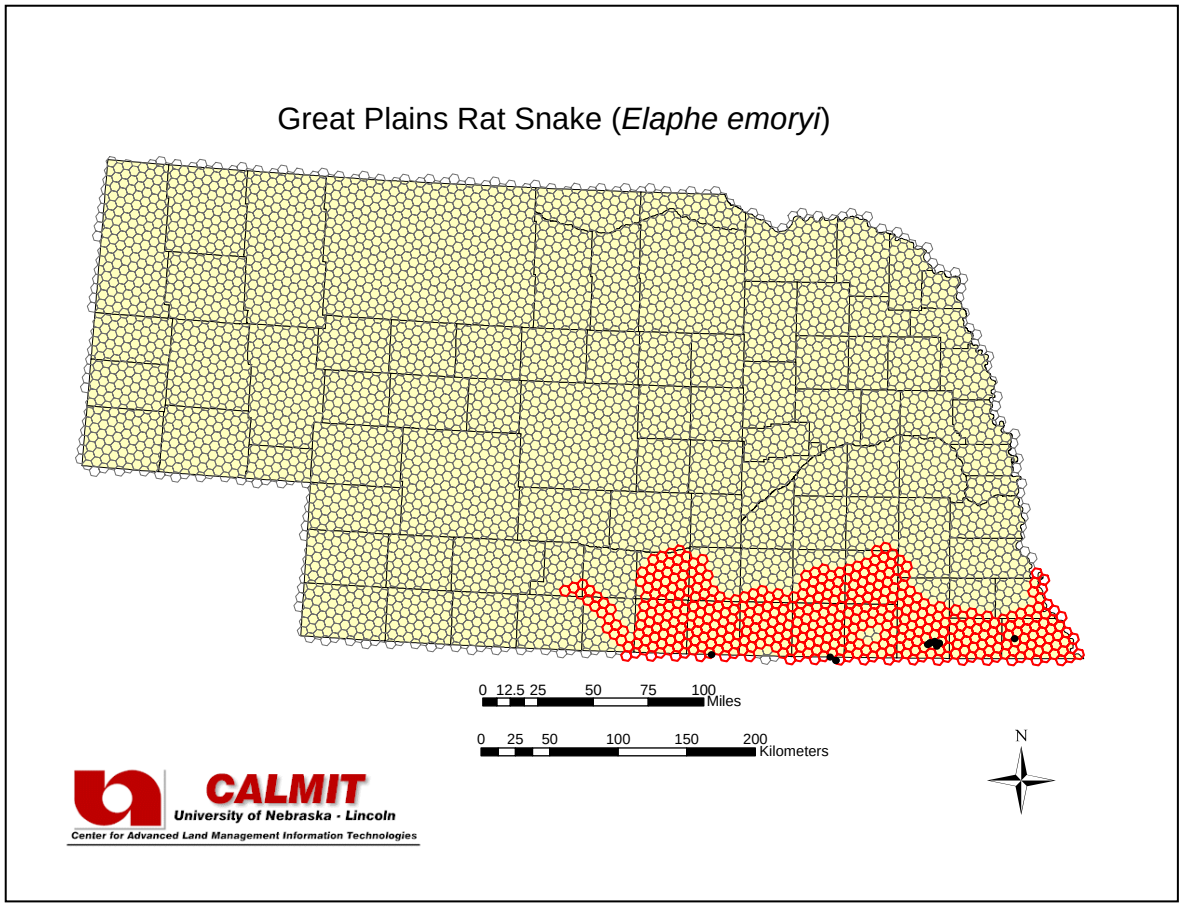
Common Name:	**Great Plains Rat Snake**	TNC Global Status:	G5
Scientific Name:	***Elaphe emoryi***	Federal Status:	-
TNC Element Code:	ARADB13020	State (NE) Status:	-

Habitat Description:
Inhabits rocky hillsides, canyons and caves. They also choose similar habitat in open woods or along woodland edge, avoiding heavily forested regions (Collins 1993). Found in forest edge and open forest habitats in eastern Kansas (Heinrich and Kaufman 1985).

Total Area of Modeled Habitat (ha): 1,832,702

Model Description:
Modeled distribution using the set of variables 'Elevation $\leq$ 780 m' AND 'Total Growing Degree Days at 0^{o}C through September > 3600 days' AND 'December Growing Degree Days Weighted Coefficient of Variation > 20%' AND 'June Growing Degree Days Weighted Coefficient of Variation $\leq$ 18.5%'.

13 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



Nebraska GAP Analysis 2004
Reptile Species Atlas

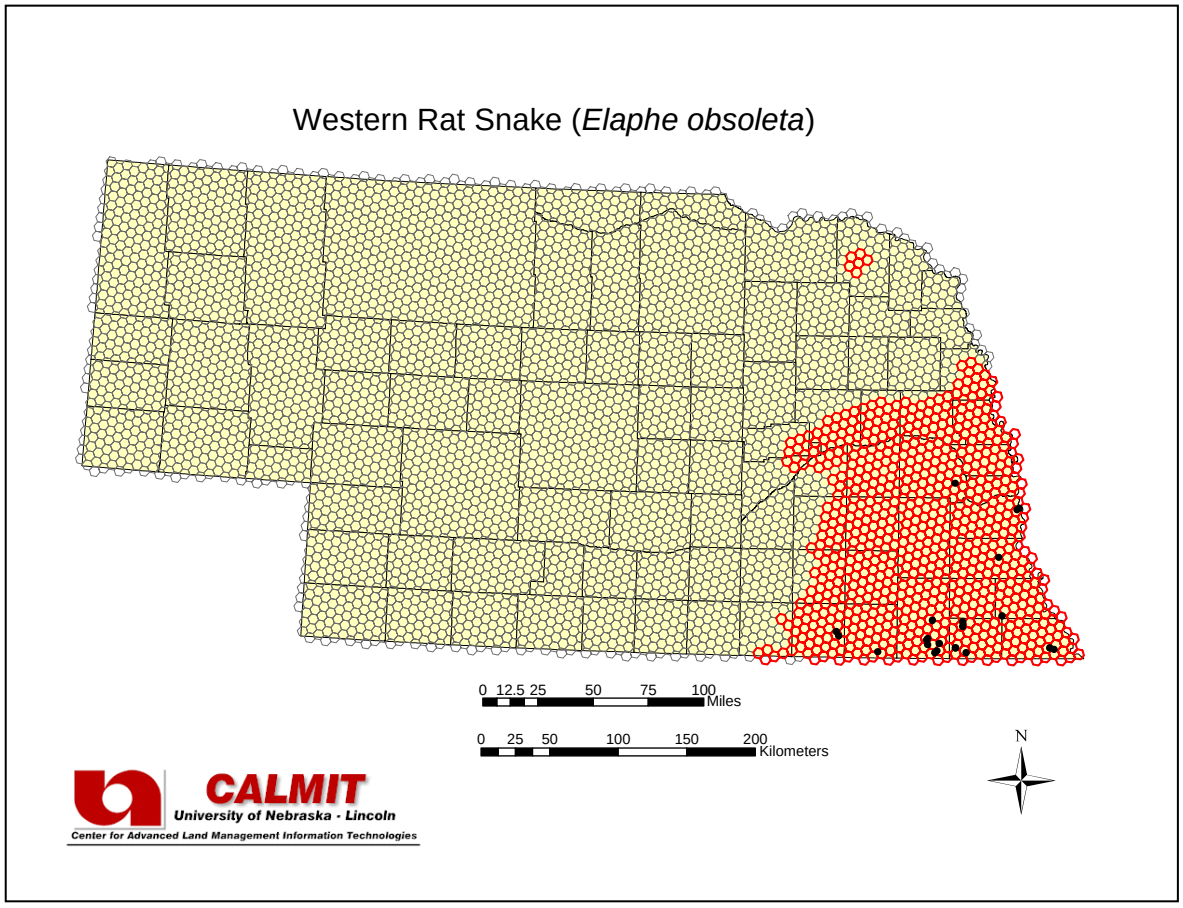
Common Name:	**Western Rat Snake**	TNC Global Status:	G5
Scientific Name:	***Elaphe obsoleta***	Federal Status:	-
TNC Element Code:	ARADB13030	State (NE) Status:	S4

Habitat Description:
Found in deciduous forests of eastern and southeastern Nebraska (Lynch 1985). Generally inhabits forested areas, particularly the rocky hillsides of open woodlands. Along the western edge of its range, it frequents the wooded areas of streams and rivers (Collins 1993).

Total Area of Modeled Habitat (ha): 3,219,366

Model Description:
Modeled distribution using the set of variables 'Elevation $\leq$ 500 m' AND 'Total Growing Degree Days at 0°C through September > 3550 days'.

22 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



Nebraska GAP Analysis 2004
Reptile Species Atlas

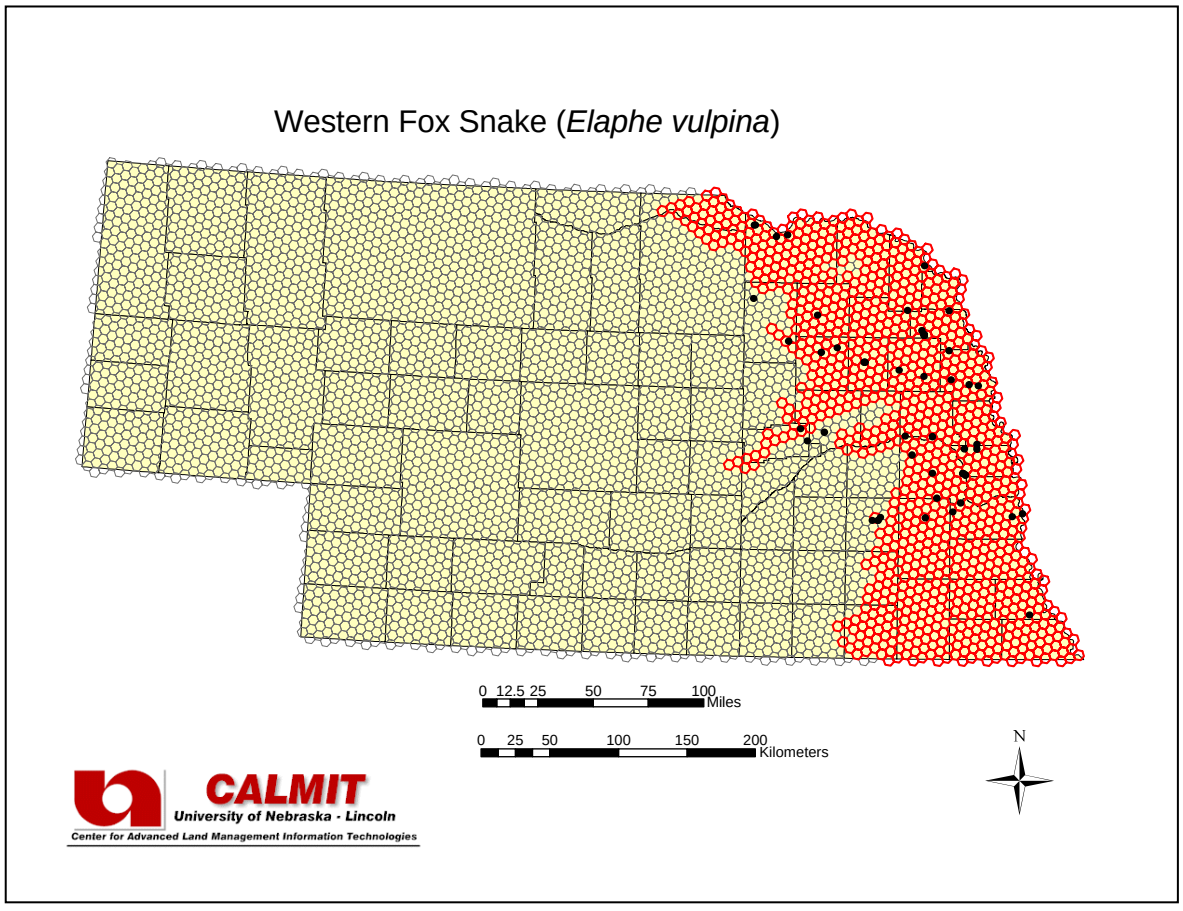
Common Name:	**Western Fox Snake**	TNC Global Status:	G5
Scientific Name:	***Elaphe vulpina***	Federal Status:	-
TNC Element Code:	ARADB13060	State (NE) Status:	-

Habitat Description:
Occurs in farmlands, prairies, stream valleys, woods and dune country (Conant and Collins 1998).

Total Area of Modeled Habitat (ha): 4,293,819

Model Description:
Modeled distribution using the set of variables 'Elevation $\leq$ 550 m' AND 'Total Growing Degree Days at 0°C through September > 3550 days' AND 'Elevation $\leq$ 450 m' OR 'Elevation > 550 m' AND 'Total Growing Degree Days at 0°C through September > 3550 days'.

55 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



Nebraska GAP Analysis 2004
Reptile Species Atlas

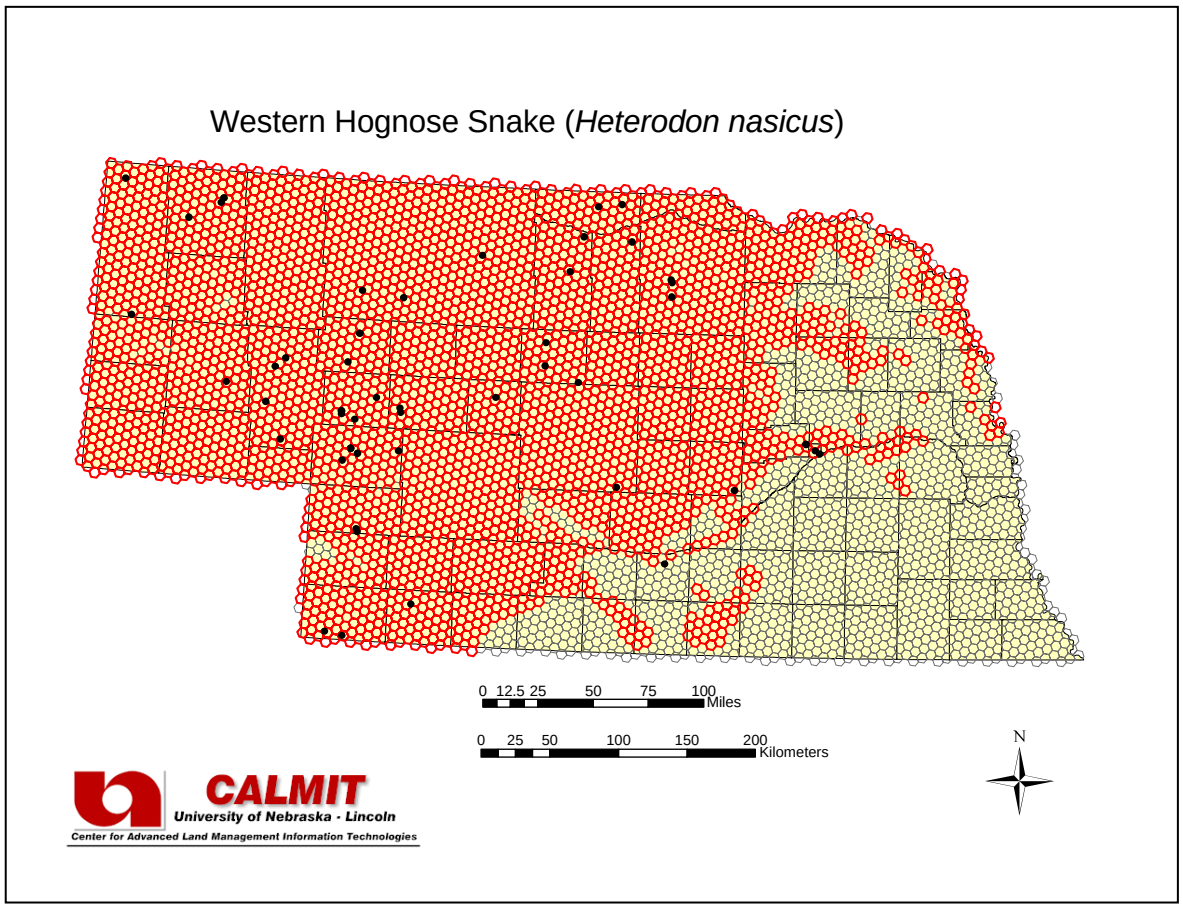
Common Name:	**Western Hognose Snake**	TNC Global Status:	G5
Scientific Name:	***Heterodon nasicus***	Federal Status:	-
TNC Element Code:	ARADB17010	State (NE) Status:	S5

Habitat Description:
Occurs over the western three-fourths of Nebraska and most common in areas of sandy soils (Lynch 1985). Generally found in grassland or sand prairie (Collins 1993).

Total Area of Modeled Habitat (ha): 14,397,936

Model Description:
Modeled distribution using the set of variables 'Land Cover class Agricultural Field $\leq$ 68.5%' AND 'Total Growing Degree Days at 0°C through November $\leq$ 4100 days'.

54 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



Nebraska GAP Analysis 2004
Reptile Species Atlas

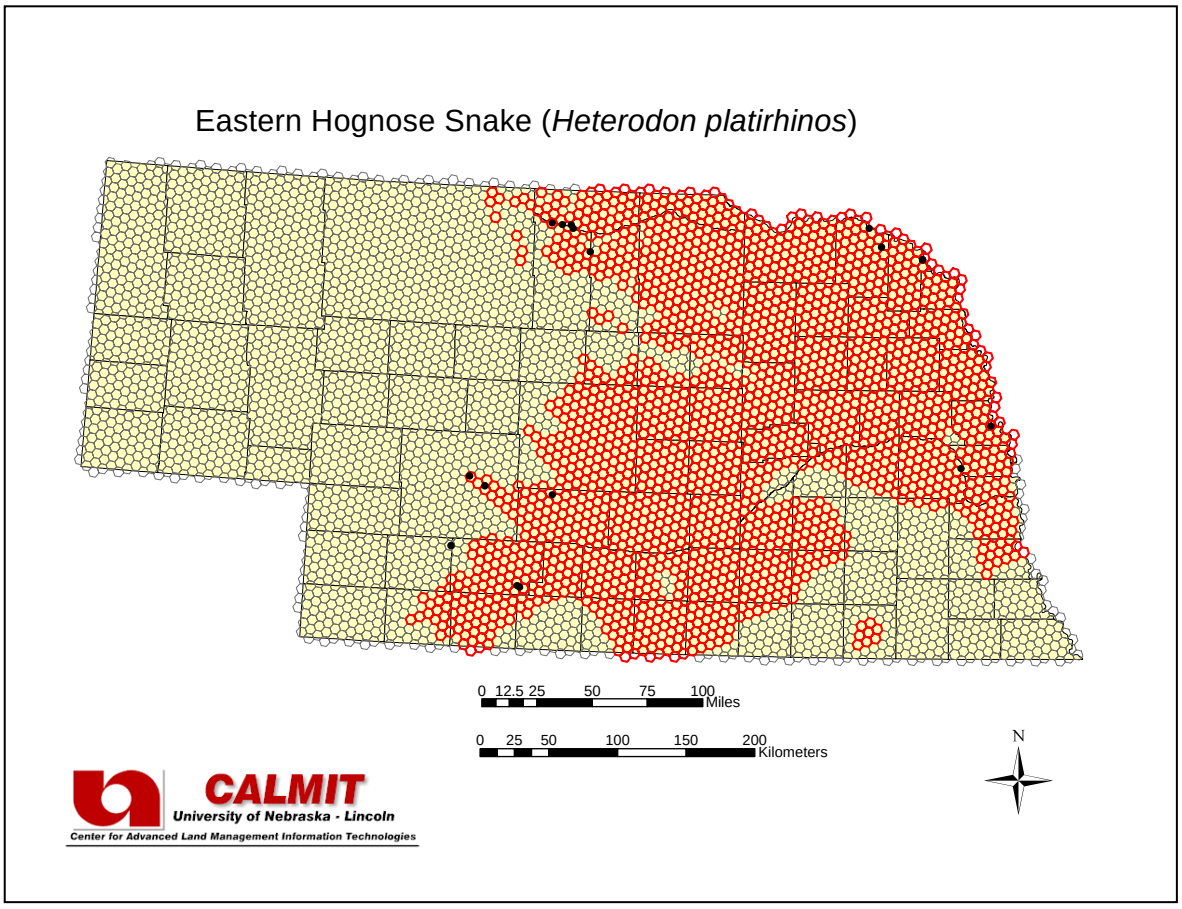
Common Name:	**Eastern Hognose Snake**	TNC Global Status:	G5
Scientific Name:	***Heterodon platirhinos***	Federal Status:	-
TNC Element Code:	ARADB17020	State (NE) Status:	-

Habitat Description:
The species has spread north along the Missouri River and its tributaries and is found in extreme eastern Nebraska in forest regions and the edge of the prairie. It has been found along the Niobrara River as far west as Cherry county but has not spread into the Nebraska Sandhills (Platt 1969). Lives in widely varying habitats, from forested areas to open prairies and prefers sandy areas (Collins 1993).

Total Area of Modeled Habitat (ha): 8,567,408

Model Description:
Modeled distribution using the set of variables 'Elevation $\leq$ 850 m' AND 'Total Growing Degree Days at 0°C through September $\leq$ 3675 days' AND 'Land Cover class Sandhills Upland Prairie $\leq$ 50%'.

17 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



Nebraska GAP Analysis 2004
Reptile Species Atlas

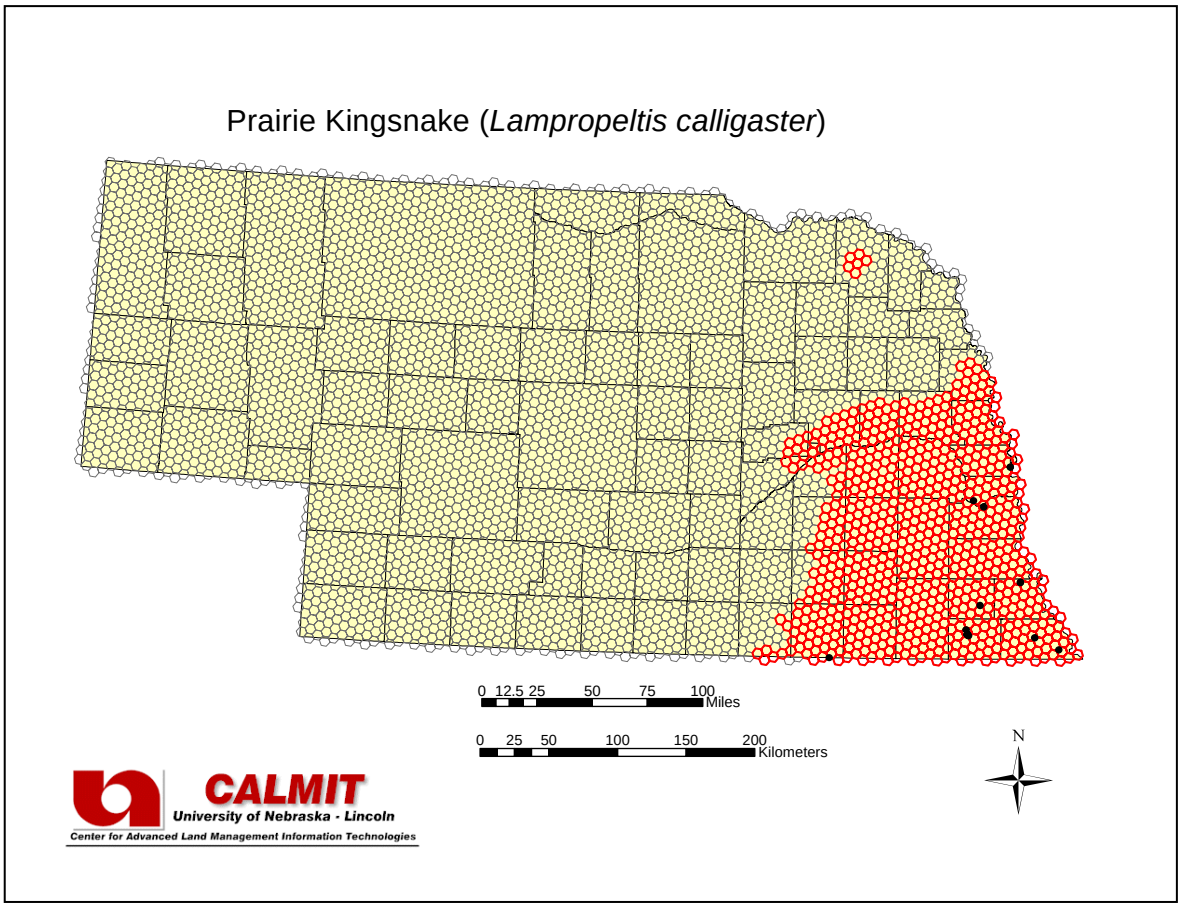
Common Name:	**Prairie Kingsnake**	TNC Global Status:	G5
Scientific Name:	***Lampropeltis calligaster***	Federal Status:	-
TNC Element Code:	ARADB19010	State (NE) Status:	S3

Habitat Description:
Inhabits a wide variety of areas, including rocky hillsides with open woods, prairie grassland, and sand prairies (Collins 1993).

Total Area of Modeled Habitat (ha): 3,219,366

Model Description:
Modeled distribution using the set of variables 'Elevation $\leq$ 500 m' AND 'Total Growing Degree Days at 0°C through September $\leq$ 3550 days'.

25 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



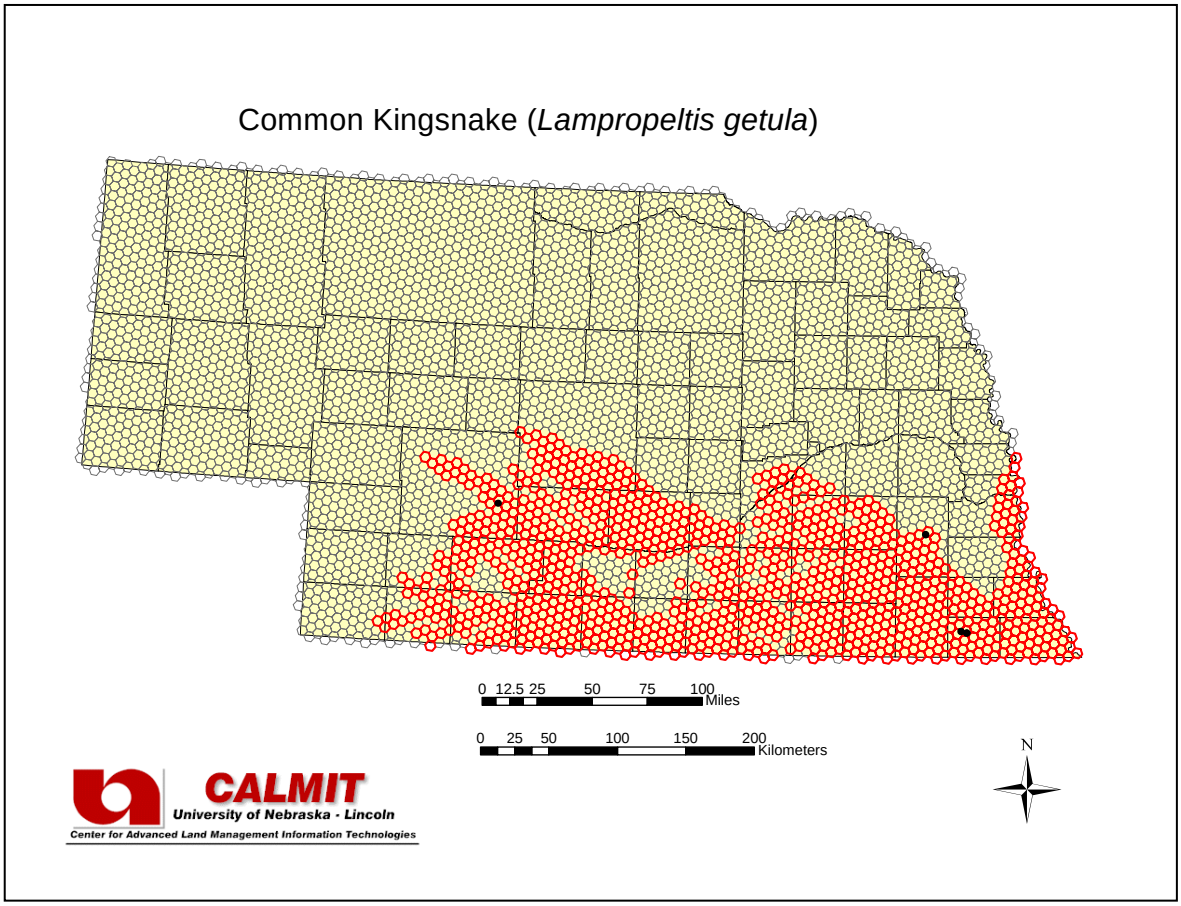
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Common Kingsnake**	TNC Global Status:	G5
Scientific Name:	***Lampropeltis getula***	Federal Status:	-
TNC Element Code:	ARADB19020	State (NE) Status:	S2

Habitat Description:
Generally inhabits moist areas of open woodland, woodland edge, or lowlands but has been found in open prairie (Collins 1993, Heinrich and Kaufman 1985). Isolated records found in literature and voucher specimens indicate the range may be greater than previously documented (Conant and Collins 1998). Observations in northern Kansas indicate high probability that this species occurs in southern Nebraska (Lynch 1985, Collins 1993).

Total Area of Modeled Habitat (ha): 4,314,152

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Elevation $\leq$ 900 m' AND 'June Growing Degree Days Weighted Coefficient of Variation $\leq$ 19.5%' AND 'Land Cover class Deciduous Forests and Woodlands > 0.5%'.



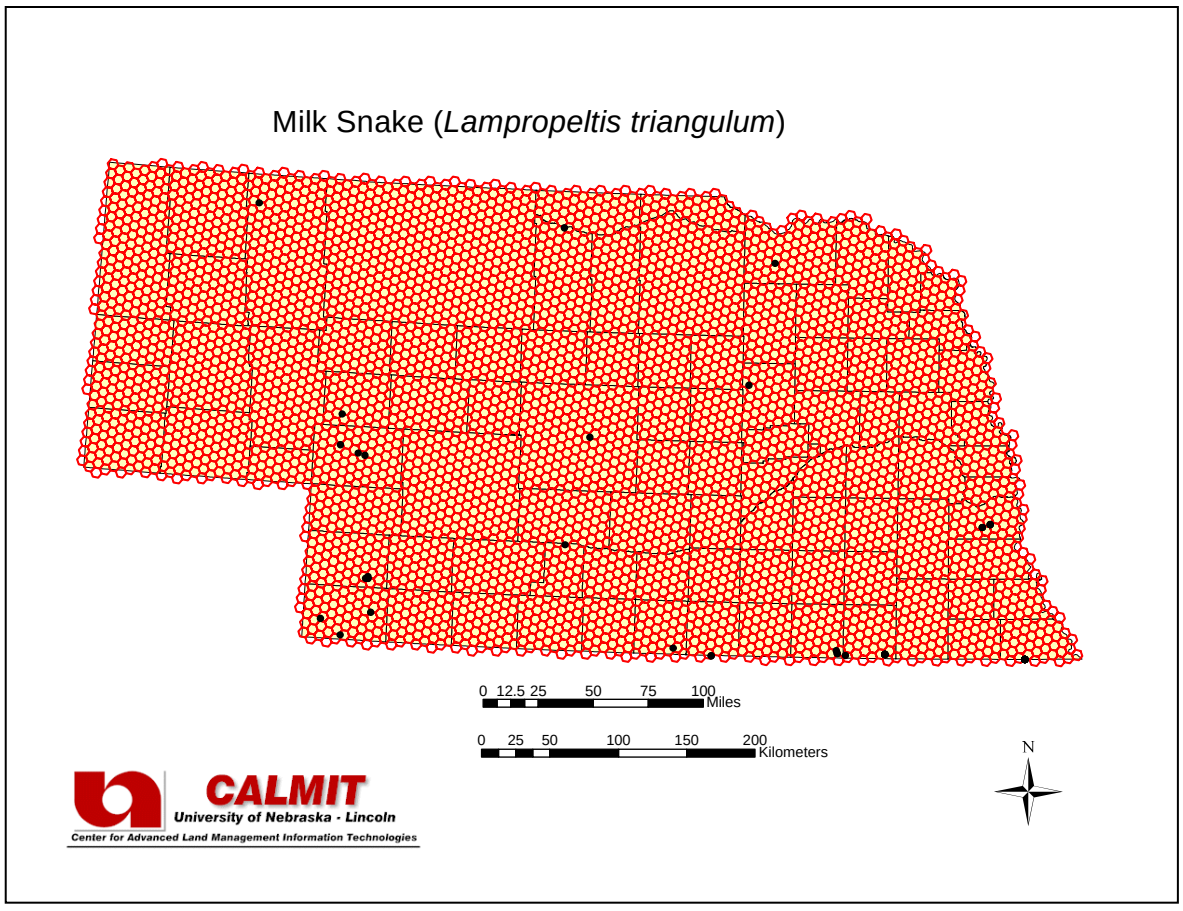
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Milk Snake**	TNC Global Status:	G5
Scientific Name:	***Lampropeltis triangulum***	Federal Status:	-
TNC Element Code:	ARADB19050	State (NE) Status:	S5

Habitat Description:
Rocky ledges of prairie canyons and the edges of streams (Collins 1993). Inhabits open woodland or woodland edge, with grass of other short vegetation with rocks or other similar shelter (Fitch and Fleet 1970). Primarily associated with grasslands (Busby and Parmelee 1995). Found in open prairies, especially sandy areas and rocky hillsides (Ballinger et al. 2000).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Habitat descriptions from literature were broad and general, resulting in no available variables for modeling.



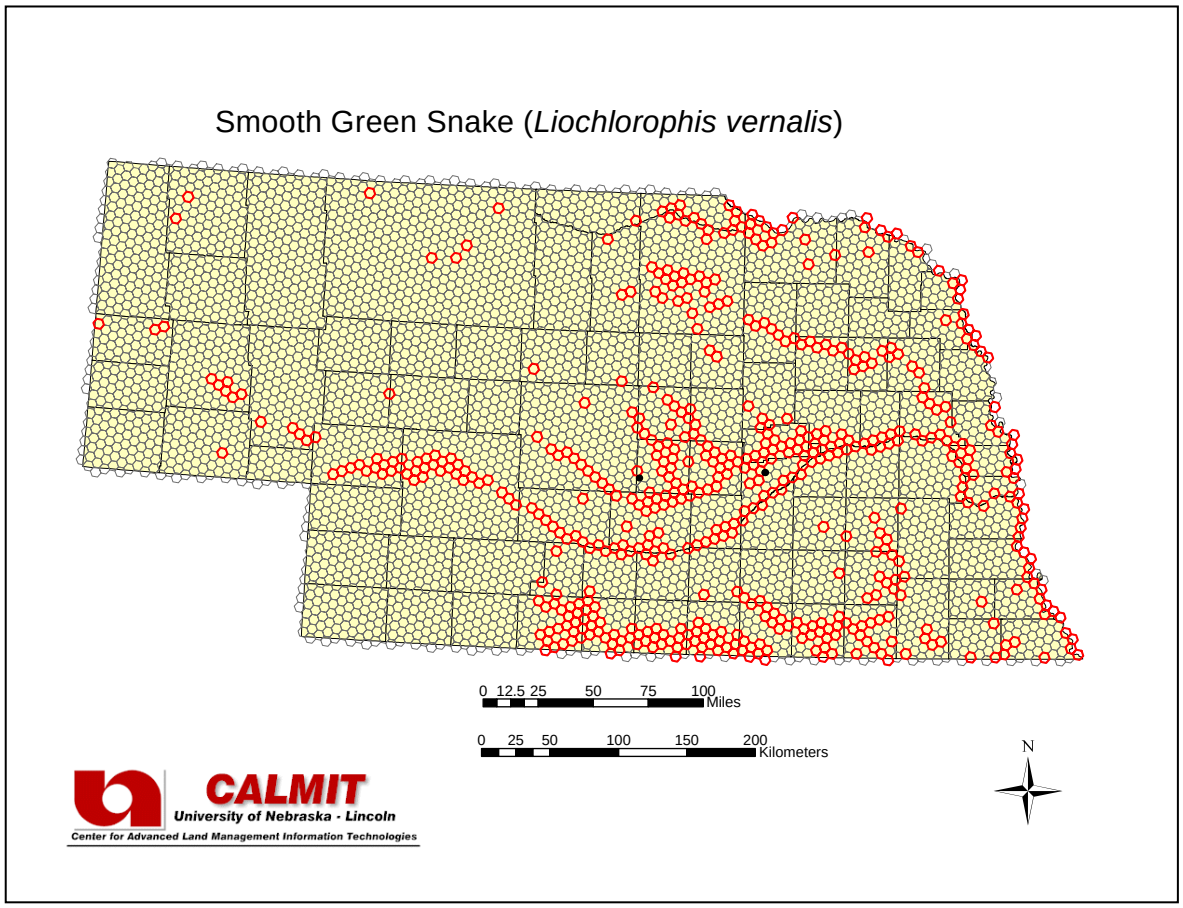
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Smooth Green Snake**	TNC Global Status:	G5
Scientific Name:	***Liochlorophis vernalis***	Federal Status:	-
TNC Element Code:	ARADB47010	State (NE) Status:	S1

Habitat Description:
Occupies the lowlands in the north-central portion of the country (Conant and Collins 1998). Associated with permanent water and occurs in marshes or along streams and rivers (Ballinger et al. 2000).

Total Area of Modeled Habitat (ha): 2,221,931

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Land Cover class Lowland Tallgrass Prairie is present' AND 'Land Cover class Riparian Woodland is present' AND 'Land Cover class Agricultural Field $\leq$ 75%' OR 'Land Cover class Open Water is present' AND 'Land Cover class Riparian Woodland is present' AND 'Land Cover class Agricultural Field $\leq$ 75%'.



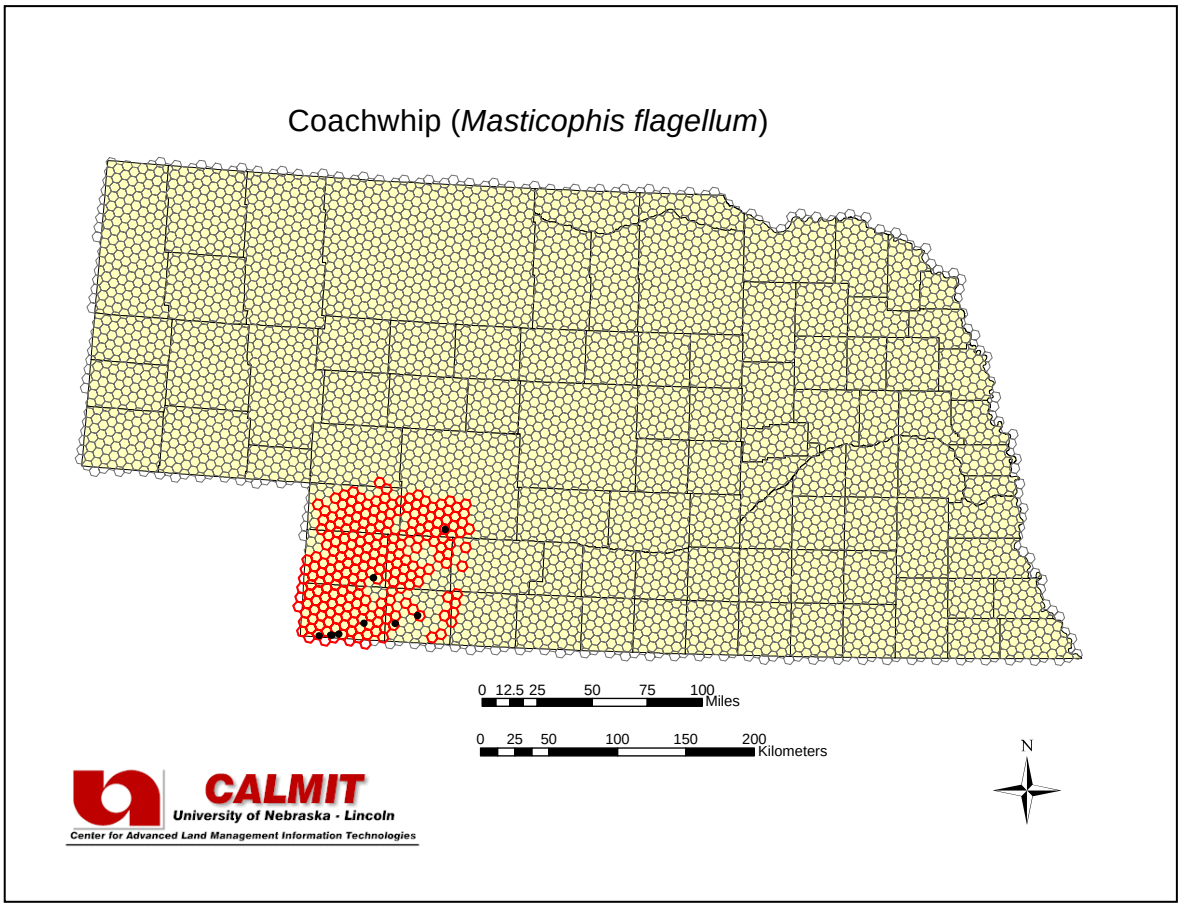
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Coachwhip**	TNC Global Status:	G5
Scientific Name:	***Masticophis flagellum***	Federal Status:	-
TNC Element Code:	ARADB21020	State (NE) Status:	S3

Habitat Description:
Found in a widely varying habitat, from open grassland prairies in western Kansas to rocky hillsides in open woodlands in southeastern Kansas (Collins 1993). A snake of grasslands, mesquite savannahs, arid brushlands, and numerous other more or less open habitats (Conant and Collins 1998). Based on observational data, the species appears to be at its range limit within southwestern Nebraska.

Total Area of Modeled Habitat (ha): 936,621

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the variable 'Land Cover class Sandsage Shrubland is present'.



Nebraska GAP Analysis 2004
Reptile Species Atlas

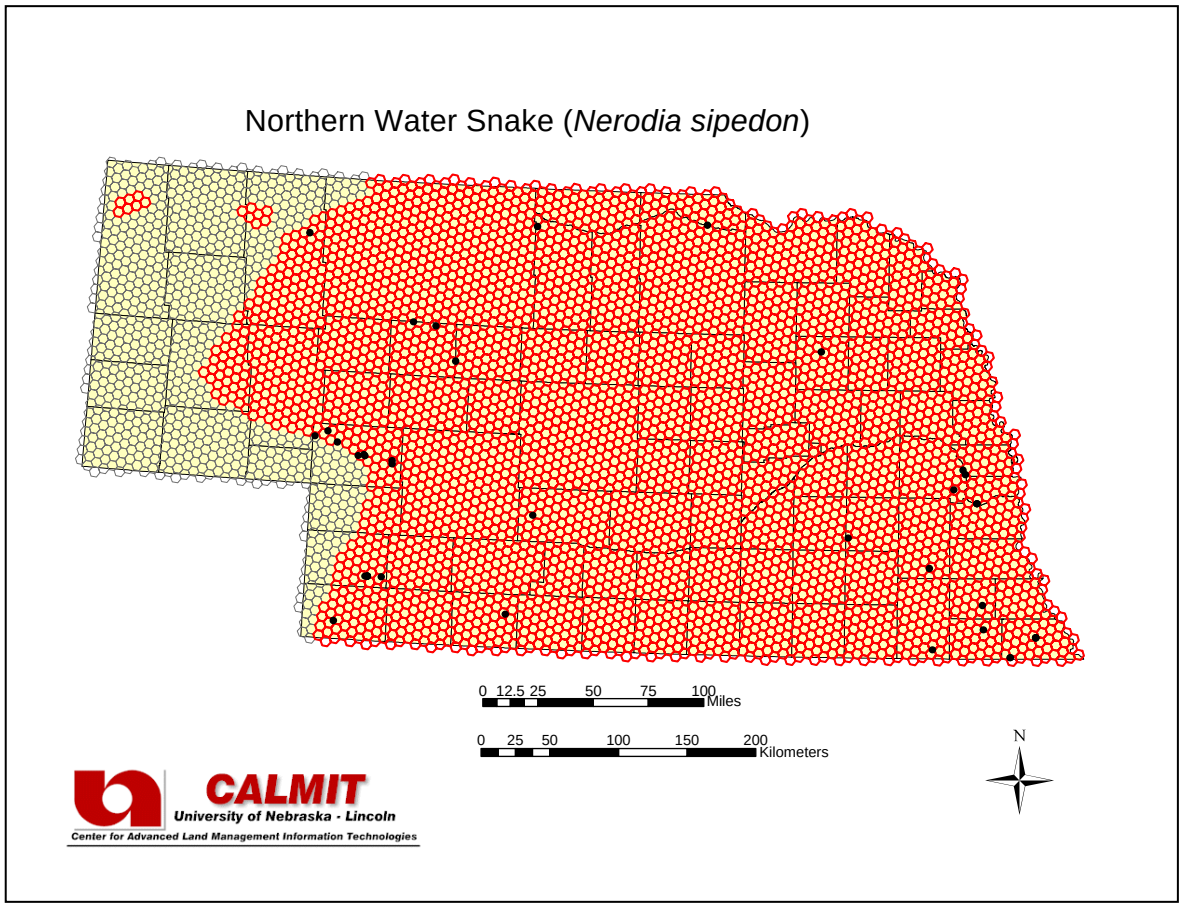
Common Name:	**Northern Water Snake**	TNC Global Status:	G5
Scientific Name:	***Nerodia sipedon***	Federal Status:	-
TNC Element Code:	ARADB22060	State (NE) Status:	S5

Habitat Description:
Occurs in marshes and along streams and rivers across Nebraska with the exception of the Panhandle (Lynch 1985). Found in almost any aquatic situation, from fast-flowing rocky streams and rivers to swamps, lakes, and marshes (Collins 1993).

Total Area of Modeled Habitat (ha): 17,215,932

Model Description:
Modeled distribution using the variable 'September 30-year Average Precipitation > 36 mm'.

41 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



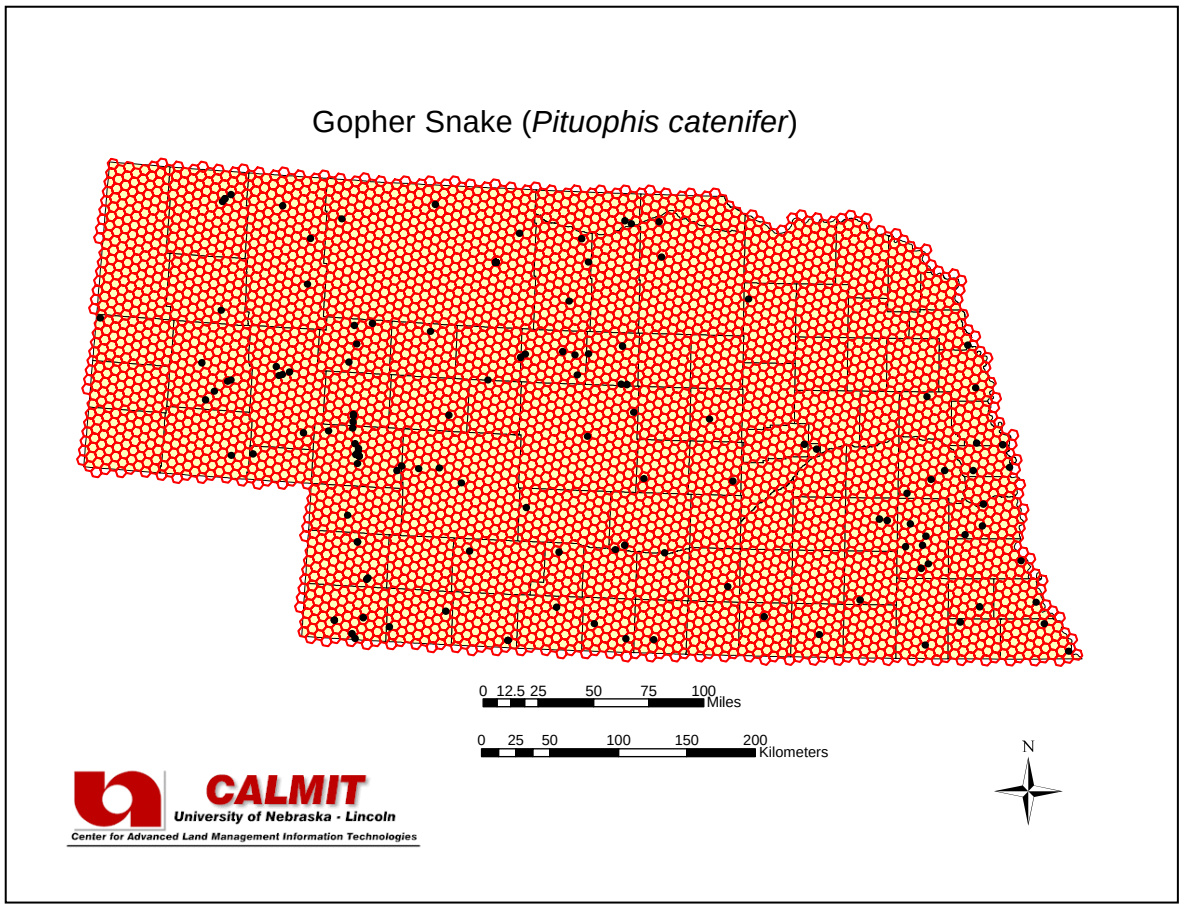
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Gopher Snake**	TNC Global Status:	G5
Scientific Name:	***Pituophis catenifer***	Federal Status:	-
TNC Element Code:	ARADB26020	State (NE) Status:	S5

Habitat Description:
In Nebraska, the species is statewide in distribution and seemingly resistant to pressures of agriculture and urban expansion (Lynch 1985). Lives in open grasslands as well as open woodland and woodland edge. It is common in cultivated fields where there is an abundance of rodents (Collins 1993). Occurs in a variety of habitats including farmland, roadsides, as well as native prairies and woodlands (Ballinger 2000).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Habitat descriptions from literature were broad and general, resulting in no available variables for modeling.



Nebraska GAP Analysis 2004
Reptile Species Atlas

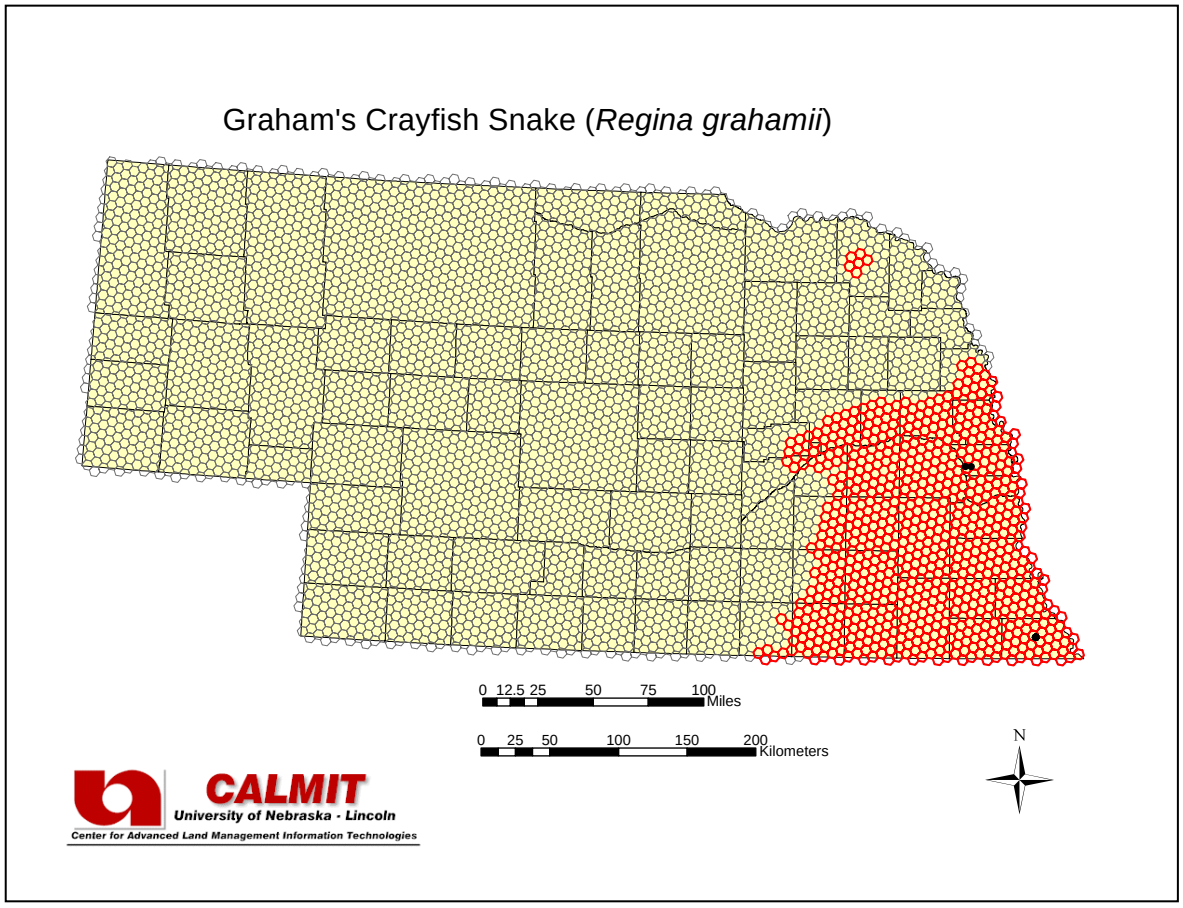
Common Name:	**Graham's Crayfish Snake**	TNC Global Status:	G5
Scientific Name:	***Regina grahamii***	Federal Status:	-
TNC Element Code:	ARADB27020	State (NE) Status:	S2

Habitat Description:
The snake is found along partially shaded streams and lakes in eastern Nebraska (Lynch 1985). Usually lives near ponds and sluggish streams of prairies, wet meadows, and river valleys (Collins 1993).

Total Area of Modeled Habitat (ha): 3,219,366

Model Description:
Modeled distribution using the set of variables 'Elevation $\leq$ 500 m' AND 'Total Growing Degree Days at 0^{o}C through September > 3550 days'.

16 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



Nebraska GAP Analysis 2004
Reptile Species Atlas

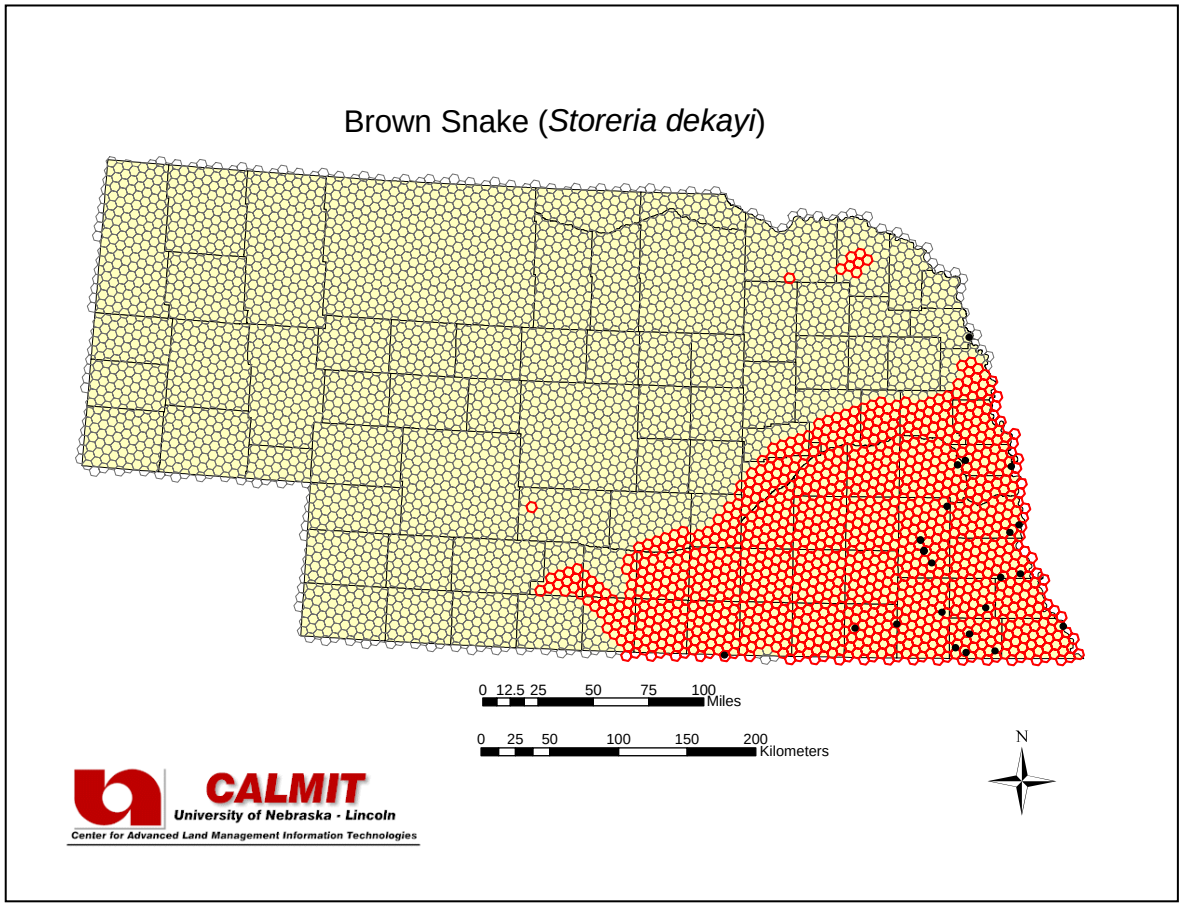
Common Name:	**Brown Snake**	TNC Global Status:	G5
Scientific Name:	***Storeria dekayi***	Federal Status:	-
TNC Element Code:	ARADB34010	State (NE) Status:	S3

Habitat Description:
Occurs most often in mesic wooded areas of southeastern Nebraska (Lynch 1985). This snake generally lives near moist situations in woodland and along woodland edge (Collins 1993).

Total Area of Modeled Habitat (ha): 4,877,720

Model Description:
Modeled distribution using the set of variables 'Elevation ≤ 780 m' AND 'Total Growing Degree Days at 0°C through September > 3550 days' AND 'December Growing Degree Days Weighted Average Coefficient of Variation > 20%'.

25 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



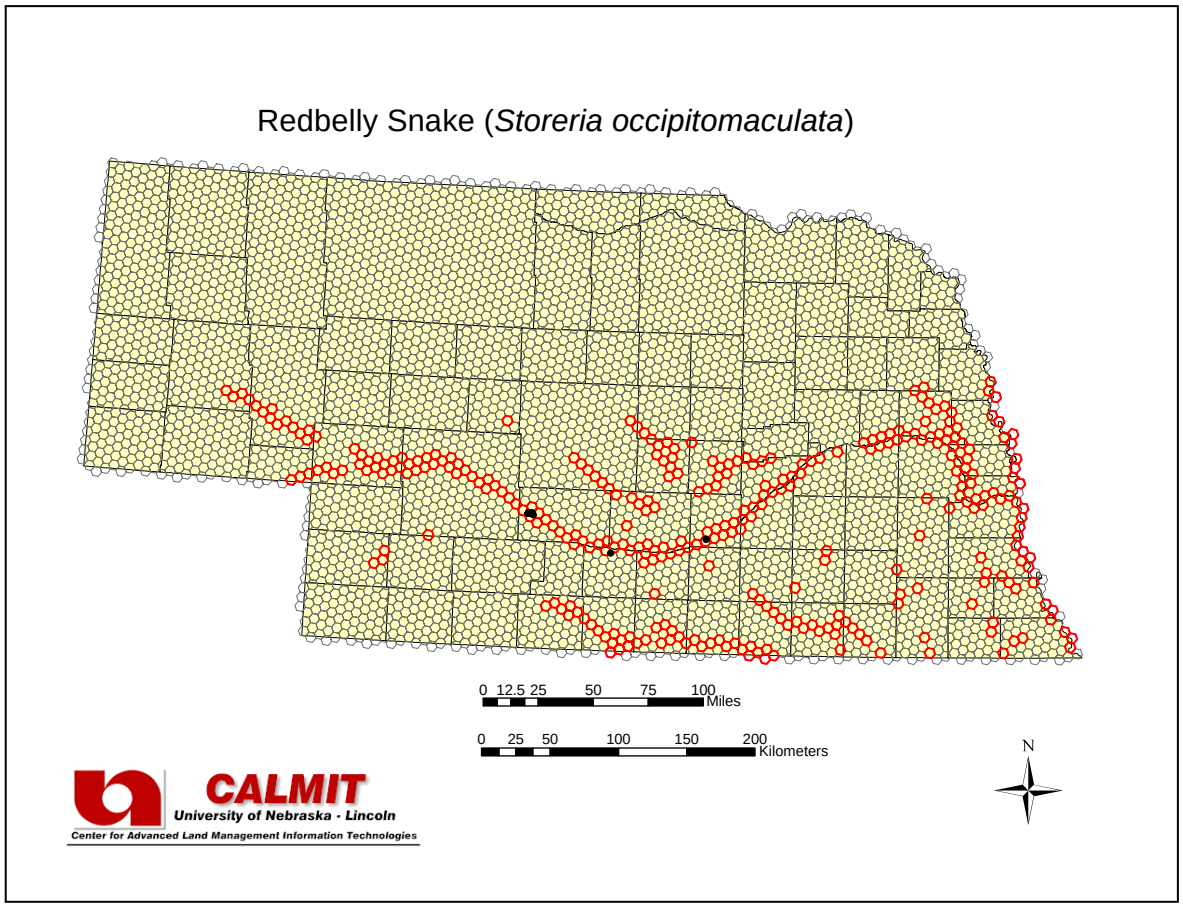
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Redbelly Snake**	TNC Global Status:	G5
Scientific Name:	***Storeria occipitomaculata***	Federal Status:	-
TNC Element Code:	ARADB34030	State (NE) Status:	S1

Habitat Description:
Limited habitat description for the western edge of its range includes woodland habitat and leaf litter (Collins 1993, Gloyd 1928). In one description these habitats were near water bodies (Gloyd 1932).

Total Area of Modeled Habitat (ha): 1,309,639

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Land Cover class Riparian Woodlands is present' AND '30-year Average Maximum Temperature Coefficient of Variation for April $\leq$ 7%' AND 'Medium-textured Soils are present'.



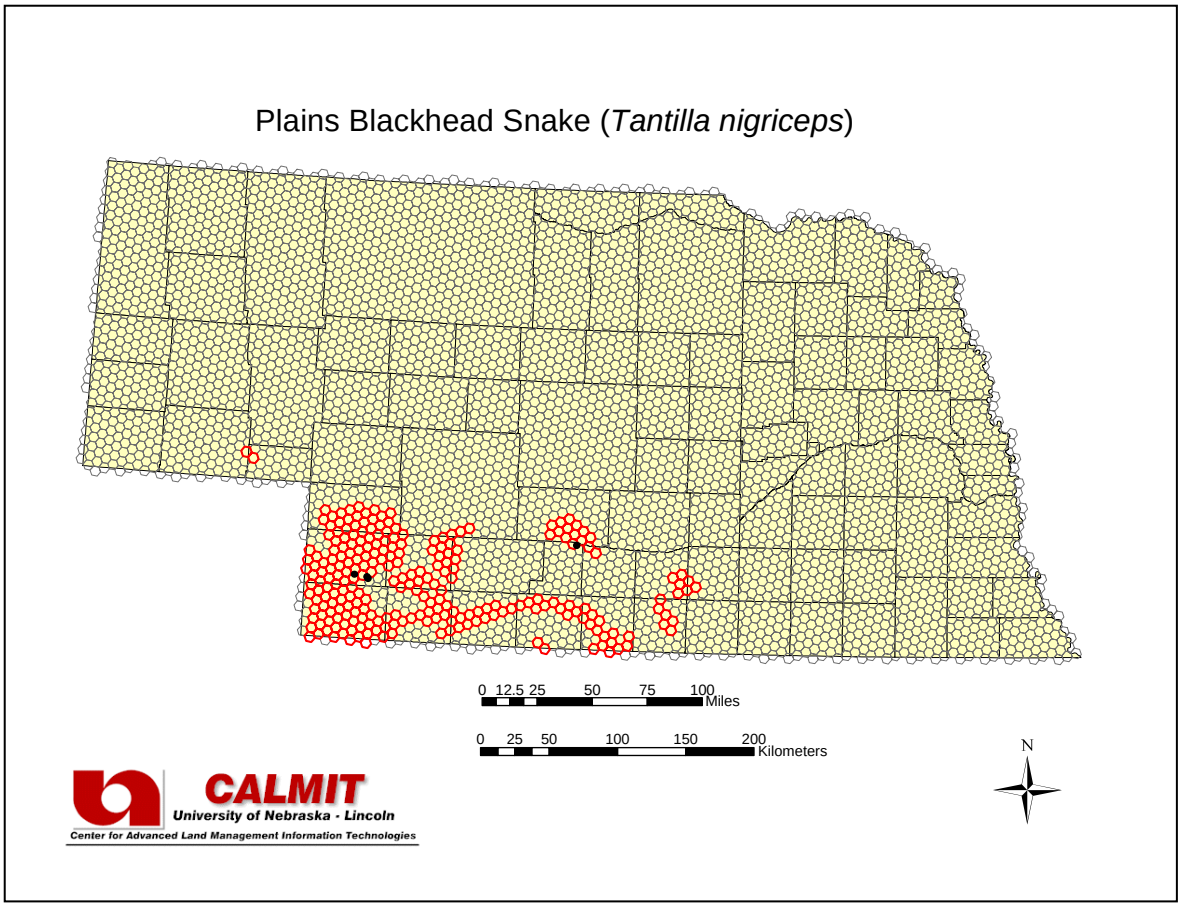
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Plains Blackhead Snake**	TNC Global Status:	G5
Scientific Name:	***Tantilla nigriceps***	Federal Status:	-
TNC Element Code:	ARADB35050	State (NE) Status:	S1

Habitat Description:
Found on rocky hillsides of grassland prairies and along prairie streams (Collins 1993). Occurs on rocky and grassy prairie; hillsides where soil is moist (Brown 1997).

Total Area of Modeled Habitat (ha): 993,392

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Elevation > 600 m' AND '30-year Average Maximum Temperature Coefficient of Variation for April ≤ 6.4%' AND 'Coarse-textured Soils are present'.



Nebraska GAP Analysis 2004
Reptile Species Atlas

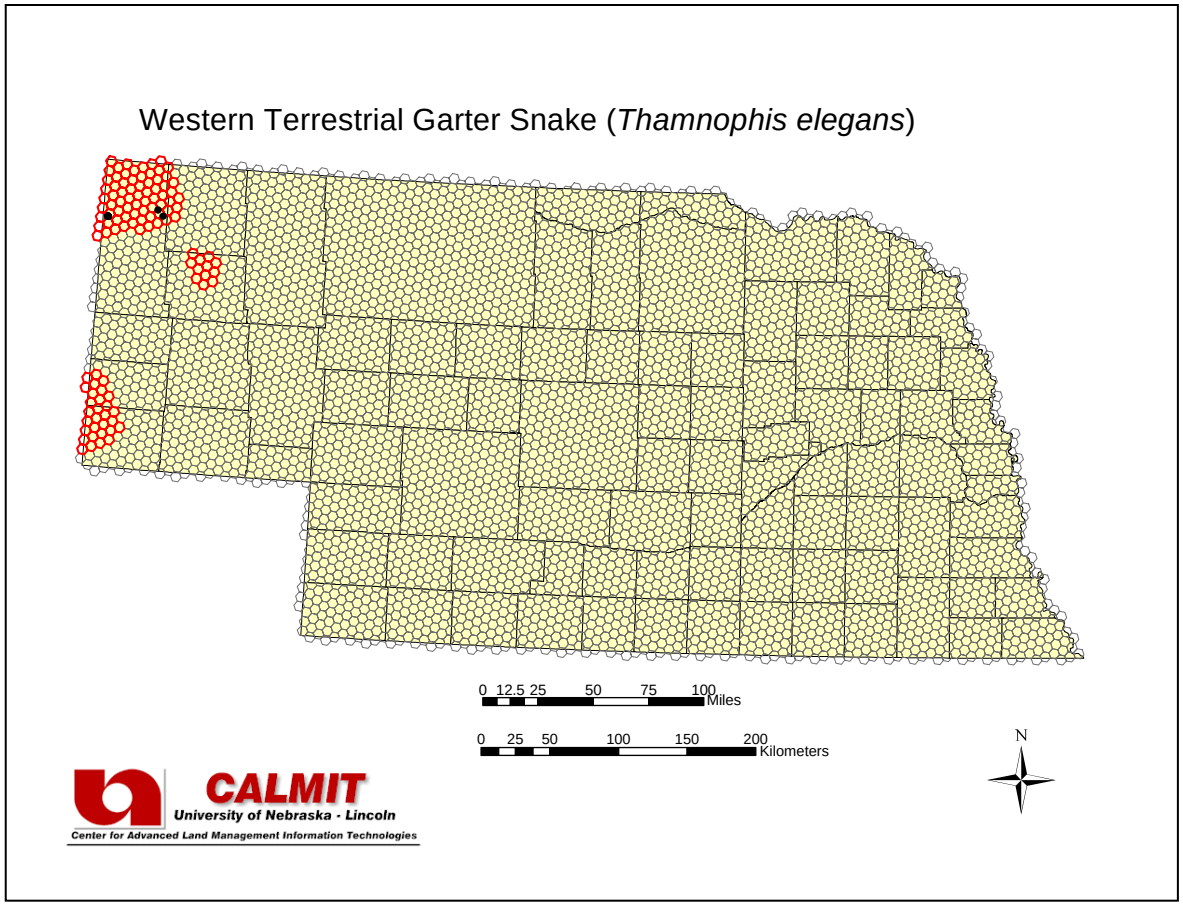
Common Name:	**Western Terrestrial Garter Snake**	TNC Global Status:	G5
Scientific Name:	***Thamnophis elegans***	Federal Status:	-
TNC Element Code:	ARADB36050	State (NE) Status:	S4

Habitat Description:
Found near ponds and streams in the Black Hills of South Dakota (Ballinger et al. 2000). Moist situations near water; margins of streams, ponds, lakes, damp meadows; open grassland to forest (Brown 1997).

Total Area of Modeled Habitat (ha): 454,116

Model Description:
Modeled distribution using the variable 'May 30-year Average Maximum Temperature $\leq$ 20%'.

22 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



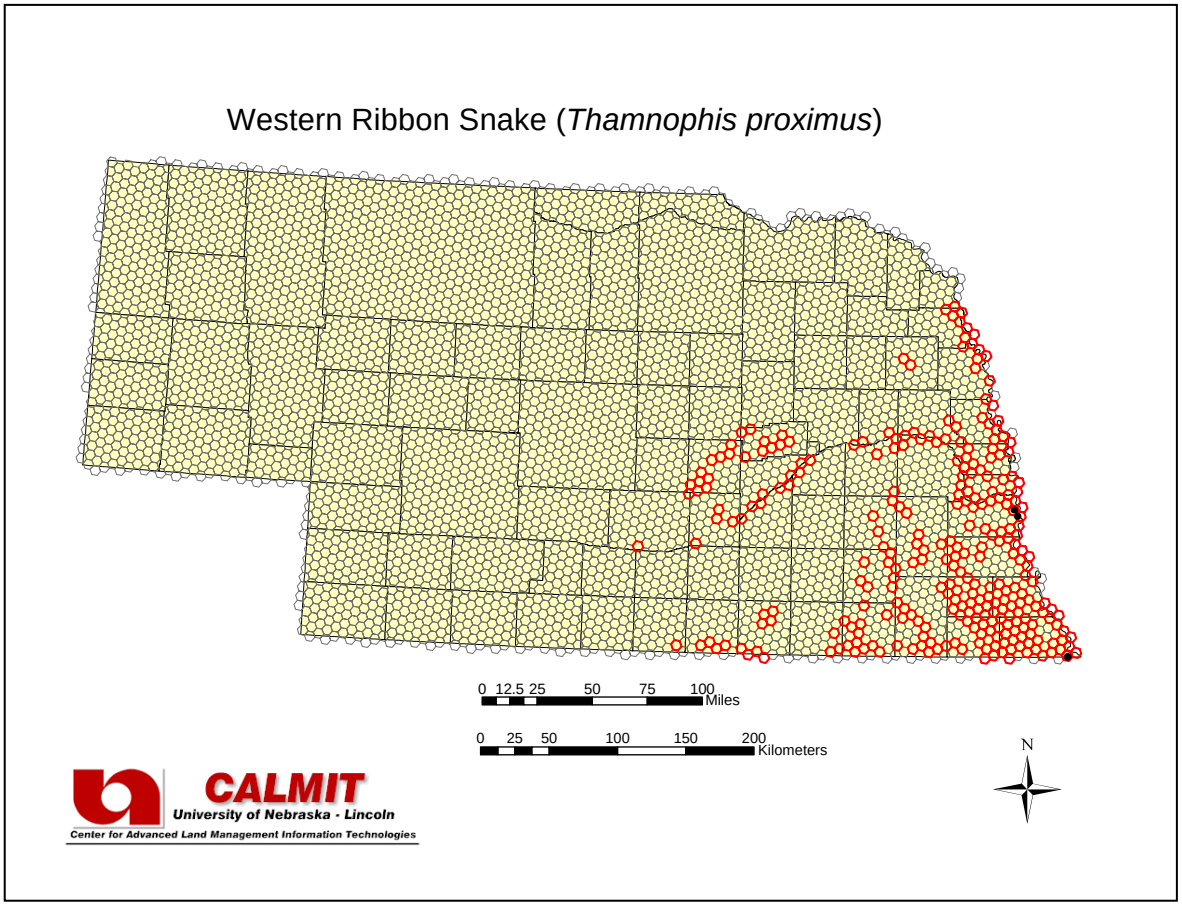
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Western Ribbon Snake**	TNC Global Status:	G5
Scientific Name:	***Thamnophis proximus***	Federal Status:	-
TNC Element Code:	ARADB36090	State (NE) Status:	S2

Habitat Description:
Frequents the edges of swamps, marshes, lakes, streams, and rivers (Collins 1993). Forages amid vegetation along water's edge (Brown 1997).

Total Area of Modeled Habitat (ha): 1,155,568

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'May 30-year Average Precipitation > 100 mm' AND 'Stream class is present' AND 'Land Cover class Deciduous Forests and Woodlands > 5%'.



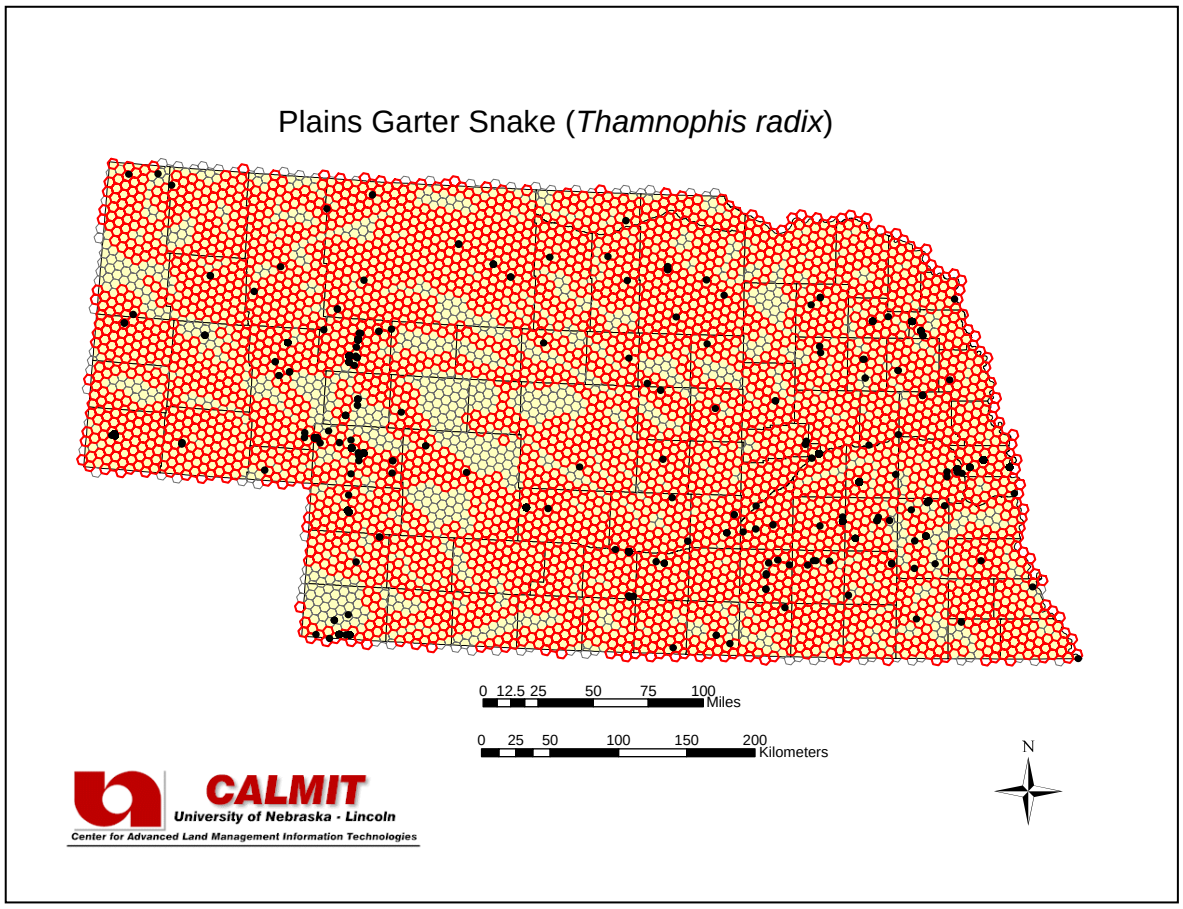
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Plains Garter Snake**	TNC Global Status:	G5
Scientific Name:	***Thamnophis radix***	Federal Status:	-
TNC Element Code:	ARADB36100	State (NE) Status:	S5

Habitat Description:
Prefer open grassy prairies, particularly along the edges of streams, marshes, and lakes (Collins 1993). Occurs in grassy areas near ponds, streams, or other wetlands (Ballinger et al. 2000, Jones et al.1981). Found throughout the Arapaho Prairie (Ballinger et al. 1979).

Total Area of Modeled Habitat (ha): 14,458,764

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Stream Class is present' OR 'Land Cover class Emergent Wetland > 1%'.



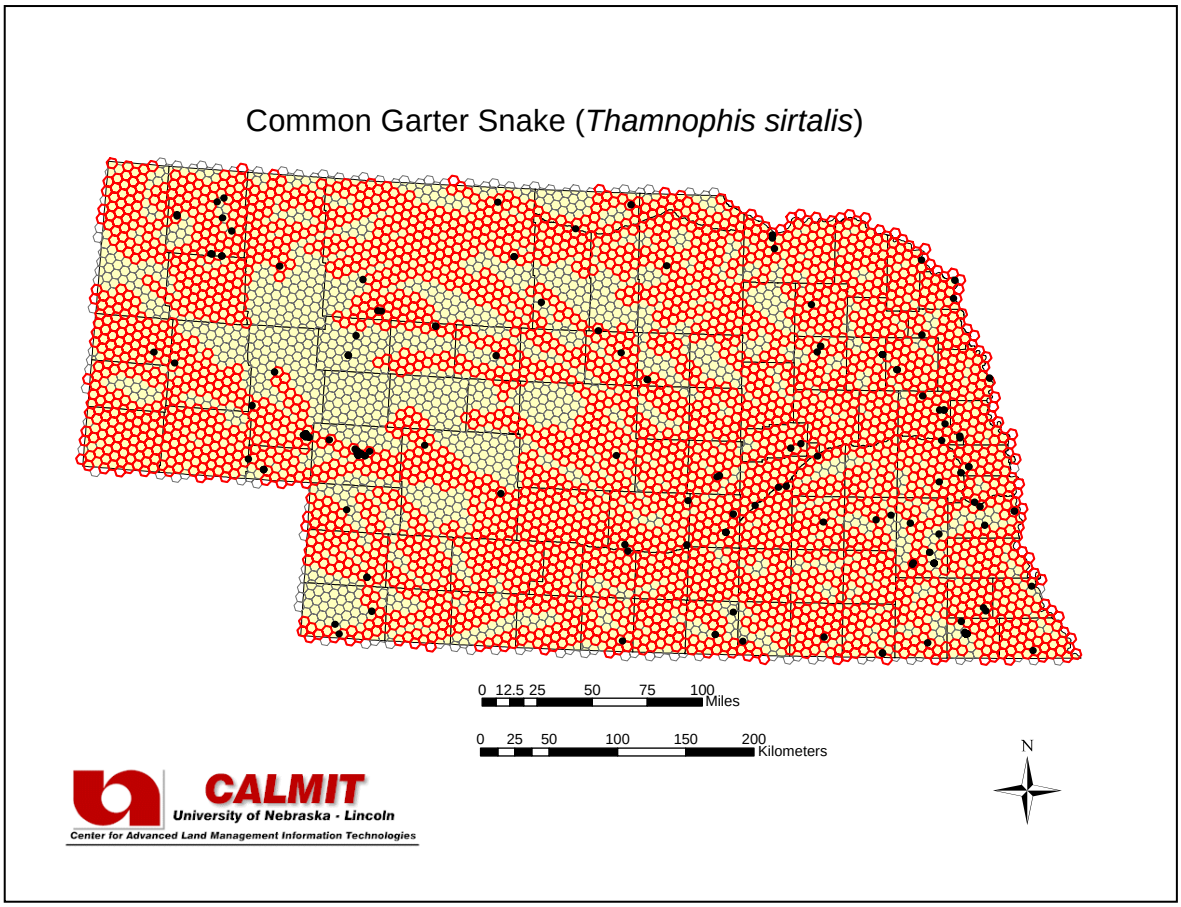
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Common Garter Snake**	TNC Global Status:	G5
Scientific Name:	***Thamnophis sirtalis***	Federal Status:	-
TNC Element Code:	ARADB36130	State (NE) Status:	S5

Habitat Description:
Nearly statewide in distribution but absent from the southwestern portion of the Panhandle and most Sandhills lakes and marshes (Lynch 1985). Found in grassy areas near ponds and wetlands but especially streams and rivers (Ballinger 2000). Found in a wide variety of habitats, including marshes and wet meadows, margins of ponds, woodland and woodland edge, floodplains, and cultivated fields. It generally prefers areas with moderately moist vegetation (Collins 1993).

Total Area of Modeled Habitat (ha): 12,536,875

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the variable 'Stream class is present'.



Nebraska GAP Analysis 2004
Reptile Species Atlas

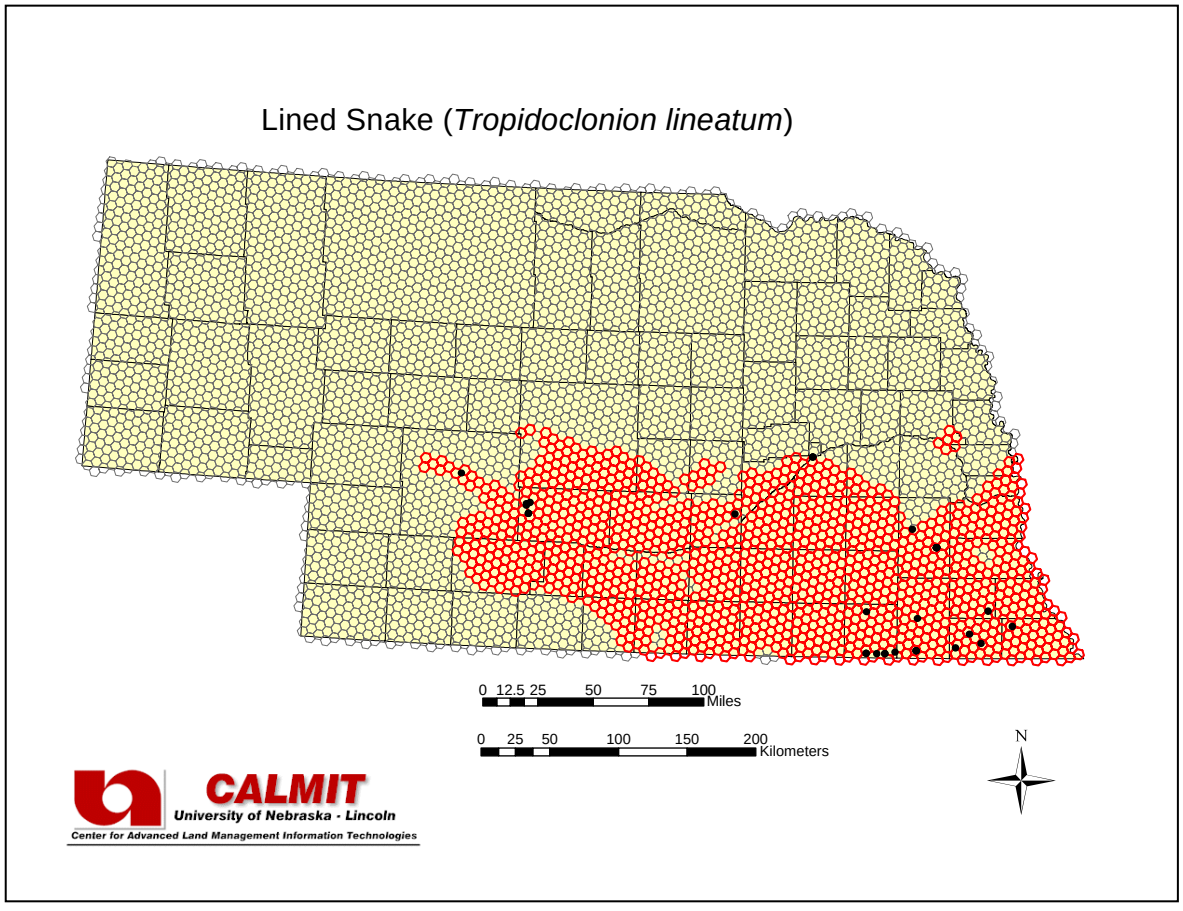
Common Name:	**Lined Snake**	TNC Global Status:	G5
Scientific Name:	***Tropidoclonion lineatum***	Federal Status:	-
TNC Element Code:	ARADB38010	State (NE) Status:	S5

Habitat Description:
Inhabits hillsides of open prairies and woodland edge and is often found inside towns and cities beneath debris in vacant lots (Collins 1993).

Total Area of Modeled Habitat (ha): 5,039,925

Model Description:
Modeled distribution using the set of variables 'Elevation $\leq$ 900 m' AND 'Percentage of Coarse-textured Soils $\leq$ 21.5%' AND 'Growing Degree Days Weighted Average Coefficient of Variation for January $\leq$ 30%' AND 'Growing Degree Days Weighted Average Coefficient of Variation for January > 23.5%'.

37 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



Nebraska GAP Analysis 2004
Reptile Species Atlas

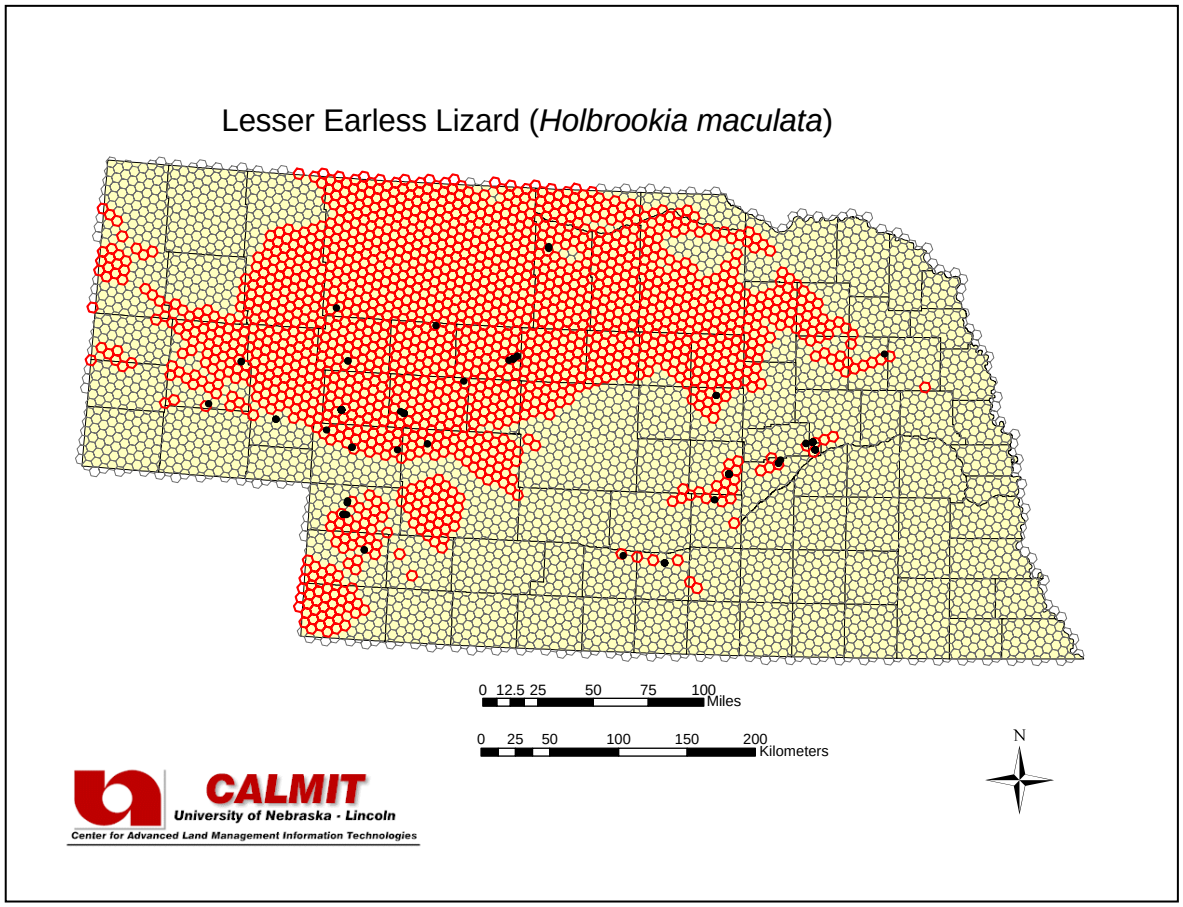
Common Name:	**Lesser Earless Lizard**	TNC Global Status:	G5
Scientific Name:	***Holbrookia maculata***	Federal Status:	-
TNC Element Code:	ARACF08020	State (NE) Status:	S5

Habitat Description:
The species is common in areas of sandy soils and sparse vegetation. Isolated populations occur on the Sand Hills (Lynch 1985). Restricted to sandy, cultivated, clay, or gravel areas of loose soil with little or no vegetation (Collins 1993).

Total Area of Modeled Habitat (ha): 7,140,183

Model Description:
Modeled distribution using the variable 'Percentage of Coarse-textured Soils > 40%'.

121 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



Nebraska GAP Analysis 2004
Reptile Species Atlas

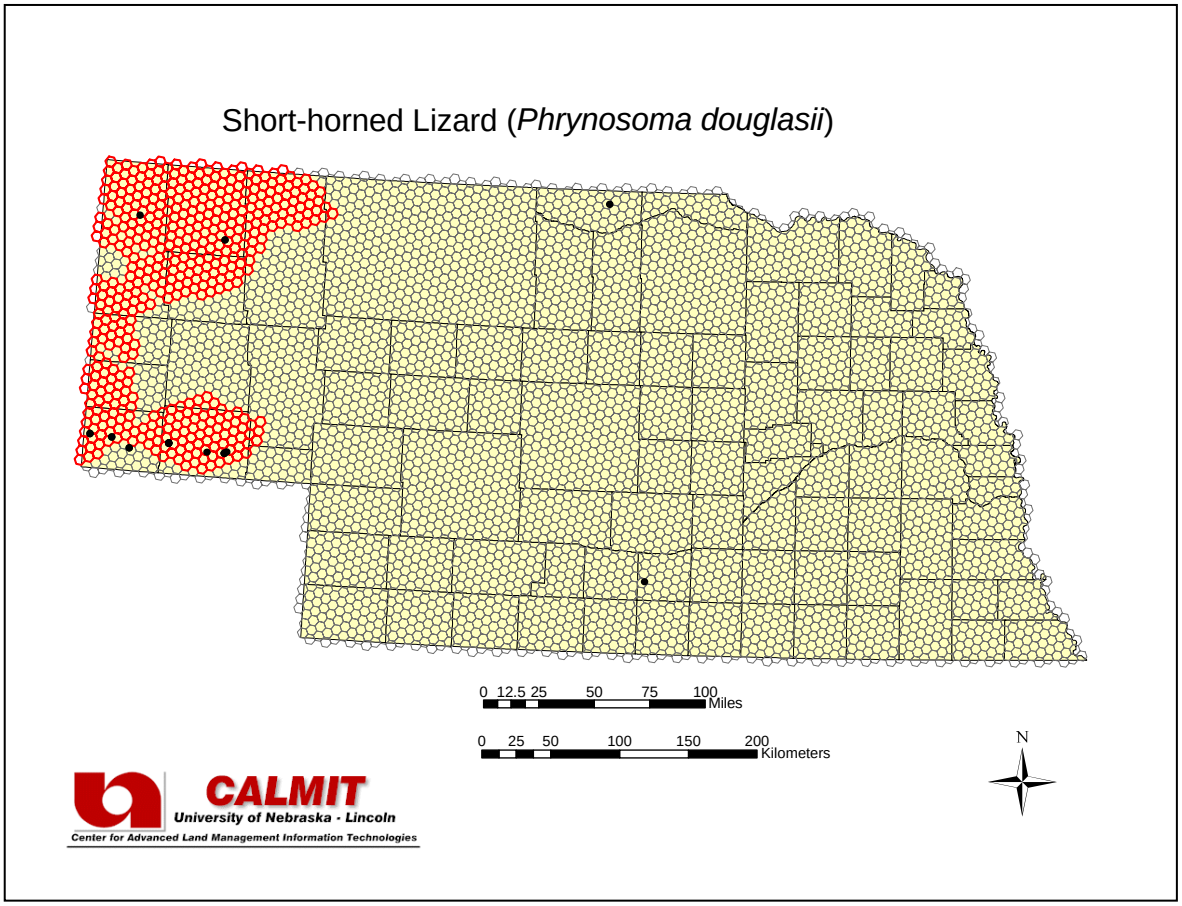
Common Name:	**Short-horned Lizard**	TNC Global Status:	G5
Scientific Name:	***Phrynosoma douglasii***	Federal Status:	NC
TNC Element Code:	ARACF12080	State (NE) Status:	S3

Habitat Description:
Occurs in the Panhandle in highlands away from the Platte River (Lynch 1985). Indigenous to semiarid, shortgrass portions of the northern Great Plains; usually found in rather rough terrain (Conant and Collins 1998).

Total Area of Modeled Habitat (ha): 1,934,047

Model Description:
Modeled distribution using the set of variables 'Percentage of Coarse-textured Soils $\leq$ 40%' AND 'Frost Free Days $\leq$ 185 days'.

21 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



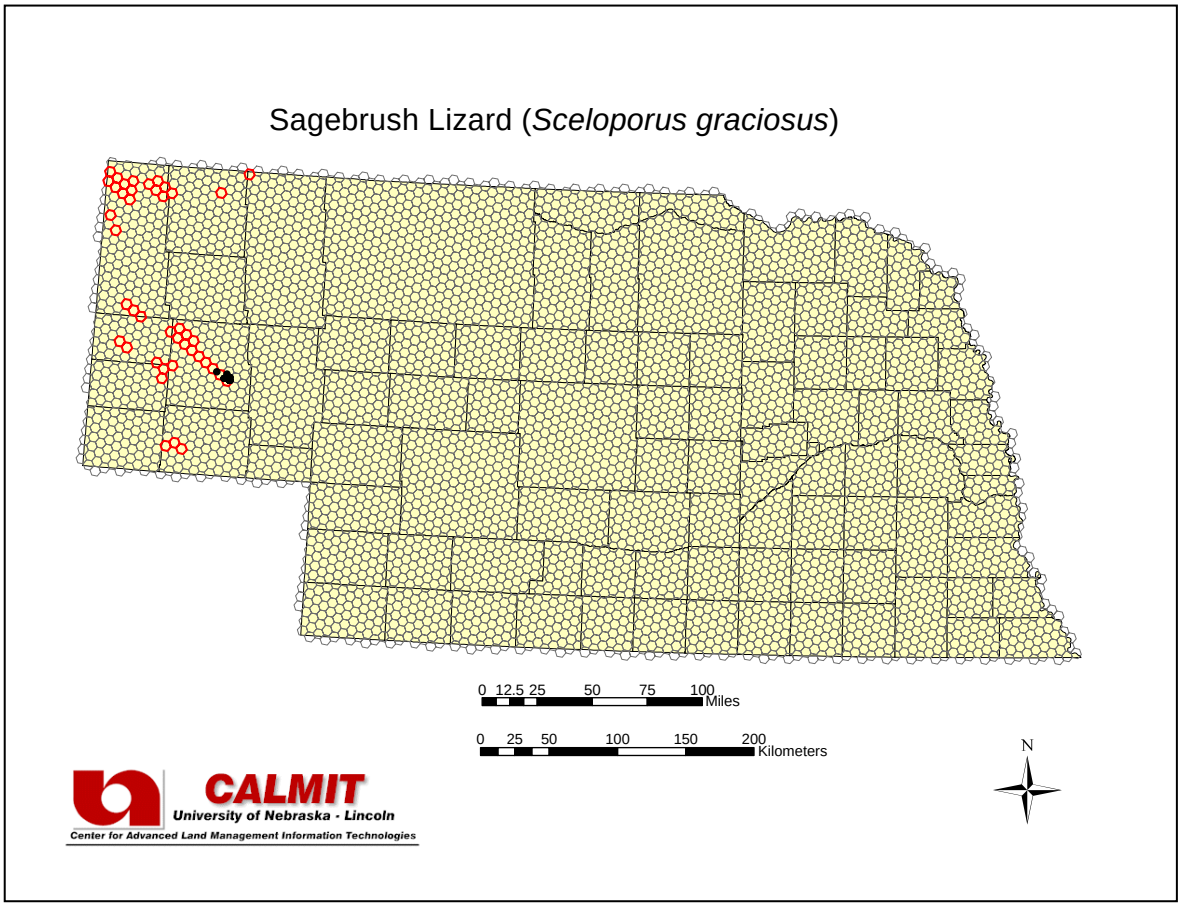
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Sagebrush Lizard**	TNC Global Status:	G5
Scientific Name:	***Sceloporus graciosus***	Federal Status:	-
TNC Element Code:	ARACF14030	State (NE) Status:	S1

Habitat Description:
Often found in sagebrush but also occurs on rocks, in open forested areas, or in canyon bottoms (Conant and Collins 1998).

Total Area of Modeled Habitat (ha): 174,346

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Land Cover class Western Shortgrass Prairie > 5%' AND 'Land Cover class Barren/Sand/Outcrop > 5%'.



Nebraska GAP Analysis 2004
Reptile Species Atlas

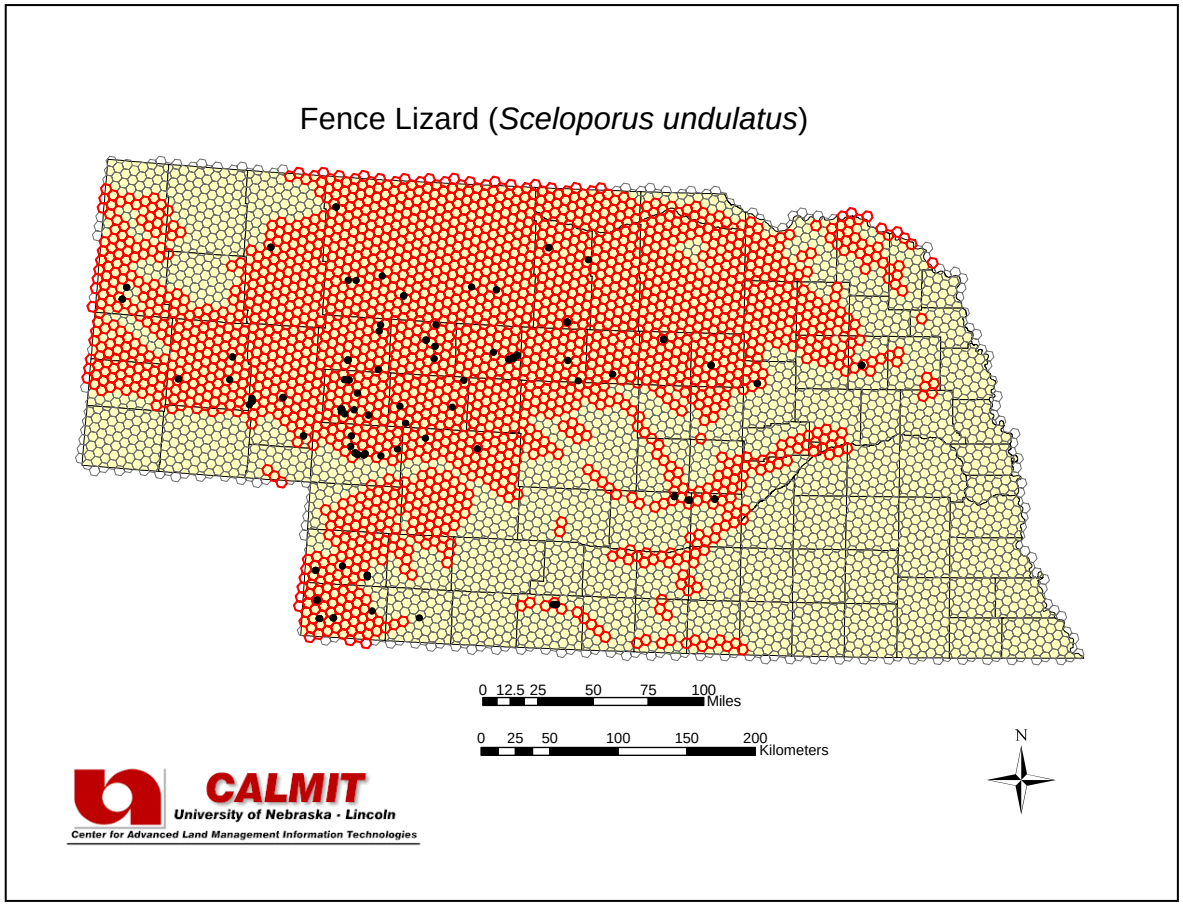
Common Name:	**Fence Lizard**	TNC Global Status:	G5
Scientific Name:	***Sceloporus undulatus***	Federal Status:	-
TNC Element Code:	ARACF14130	State (NE) Status:	-

Habitat Description:
Common in a variety of habitats especially with structural features such as yucca, fence posts, and trees across the prairie. It is common throughout the Sand Hills and Panhandle and the western portion of the Republican River basin (Lynch 1985). Prefers dry, open forests and can also be found in low sandy regions and frequently is found around sandstone and limestone outcrops (Collins 1993).

Total Area of Modeled Habitat (ha): 9,536,447

Model Description:
Modeled distribution using the variable 'Percentage of Coarse-textured Soils > 10%'.

149 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



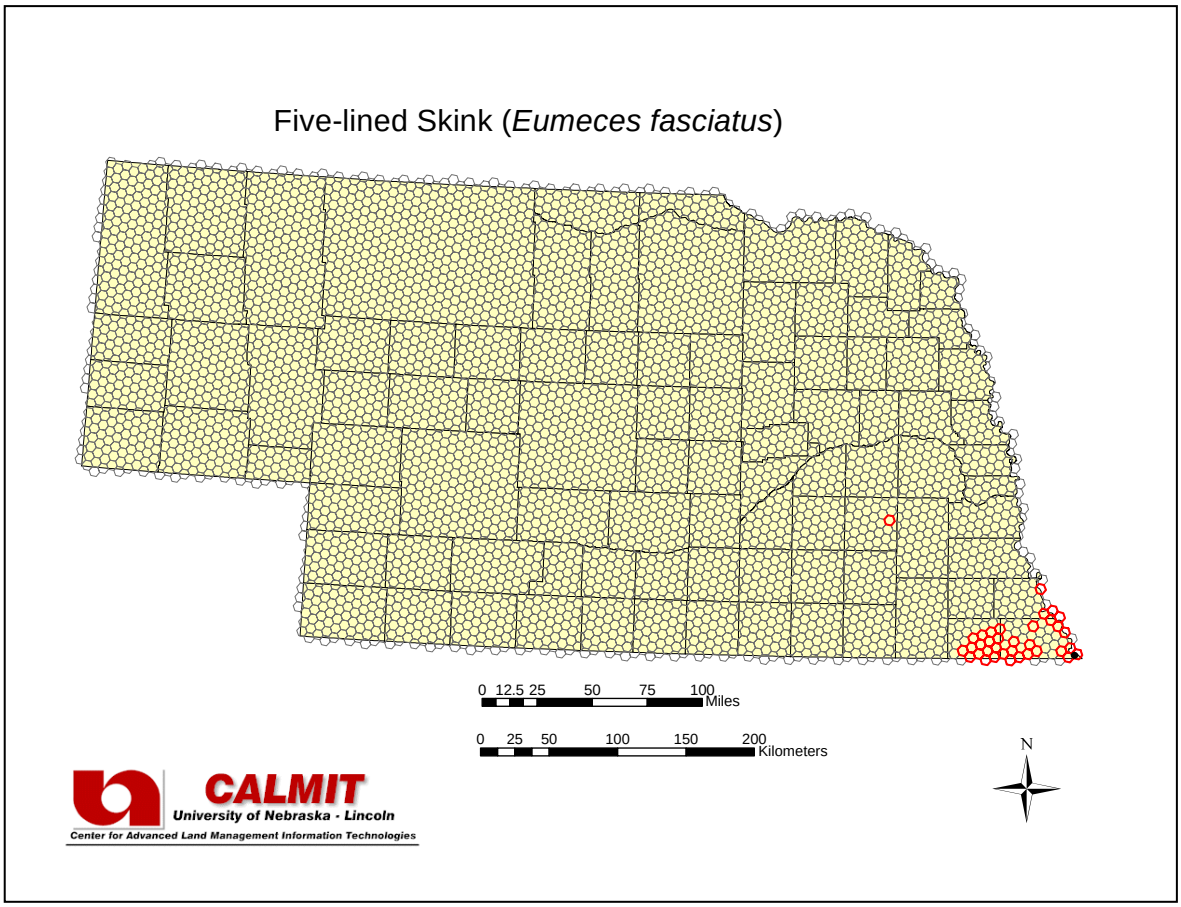
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Five-lined Skink**	TNC Global Status:	G5
Scientific Name:	***Eumeces fasciatus***	Federal Status:	-
TNC Element Code:	ARACH01050	State (NE) Status:	S1

Habitat Description:
Lives in open, rocky, well-drained, cut-over forests in upland areas (Fitch 1954, Collins 1993). Nebraska specimens found in wooded terrain along the Missouri River (Lynch 1985). Based on observational data, the species appears to be at its range limit within southeastern Nebraska.

Total Area of Modeled Habitat (ha): 145,968

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables '30-year Average Minimum Temperature Coefficient of Variation for March $\leq$ 14.7%' AND 'Land Cover class Deciduous Forests and Woodlands > 10%'.



Nebraska GAP Analysis 2004
Reptile Species Atlas

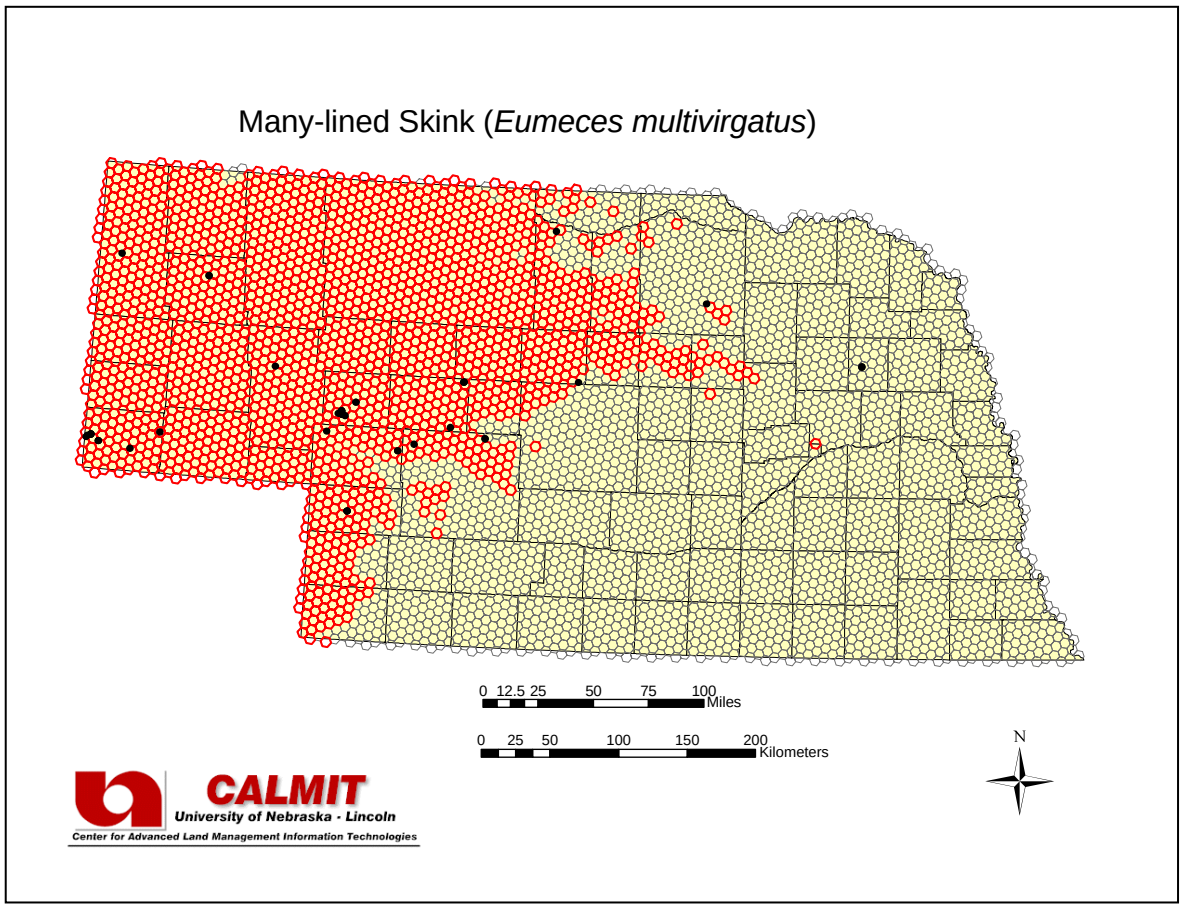
Common Name:	**Many-lined Skink**	TNC Global Status:	G5
Scientific Name:	***Eumeces multivirgatus***	Federal Status:	-
TNC Element Code:	ARACH01090	State (NE) Status:	S5

Habitat Description:
Occurs in the sage-sandhills in southwestern Nebraska and the Sand Hills and associated isolates (Lynch 1985). A lizard of the open plains and sand hills, often occurring in vacant lots and under debris in towns and settlement (Conant and Collins 1998).

Total Area of Modeled Habitat (ha): 8,328,167

Model Description:
Modeled distribution using the set of variables 'Land Cover class Sandhills Upland Prairie > 50%' OR 'Land Cover class Sandhills Upland Prairie ≤ 50%' AND 'Elevation > 1000 m'.

55 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



Nebraska GAP Analysis 2004
Reptile Species Atlas

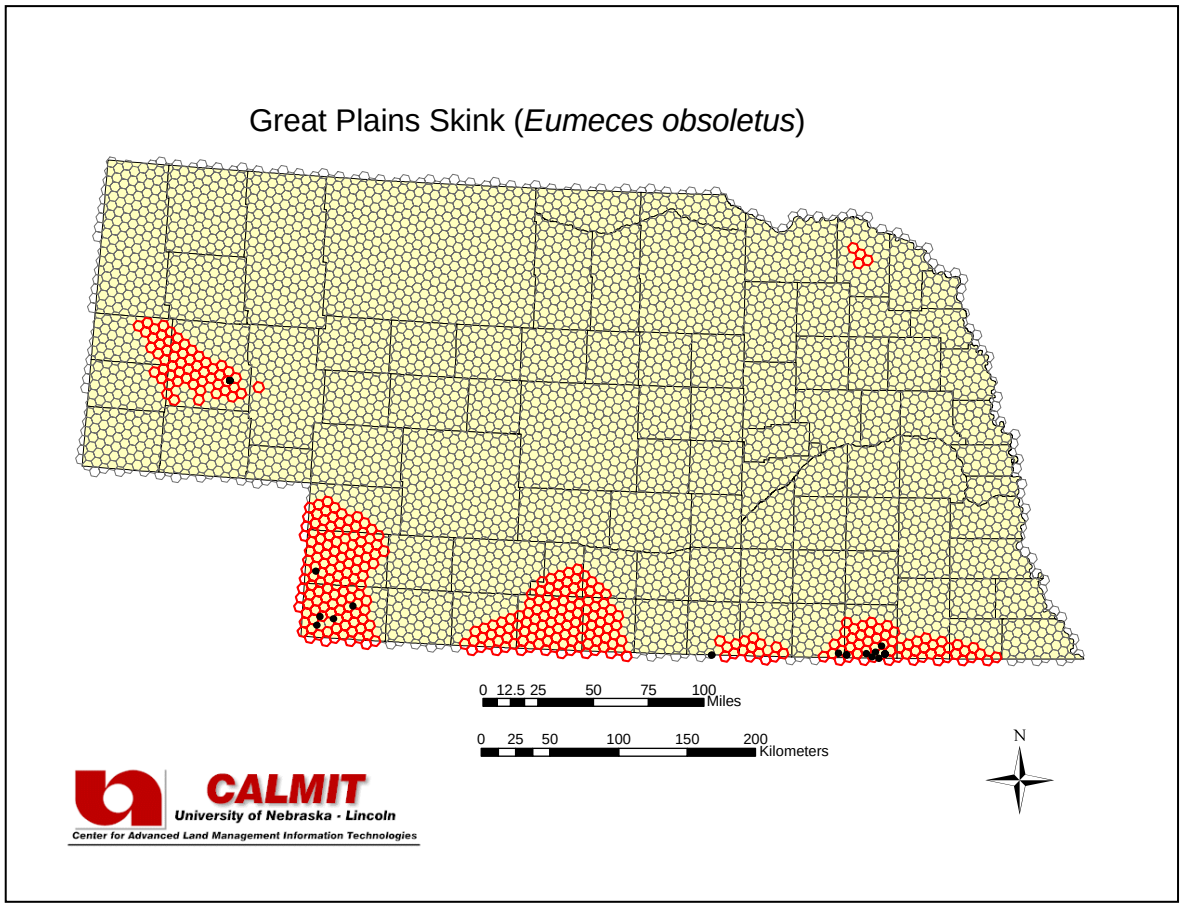
Common Name:	**Great Plains Skink**	TNC Global Status:	G5
Scientific Name:	***Eumeces obsoletus***	Federal Status:	-
TNC Element Code:	ARACH01130	State (NE) Status:	S3

Habitat Description:
Inhabits open rocky hillsides with low vegetation and apparently avoids sandy areas (Collins 1993).

Total Area of Modeled Habitat (ha): 1,532,657

Model Description:
Modeled distribution using the set of variables 'Land Cover class Sandhills Upland Prairie $\leq$ 50%' AND '30-year Average Precipitation Coefficient of Variation for April $\leq$ 56%' AND 'Land Cover class Fallow Agricultural Field $\leq$ 6%' AND '30-year Average Precipitation Coefficient of Variation for July > 60%' OR 'Land Cover class Sandhills Upland Prairie $\leq$ 50%' AND '30-year Average Precipitation Coefficient of Variation for April > 56%' AND 'Elevation $\leq$ 1244 m' AND 'Total Growing Degree Days at 0°C through February > 6 days'.

28 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



Nebraska GAP Analysis 2004
Reptile Species Atlas

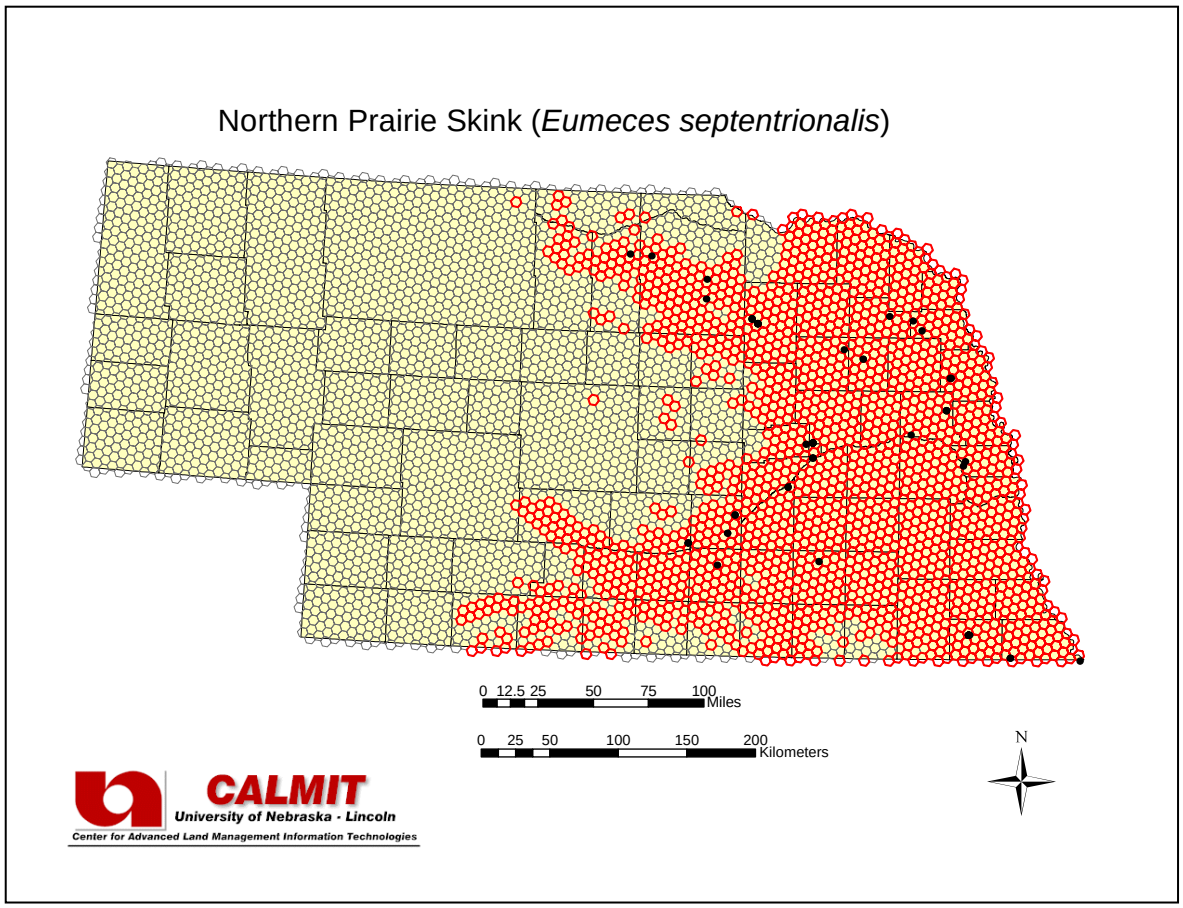
Common Name:	**Northern Prairie Skink**	TNC Global Status:	G5
Scientific Name:	***Eumeces septentrionalis***	Federal Status:	-
TNC Element Code:	ARACH01100	State (NE) Status:	

Habitat Description:
The skink is restricted to grasslands and requires soft soil in which it builds tunnels beneath logs and flat rocks (Jones et al.1981). Frequent open, grass-covered, rocky hillsides near streams, but occasionally have been found in forests or at forest edges (Collins 1993).

Total Area of Modeled Habitat (ha): 7,784,869

Model Description:
Modeled distribution using the set of variables 'Land Cover class Sandhills Upland Prairie ≤ 50%' AND 'Elevation ≤ 800 m' AND 'Land Cover class Little Bluestem-Gramma Mixedgrass Prairie ≤ 35%'.

67 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



Nebraska GAP Analysis 2004
Reptile Species Atlas

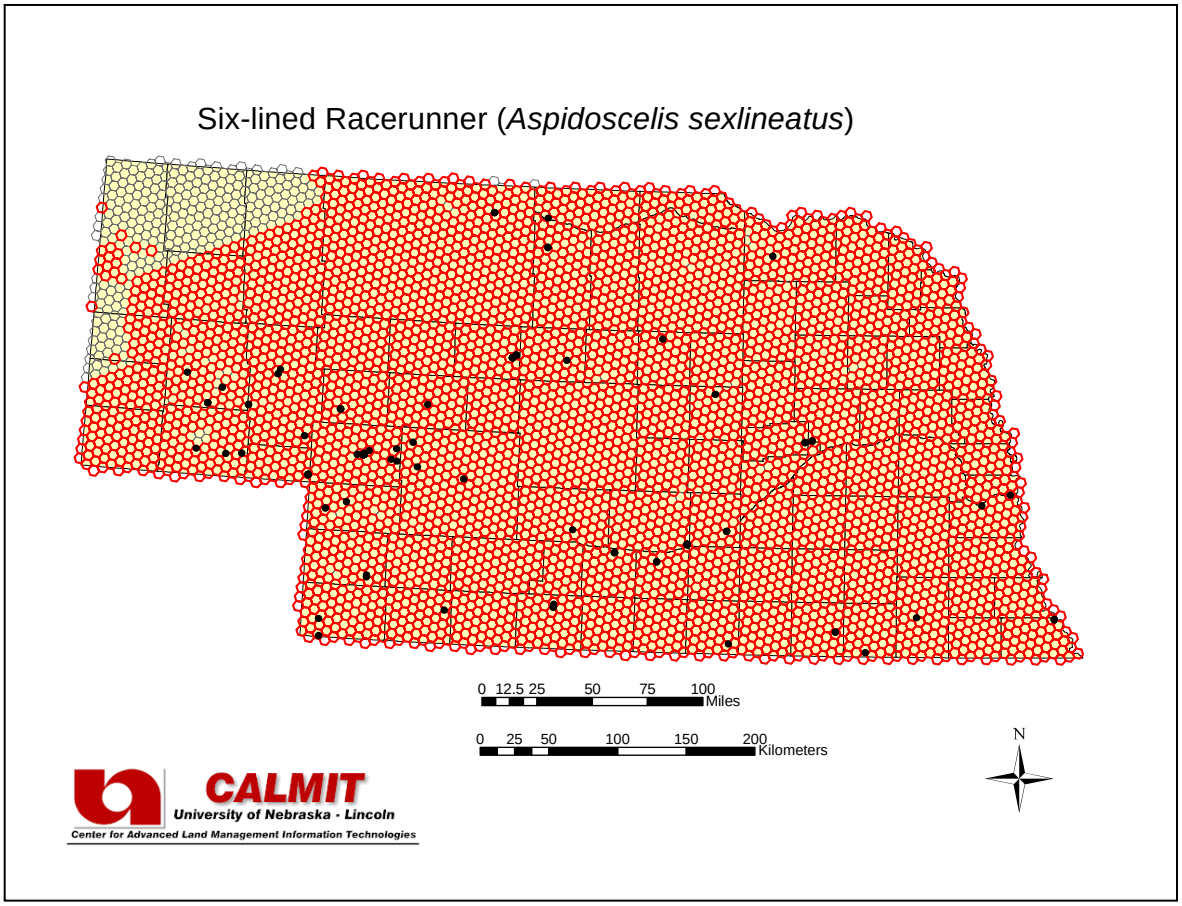
Common Name:	**Six-lined Racerunner**	TNC Global Status:	G5
Scientific Name:	***Cnemidophorus sexlineatus***	Federal Status:	-
TNC Element Code:	ARACJ02110	State (NE) Status:	S5

Habitat Description:
The species is frequently encountered along rivers and forage in the sparse vegetation on sandy soils. Common in the Sand Hills. Rarely found in heavily wooded areas of eastern Nebraska (Lynch 1985). A lizard of dry, open, sandy areas with little leafy vegetation and also inhabits open, rocky, grazed, and cultivated regions (Collins 1993).

Total Area of Modeled Habitat (ha): 19,072,917

Model Description:
Modeled distribution using the set of variables 'Percentage of Coarse-textured Soils ≤ 50%' AND 'Frost Free Days > 180 days' OR 'Percentage of Coarse-textured Soils > 50%'.

159 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



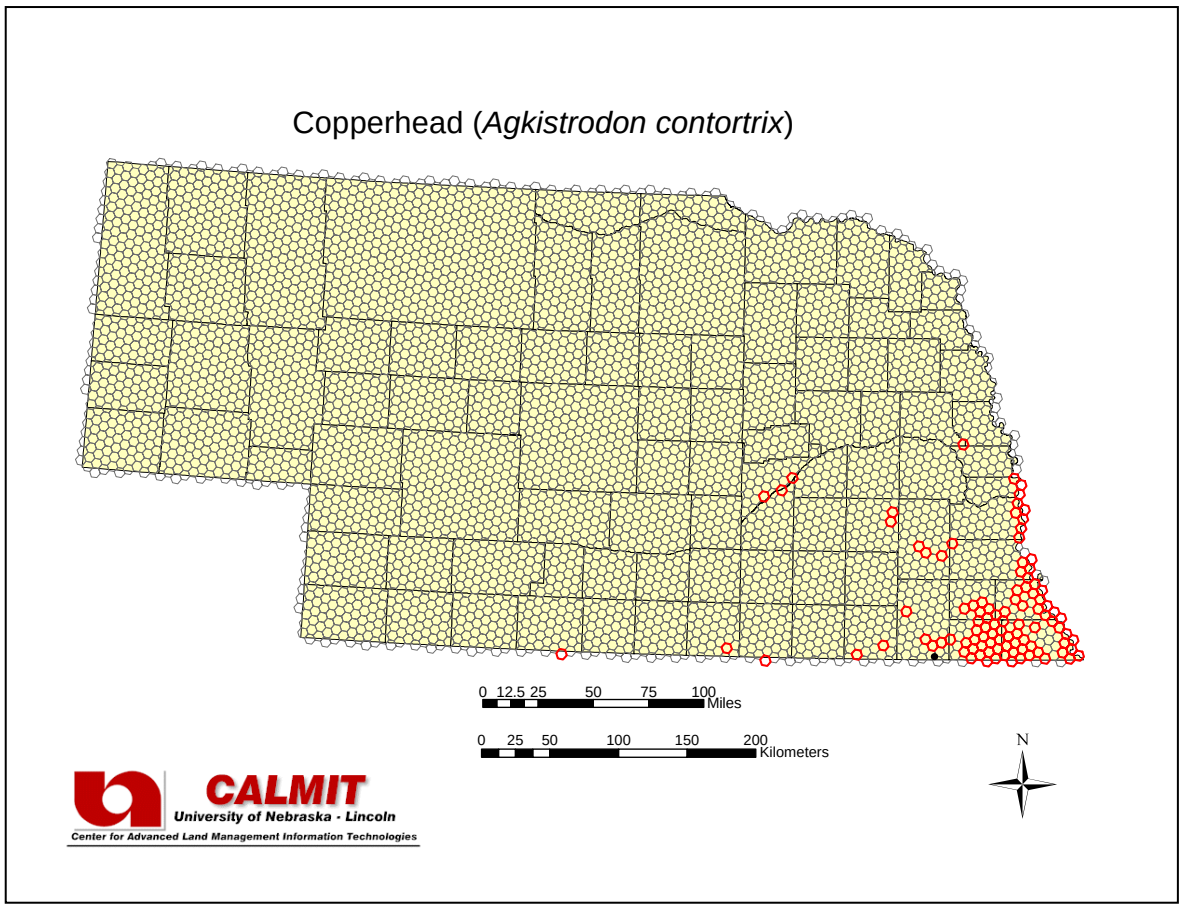
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Copperhead**	TNC Global Status:	G5
Scientific Name:	***Agkistrodon contortrix***	Federal Status:	-
TNC Element Code:	ARADE01010	State (NE) Status:	S1

Habitat Description:
Associated with woodlands and/or dense vegetation. Generally avoid fallow fields and cultivated fields (Fitch 1960). Lives along rocky, wooded hillsides, brushy areas along creeks, and near abandoned farm building and sawmills (Conant and Collins 1998). Copperheads are found in open rocky woodland, woodland edge, and meadows with clumps of brush adjacent to woodland (Collins 1993). Based on observational data, the species appears to be at its range limit within southeastern Nebraska.

Total Area of Modeled Habitat (ha): 409,520

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Total Growing Degree Days at 0°C through April > 440 days' AND 'Land Cover class Deciduous Forests and Woodlands > 7.5%'.



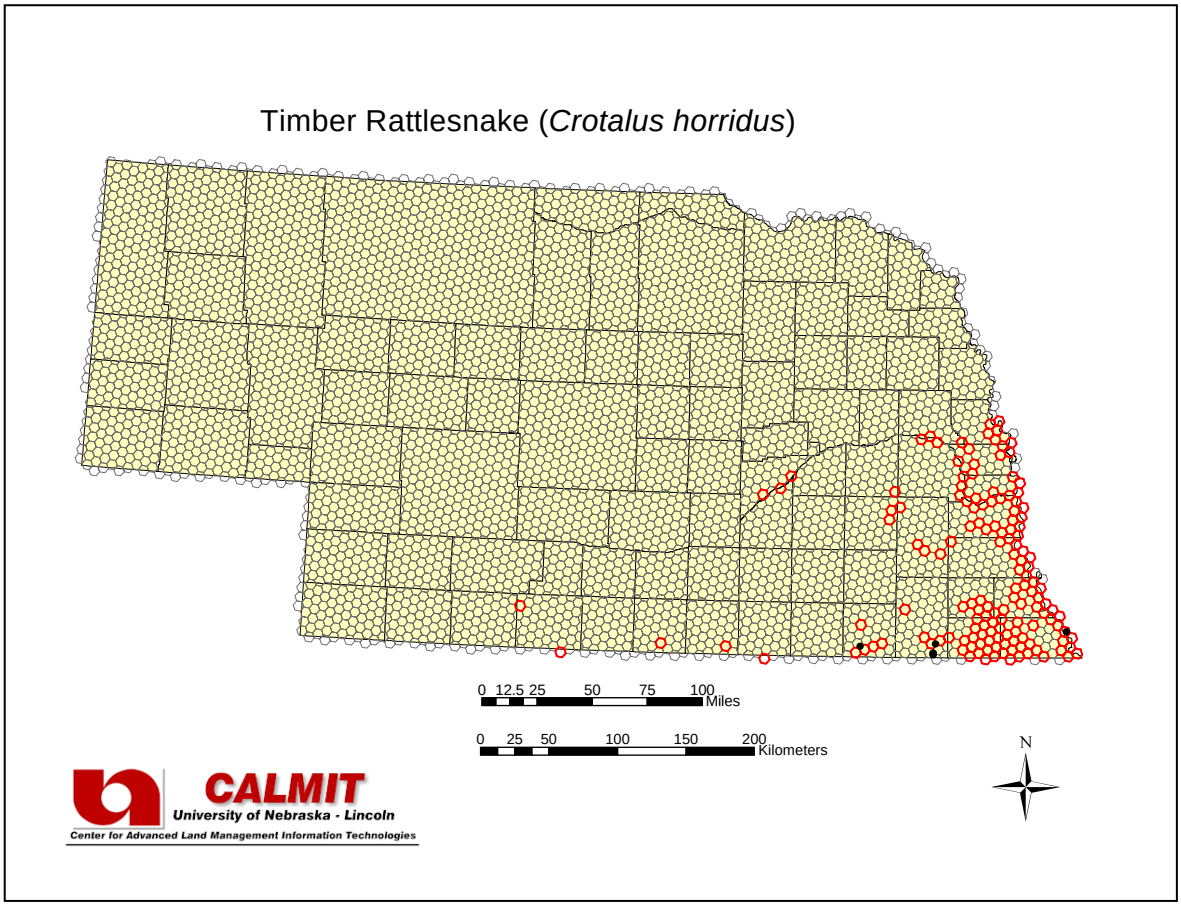
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Timber Rattlesnake**	TNC Global Status:	G5
Scientific Name:	***Crotalus horridus***	Federal Status:	-
TNC Element Code:	ARADE02040	State (NE) Status:	S1

Habitat Description:
Found in rugged terrain along heavily vegetated, rocky outcrops on partially forested hillsides (Collins 1993). The species follows wooded stream valleys that extend out into the prairies (Conant and Collins 1998). Prefers deciduous woodland habitats (Reinert 1984).

Total Area of Modeled Habitat (ha): 596,030

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Total Growing Degree Days at 0°C through April > 410 days' AND 'Land Cover class Deciduous Forests and Woodlands > 7.5%'.



Nebraska GAP Analysis 2004
Reptile Species Atlas

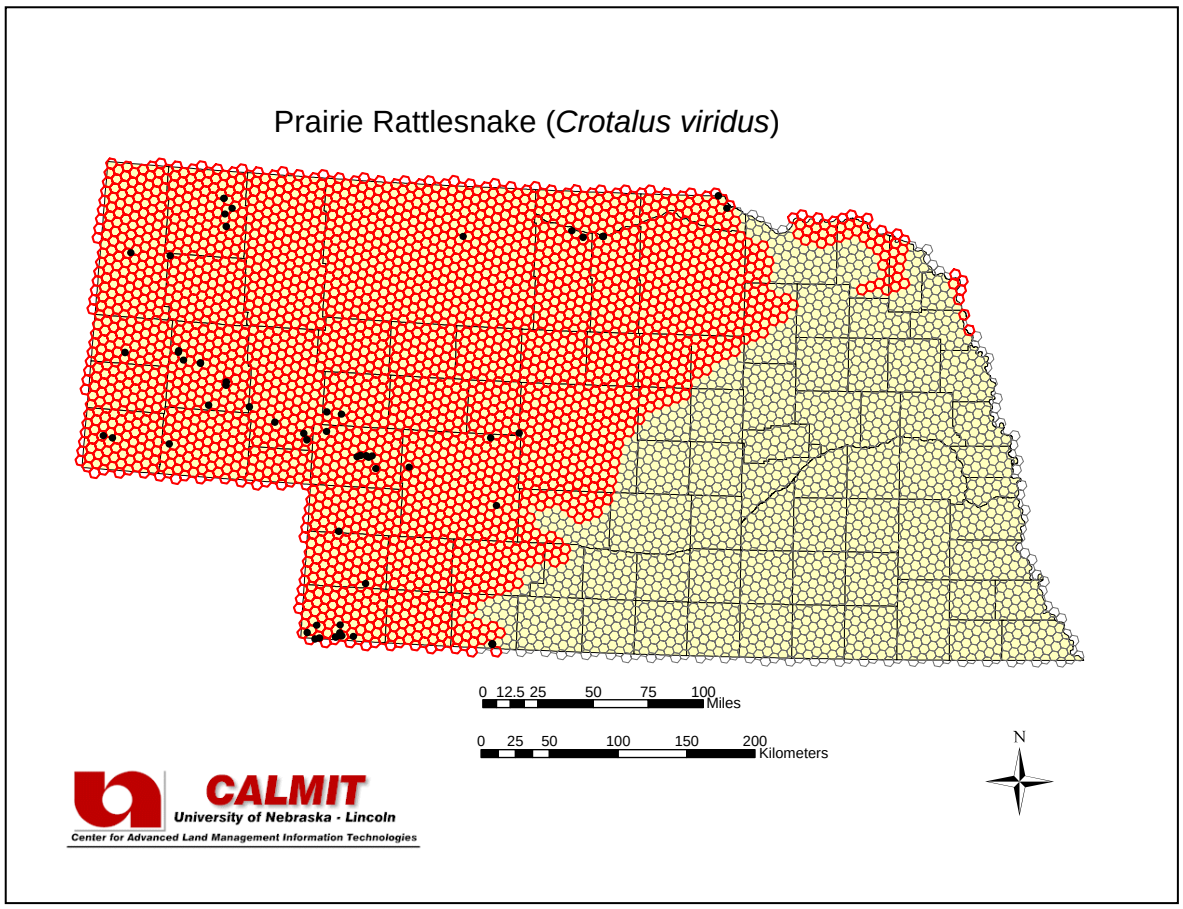
Common Name:	**Prairie Rattlesnake**	TNC Global Status:	G5
Scientific Name:	***Crotalus viridis***	Federal Status:	-
TNC Element Code:	ARADE02120	State (NE) Status:	S4

Habitat Description:
The species is distributed across two-thirds of the state and is most common in areas having extensive rock outcropping and dissected pasture lands (Lynch 1985). Prefers rocky canyons or open prairies with an abundance of small burrows, particularly those of the prairie dog (Collins 1993).

Total Area of Modeled Habitat (ha): 12,334,128

Model Description:
Modeled distribution using the set of variables 'Elevation > 780 m' OR 'Elevation $\leq$ 780 m' AND 'Total Growing Degree Days at 0°C through September $\leq$ 3500 days' AND '30-year Average Precipitation for April coefficient of variation $\leq$ 69%'.

63 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



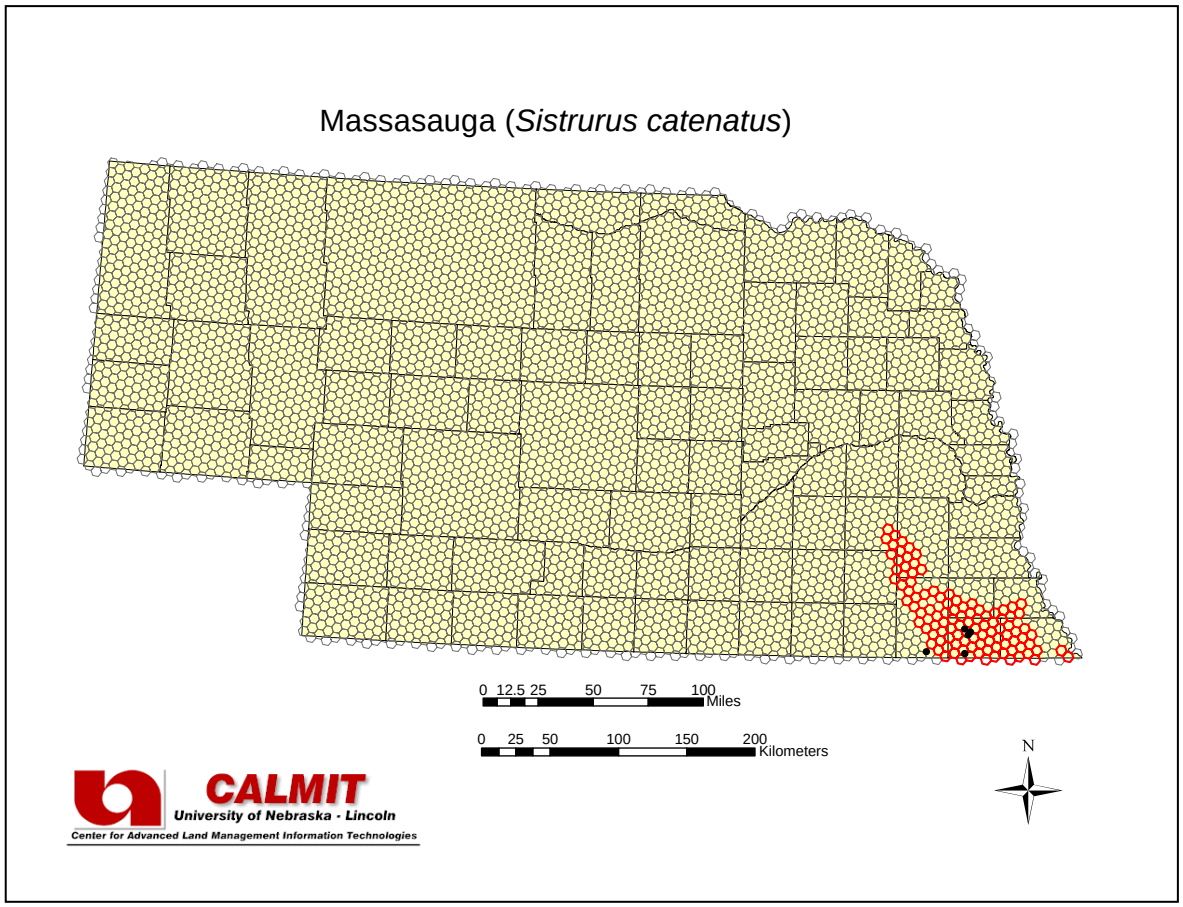
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Massasauga**	TNC Global Status:	G4
Scientific Name:	***Sistrurus catenatus***	Federal Status:	-
TNC Element Code:	ARADE03010	State (NE) Status:	S1

Habitat Description:
Found in a wide variety of habitats ranging from arid open sagebrush prairie and rocky, prairie hillsides to open wetlands (Collins 1993, Brown 1997). In Nebraska, inhabits tallgrass prairies and marshes. Distribution has been reduced due to altered habitat (Lynch 1985). Based on observational data, the species appears to be at its range limit within southeastern Nebraska.

Total Area of Modeled Habitat (ha): 437,904

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Total Growing Degree Days at 0°C through April > 470 days' AND 'Land Cover class Upland Tallgrass Prairie > 20%'.



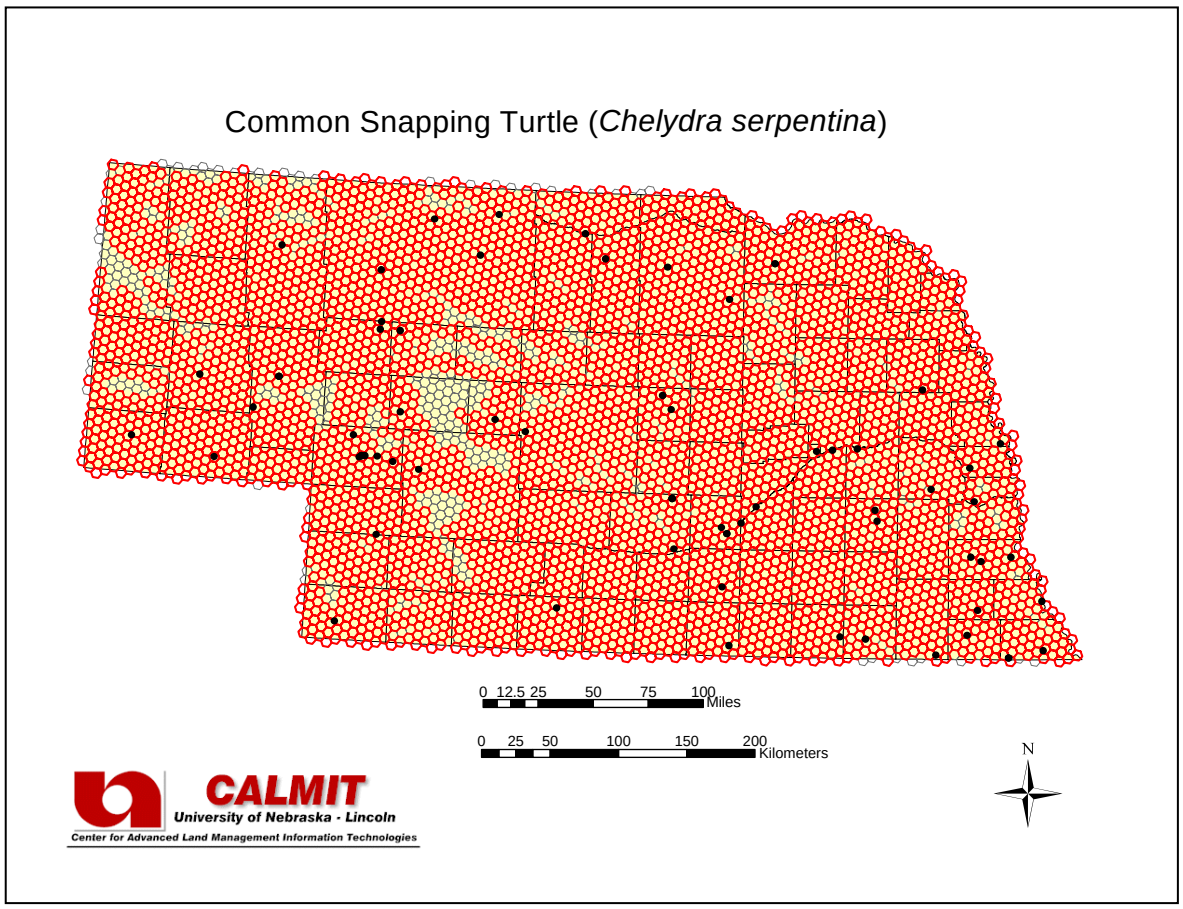
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Common Snapping Turtle**	TNC Global Status:	G5
Scientific Name:	***Chelydra serpentina***	Federal Status:	-
TNC Element Code:	ARAAB01010	State (NE) Status:	S5

Habitat Description:
Statewide in distribution and found in most permanent aquatic habitats (Lynch 1985, Jones et al. 1981). Thrives in most aquatic habitats. Prefers waters with soft mud bottoms, submerged logs and branches, and abundant edge vegetation (Heinrich and Kaufman 1985).

Total Area of Modeled Habitat (ha): 17,807,880

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Stream class is present' OR 'Land Cover class Emergent Wetland is present'.



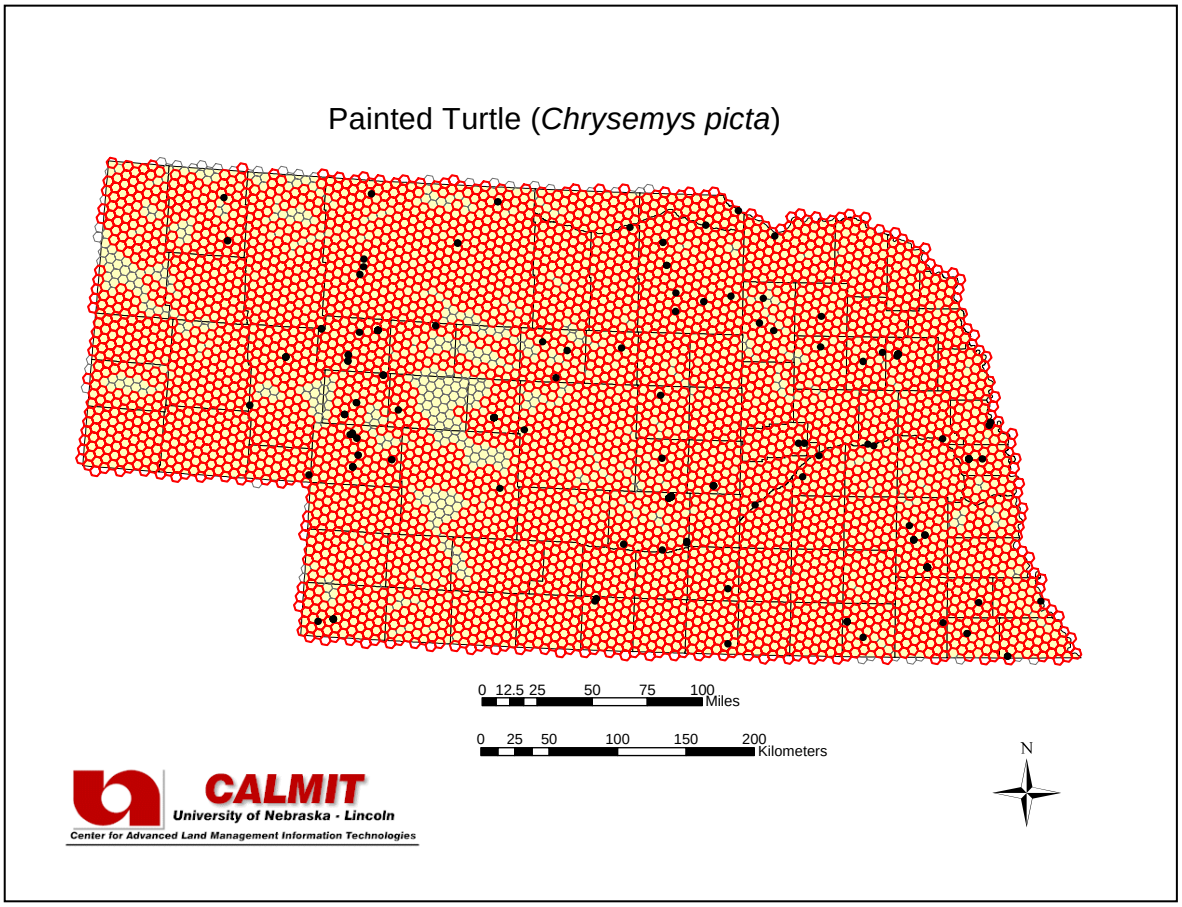
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Painted Turtle**	TNC Global Status:	G5
Scientific Name:	***Chrysemys picta***	Federal Status:	-
TNC Element Code:	ARAAD01010	State (NE) Status:	S5

Habitat Description:
Resides in slow-moving shallow streams and rivers and shallow ponds and lakes having soft bottoms with aquatic plants and numerous logs and branches on which to bask (Collins 1993). Statewide distribution in Nebraska (Lynch 1985). Occurs in permanent water bodies within the Arapahoe Prairie study area (Ballinger et al. 1979). Found throughout South Dakota in permanent aquatic habitats (Ballinger 2000).

Total Area of Modeled Habitat (ha): 17,807,880

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Stream class is present' OR 'Land Cover class Emergent Wetland is present'.



Nebraska GAP Analysis 2004
Reptile Species Atlas

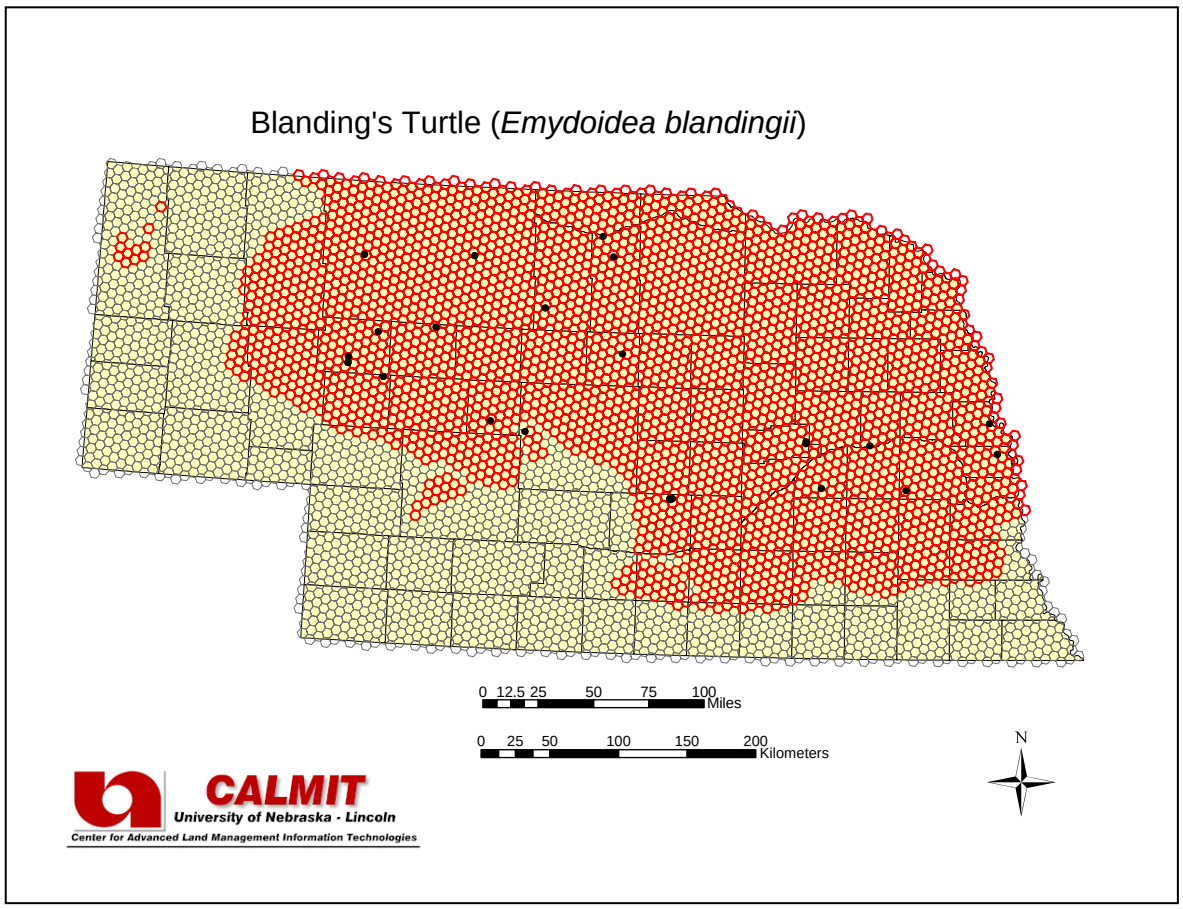
Common Name:	**Blanding's Turtle**	TNC Global Status:	G4
Scientific Name:	***Emydoidea blandingii***	Federal Status:	-
TNC Element Code:	ARAAD04010	State (NE) Status:	S4

Habitat Description:
Lives in productive, eutrophic habitats, with clean shallow water, a soft but firm, organic bottom, and abundant aquatic vegetation. It is found in lakes, ponds, marshes, creeks, wet prairies, and sloughs (Ernst et al. 1994).

Total Area of Modeled Habitat (ha): 12,476,054

Model Description:
Modeled distribution using the set of variables 'Percentage of Coarse-textured Soils > 20%' AND 'Growing Degree Days Weighted Average Coefficient of Variation for January > 27%' OR 'Percentage of Coarse-textured Soils $\leq$ 20%' AND 'Land Cover class Sandsage Shrubland $\leq$ 2%' AND '30-year Maximum Temperature Coefficient of Variation for March > 12%'.

29 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



Nebraska GAP Analysis 2004
Reptile Species Atlas

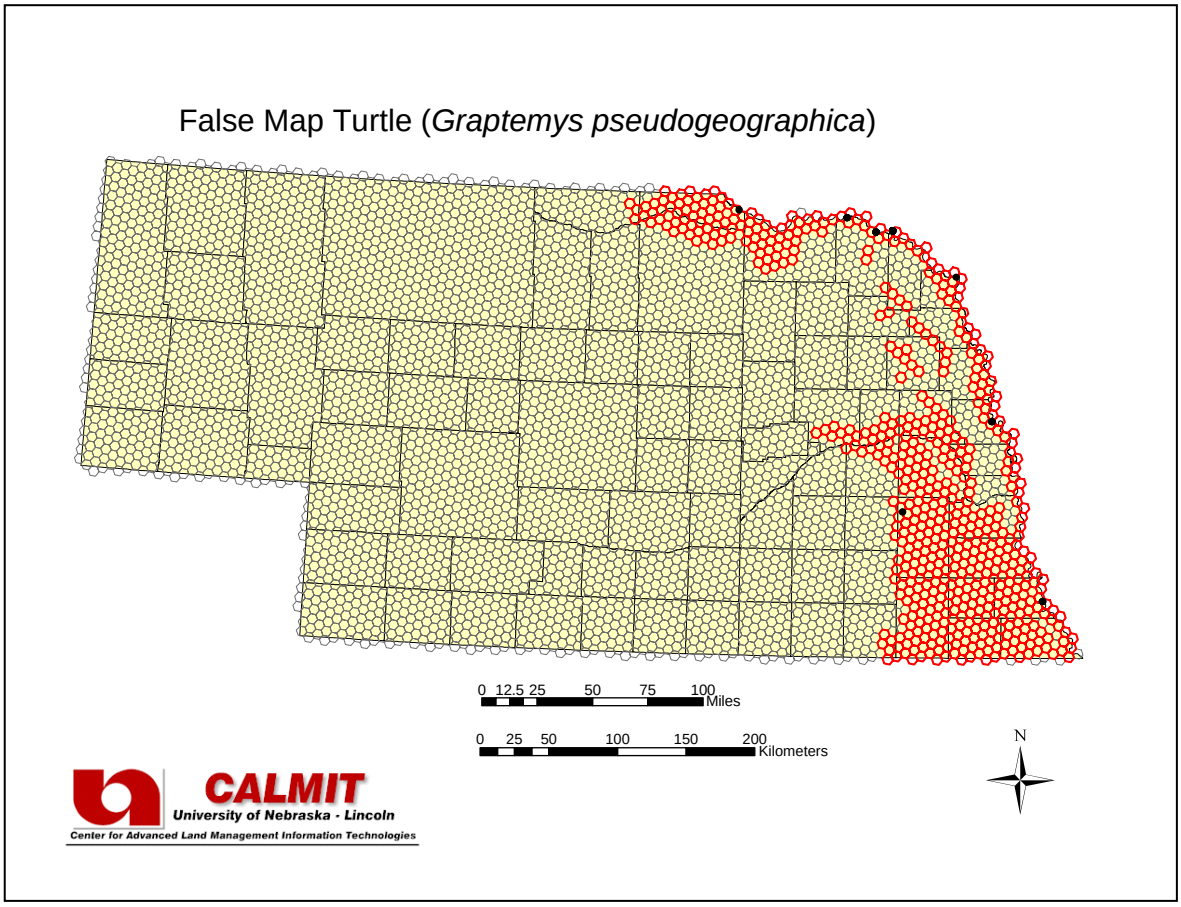
Common Name:	**False Map Turtle**	TNC Global Status:	G5
Scientific Name:	***Graptemys pseudogeographica***	Federal Status:	-
TNC Element Code:	ARAAD05080	State (NE) Status:	S3

Habitat Description:
Occurs in eastern Nebraska in the Missouri River and associated oxbow lakes (Lynch 1985). Inhabits large rivers, backwaters, sloughs, lakes, and ponds. It is found in still, slow, and fast-moving water and prefers an abundance of aquatic vegetation (Collins 1993).

Total Area of Modeled Habitat (ha): 2,396,269

Model Description:
Modeled distribution using the set of variables 'Percentage of Fine-textured Soils > 2%' AND 'Elevation ≤ 600 m'.

39 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Ornate Box Turtle**	TNC Global Status:	G5
Scientific Name:	***Terrapene ornata***	Federal Status:	-
TNC Element Code:	ARAAD08020	State (NE) Status:	-

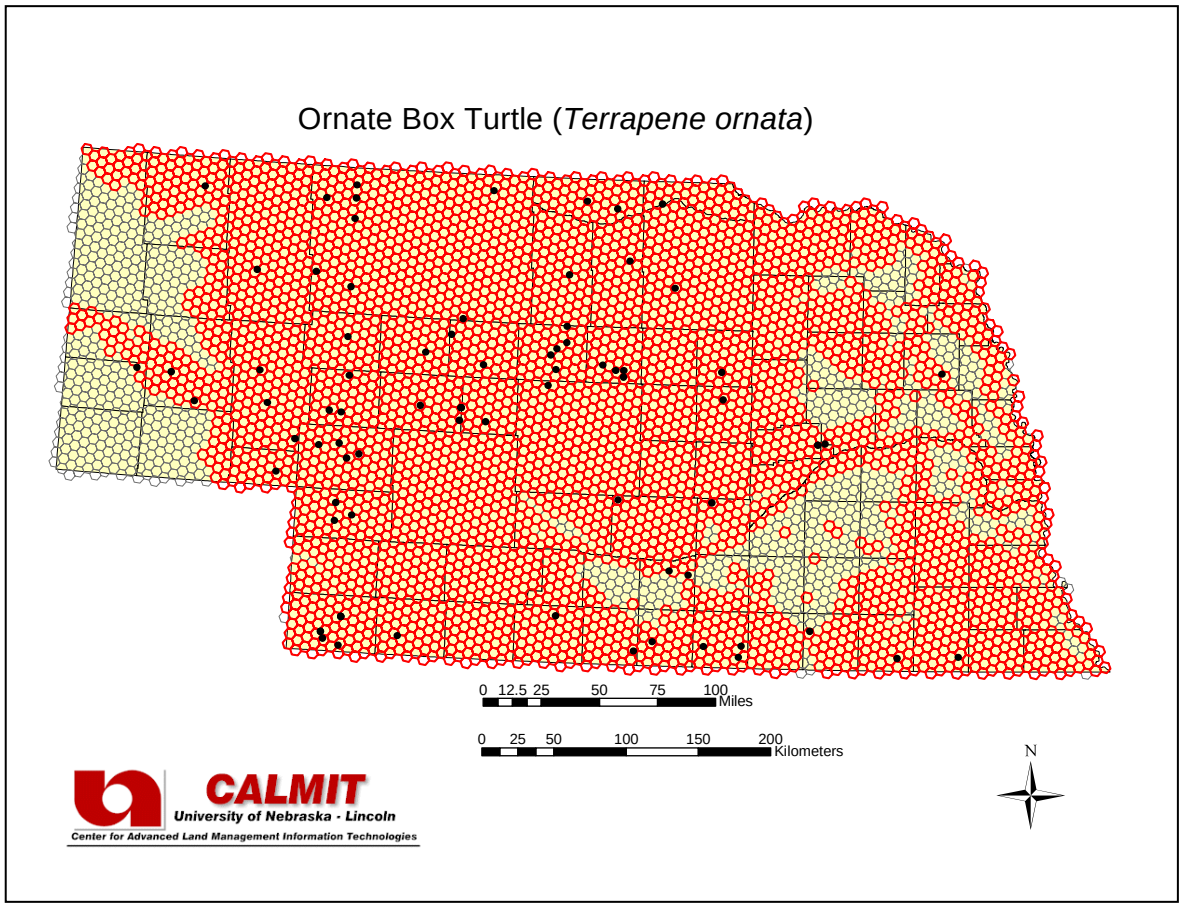
Habitat Description:
Generally a prairie turtle, inhabiting treeless, sandy plains and gently rolling country with grass and scattered low brush as the dominant vegetation (Ernst et al. 1994). Common throughout Kansas with most species found in prairie habitats (Heinrich and Kaufman 1985). Highly terrestrial and prefers sandy open areas (Jones et al. 1981). Habitat destruction has led to population decline in Iowa (Christiansen 1981).

Total Area of Modeled Habitat (ha): 16,498,257

Model Description:
Statewide distribution of observations precluded the use of QUEST (Loh and Shih 1997,

Shih 2000). Distribution was modeled from literature using the set of variables

'Elevation ≤ 1250 m' AND 'Land Cover class Agricultural Field ≤ 80%'.



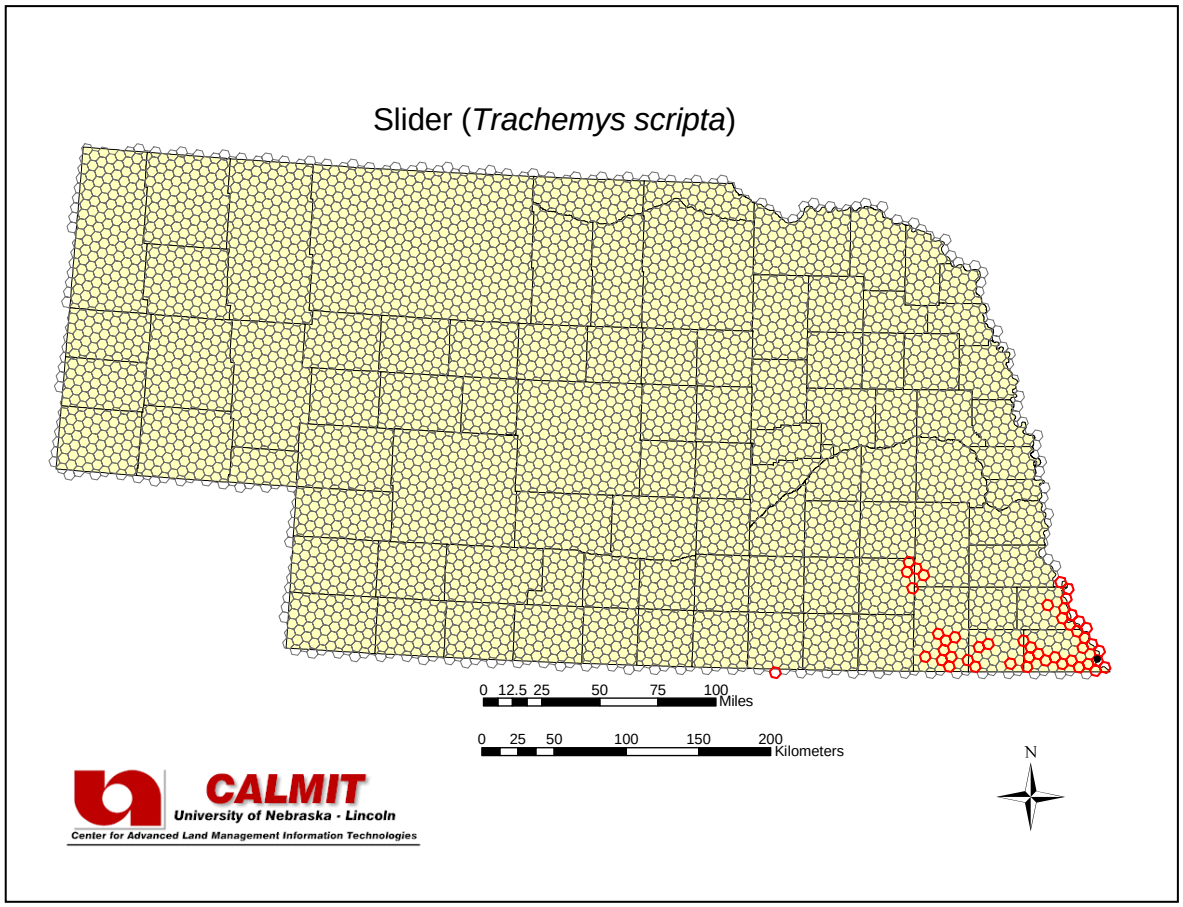
Nebraska GAP Analysis 2004
Reptile Species Atlas

Common Name:	**Slider**	TNC Global Status:	G5
Scientific Name:	***Trachemys scripta***	Federal Status:	-
TNC Element Code:	ARAAD09010	State (NE) Status:	-

Habitat Description:
This turtle is found in nearly every permanent body of water. Prefers quiet water with soft mud bottoms, plentiful aquatic vegetation, and basking sites. Absent along the northern and western borders of Kansas (Collins 1993). Based on observational data, the species appears to be at its range limit within southeastern Nebraska.

Total Area of Modeled Habitat (ha): 194,622

Model Description:
Limited observational data precluded the use of QUEST (Loh and Shih 1997, Shih 2000). Distribution was modeled from literature using the set of variables 'Total Growing Degree Days at 0°C through April > 480 days' AND 'Land Cover class Open Water > 1%'.



Nebraska GAP Analysis 2004
Reptile Species Atlas

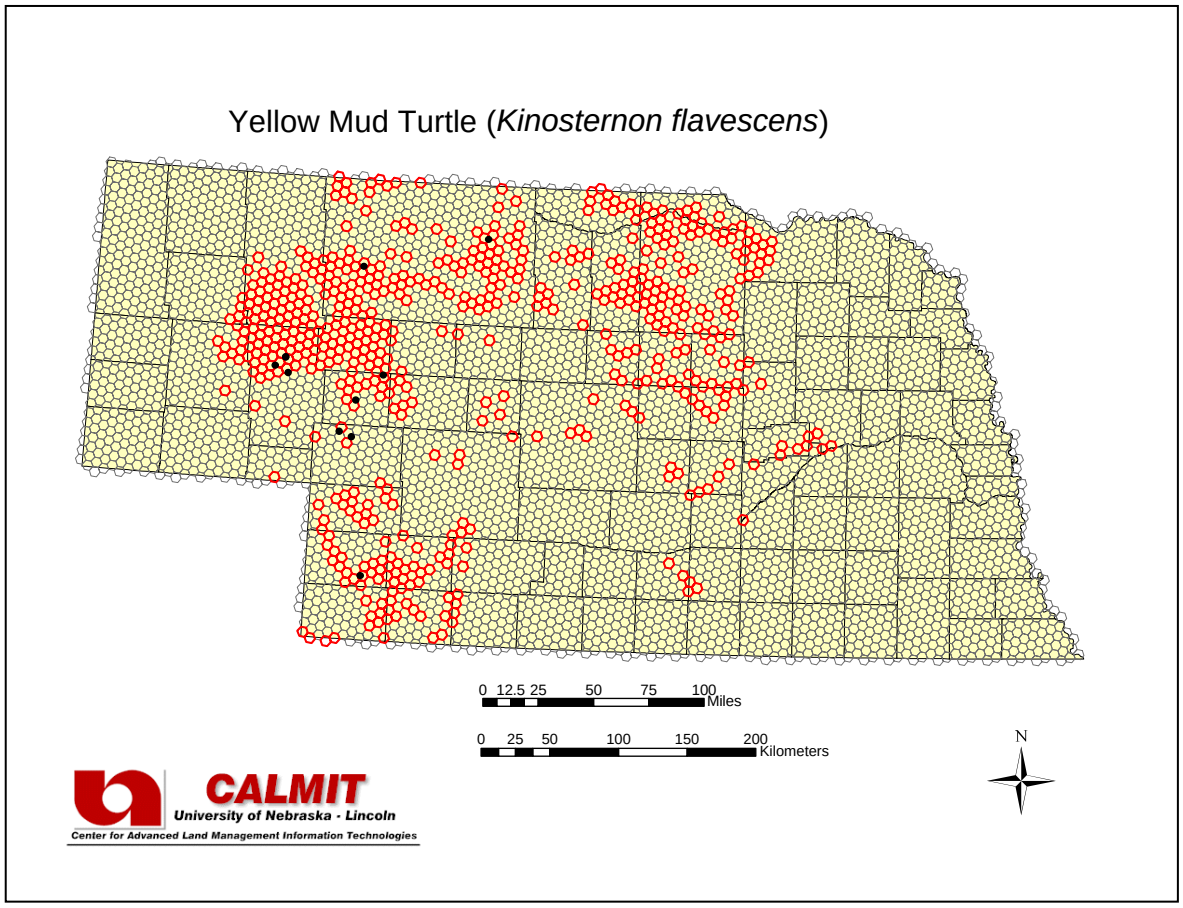
Common Name:	**Yellow Mud Turtle**	TNC Global Status:	G5
Scientific Name:	***Kinosternon flavescens***	Federal Status:	-
TNC Element Code:	ARAAE01020	State (NE) Status:	S3

Habitat Description:
Occurs throughout the Republican River drainage and non-alkaline ponds and lakes in the Sand Hills (Lynch 1985). Missouri populations could be accounted for by the amount of very coarse sand in the habitat (Kangas 1986). Prefers quiet water with a mud or sand bottom, has been found in sloughs, backwaters, swamps, sinkholes, rivers, cisterns, roadside ditches, and cattle tanks (Collins 1993).

Total Area of Modeled Habitat (ha): 2,404,387

Model Description:
Modeled distribution using the set of variables 'Percentage of Coarse-textured Soils > 20%' AND 'Land Cover class Upland Tallgrass Prairie $\leq$ 5%' AND 'Land Cover class Aquatic Bed Wetland is present' OR 'Percentage of Coarse-textured Soils $\leq$ 20%' AND 'Land Cover class Sandsage Shrubland is present'.

11 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



Nebraska GAP Analysis 2004
Reptile Species Atlas

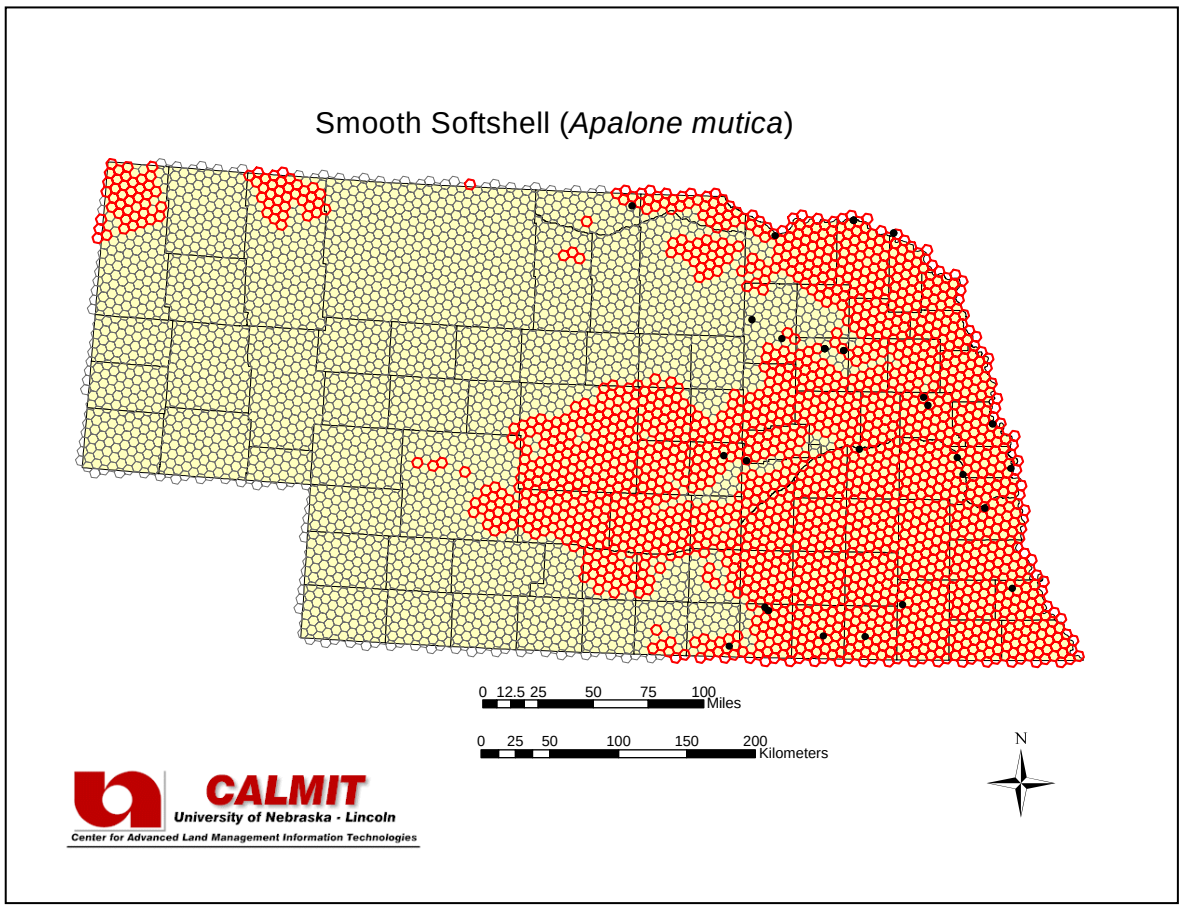
Common Name:	**Smooth Softshell**	TNC Global Status:	G5
Scientific Name:	***Apalone mutica***	Federal Status:	-
TNC Element Code:	ARAAG01020	State (NE) Status:	S5

Habitat Description:
Occurs in large rivers and streams with moderate to fast currents. Also known from lakes impoundments and shallow bogs. Waterways with sandy bottoms and few rocks or aquatic plants are preferred (Ernst et al.1994). Prefers the sand or mud bottoms of moderate to fast-flowing rivers and streams, rarely straying far from water (Collins 1993).

Total Area of Modeled Habitat (ha): 8,117,340

Model Description:
Modeled distribution using the set of variables 'Percentage of Coarse-textured Soils $\leq$ 25%' AND 'Land Cover class Sandsage Shrubland $\leq$ 2%' AND '30-year Maximum Temperature Coefficient of Variation for March > 10.5%' AND 'Land Cover class Fallow Agricultural Field $\leq$ 0.5%' AND '30-year Average Precipitation for June > 80 mm'.

37 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



Nebraska GAP Analysis 2004
Reptile Species Atlas

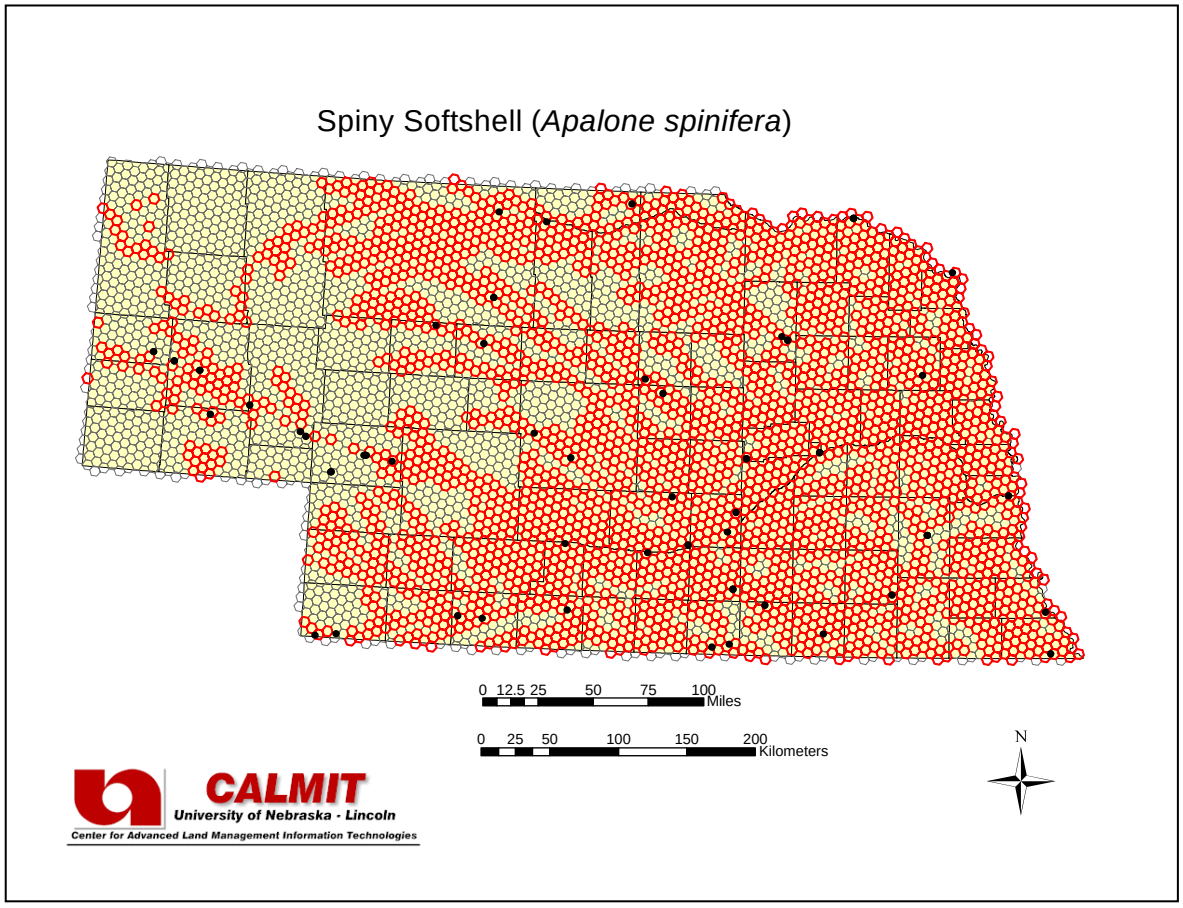
Common Name:	**Spiny Softshell**	TNC Global Status:	G5
Scientific Name:	***Apalone spinifera***	Federal Status:	-
TNC Element Code:	ARAAG01030	State (NE) Status:	S5

Habitat Description:
Occurs in major rivers and many smaller streams in Nebraska (Lynch 1985). Found in a wide variety of aquatic habitats, ranging from swift-flowing rivers and streams to stillwater oxbows, lakes, and reservoirs. It prefers an area with sandbars or mud flats and bodies of water with soft bottoms (Collins 1993).

Total Area of Modeled Habitat (ha): 10,793,403

Model Description:
Modeled distribution using the set of variables 'Percentage of Coarse-textured Soils $\leq$ 25%' AND '30-year Average Precipitation for June > 80 mm' AND 'Stream class is present' OR 'Percentage of Coarse-textured Soils > 25%' AND 'Stream class is present'

67 voucher specimen observations were used as the input to QUEST (Loh and Shih 1997, Shih 2000). After interactive trimming of the resulting statistical tree, the set of variables indicated above were determined to model the observational data effectively.



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Species Models of Nebraska Mammals

Nebraska Gap Analysis Project

2005

University of Nebraska Lincoln

Modeled Nebraska Mammals

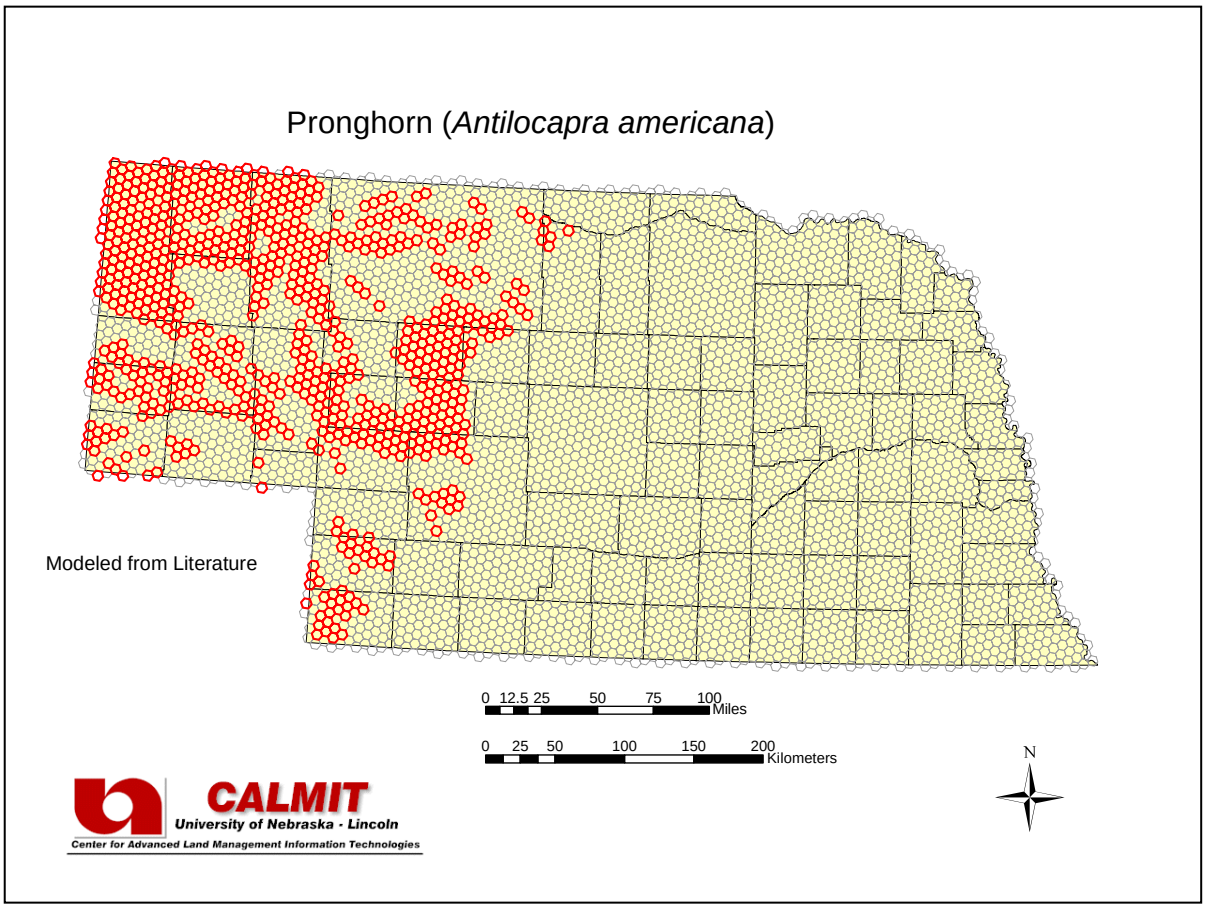
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Pronghorn**	TNC Global Status:	G5
Scientific Name:	***Antilocapra americana***	Federal Status:	-
TNC Element Code:	AMALD01010	State (NE) Status:	S3

Habitat Description:
Nebraska is on the fringe of the pronghorn's range and there are large areas within the range boundary where pronghorns do not occur (NGPC 2002). The highest densities are in the northern and southern Panhandle. Small herds are scattered throughout the Sandhills. The northwestern corner of the state -- the short-grass gumbo prairies and badlands -- is the state's prime pronghorn range. The Pierre Hills rangeland of northwest Nebraska, characterized by rolling plains developed on soft clay shales, contains the state's best antelope range and carries the highest number of pronghorn.

Total Area of Modeled Habitat (ha): 3,284,248

Model Description:
Modeled from literature using the set of variables 'Land Cover class Western Shortgrass Prairie > 50%' OR 'Land Cover class Sandsage Shrubland > 20%' OR 'Percentage of Coarse-textured Soil >95%' AND '30-year Average Precipitation for July < 85 mm'.



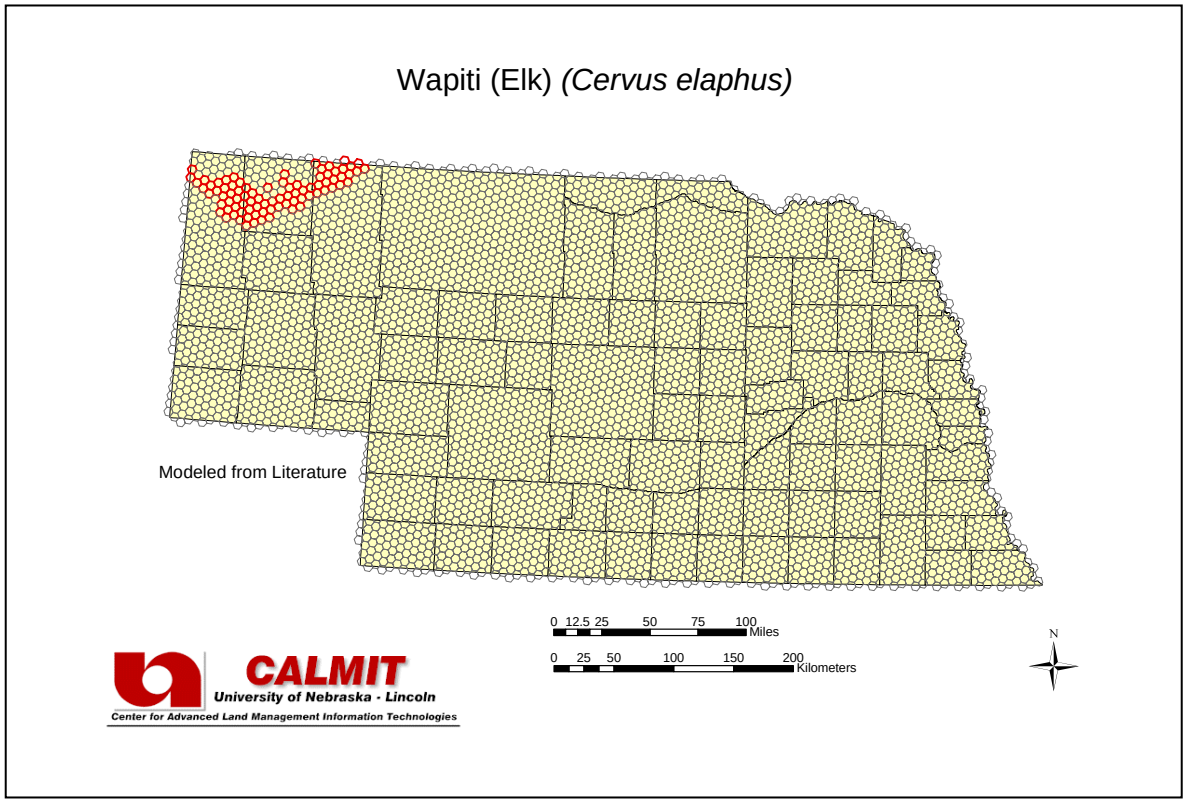
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Wapiti (Elk)**	TNC Global Status:	G5
Scientific Name:	***Cervus elaphus***	Federal Status:	-
TNC Element Code:	AMALC01010	State (NE) Status:	S2

Habitat Description:
Wapiti showed a preference for grassland, shrubland and recent burns (Rounds 1981). Wapiti strongly selected upland grassland at all seasons (Cairns and Telfer 1980). In summer, chiefly high, open mountain pastures; in winter, lower wooded slopes, often dense woods (Whitaker 1997). Wapiti showed a rejection of mixed forest of quaking aspen-white spruce, white spruce, jack pine, and bog communities (Rounds 1981). Wapiti avoid snow at high elevations during winter by migrating to sagebrush grassland communities in mountain valleys, communities that are used by cattle in the spring and early summer (Hobbs et al 1996). Elk breed in late September or early October. The gestation period is approxiamtely 240 days with parturition around the first of June (Wilson and Ruff, 1999). The Wapiti are herbivores, consuming grasses (83-92% of the diet), forbs and browse. They regularly drink water and in winter they consume snow to meet the need for water (Jones et al 1983).

Total Area of Habitat (ha): 340,594

Model Description:
Modeled from literature using the set of variables 'Land Cover class Western Shortgrass Prairie > 1%' and 'Average Frost Free Days < 179 days'.



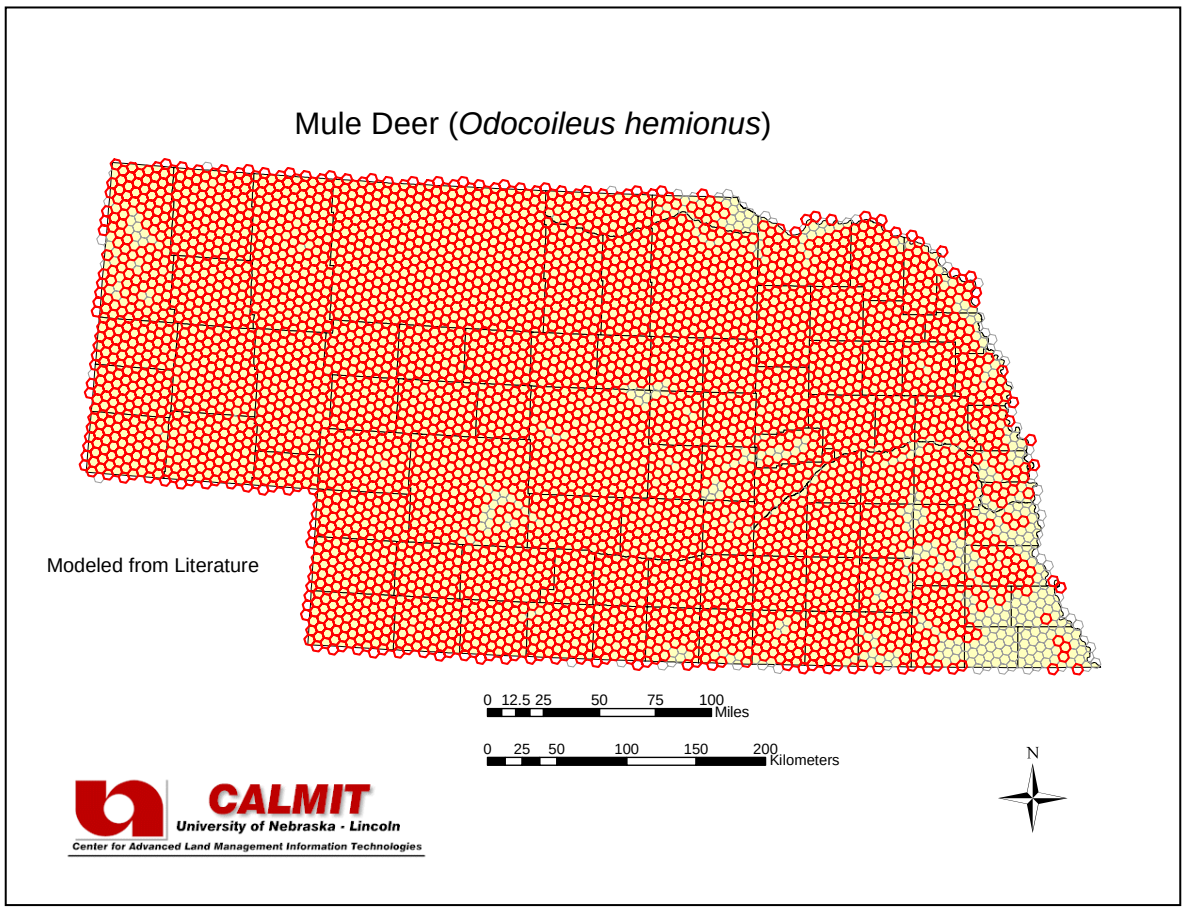
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Mule deer**	TNC Global Status:	G5
Scientific Name:	***Odocoileus hemionus***	Federal Status:	-
TNC Element Code:	AMALC02010	State (NE) Status:	S5

Habitat Description:
Large populations occur in prairie habitats, especially along the eastern range of their distribution. Ideal habitat on the plains is draws dominated by hardwoods and shrubs and floodplains dominated by cottonwood (*Populus deltoides*), both associated with rough terrain. (Mackie et al. 1982; McCullough 1999; Kerr 1979; Rue 1978; Wallmo 1981). Mule deer are less likely than whitetail deer to use mature timber (NGPC 2002). Mule deer can be found throughout Nebraska, but are mainly located in the western portion of the state (NGPC 2002). Concentrations occur in and near the Pine Ridge of Northwestern Nebraska, the Wildcat Hills and Cheyenne Escarpment in Banner, Morrill and Scottsbluff counties, the Niobrara River Valley and breaks east to Rock county, and over a relatively large area of southwestern Nebraska.

Total Area of Modeled Habitat (ha): 1.84×10^7

Model Description:
Modeled from literature using the set of variables 'Land Cover class Lowland Tallgrass Prairie is present' OR 'Land Cover Class Upland Tallgrass Prairie is present' OR 'Land Cover class Little Bluestem-Gramma Mixedgrass Prairie is present' AND NOT 'Land Cover Class Deciduous Forests and Woodlands > 5%'.



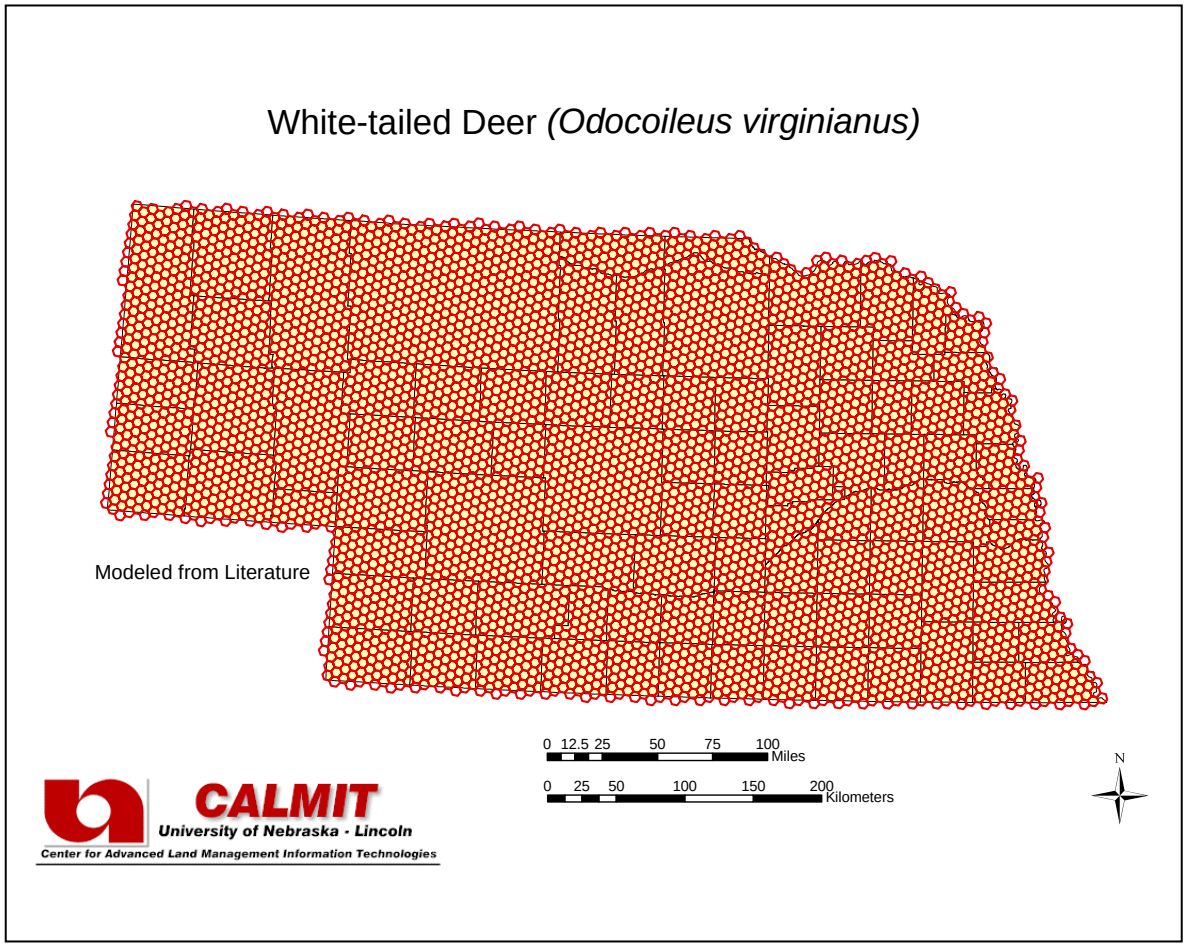
Nebraska GAP Analysis 2004
Mammal Species Atlas

	White-tailed deer	TNC Global Status:	G5
Scientific Name:	***Odocoileus virginianus***	Federal Status:	-
TNC Element Code:	AMALC02020	State (NE) Status:	S5

Habitat Description:
Occur in a variety of habitats from north temperate to subtropical/tropical and semi-arid environments. Preferred habitats in Nebraska include woodlands, forest edges, riparian vegetation and vegetation adjacent to croplands (Jones et al. 1983). Neither dense forest nor expanses of open country are favored. Also may be found in swamps, river bottoms and forest edges of high country. Does best in sub-climax or temporary habitat (Baker 1983; Hesselton 1982; Jones 1985; Rue 1978; Schwartz 1981; Smith 1991; Wilson and Ruff 1999). Densities depend on pattern and distribution of wooded areas and quality of habitat (Schwartz 1981 Wilson and Ruff 1999).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



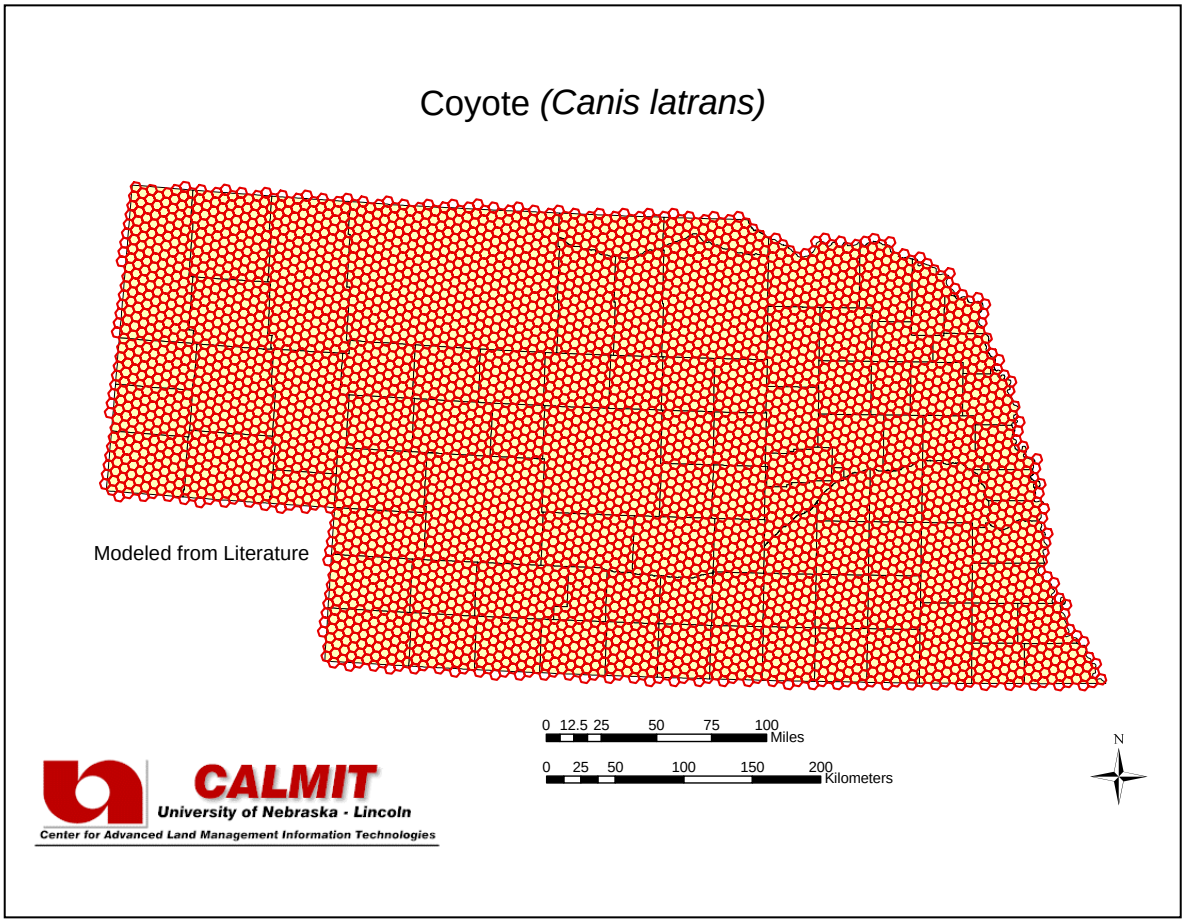
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Coyote**	TNC Global Status:	G5
Scientific Name:	***Canis latrans***	Federal Status:	-
TNC Element Code:	AMAJA01010	State (NE) Status:	S5

Habitat Description:
Found on the open plains (Whitaker 1997). The coyote succeeds in open grasslands, brushy areas, badlands, and woodlands (Jones et al. 1983, Forsyth 1999). In Nebraska, coyotes are more abundant in western Nebraska and the Sandhills regions where ranching predominates over crop farming (Nebraska Game and Parks 2002). Tend to not be found in thickly settled areas but can survive there (Jones et al. 1983).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



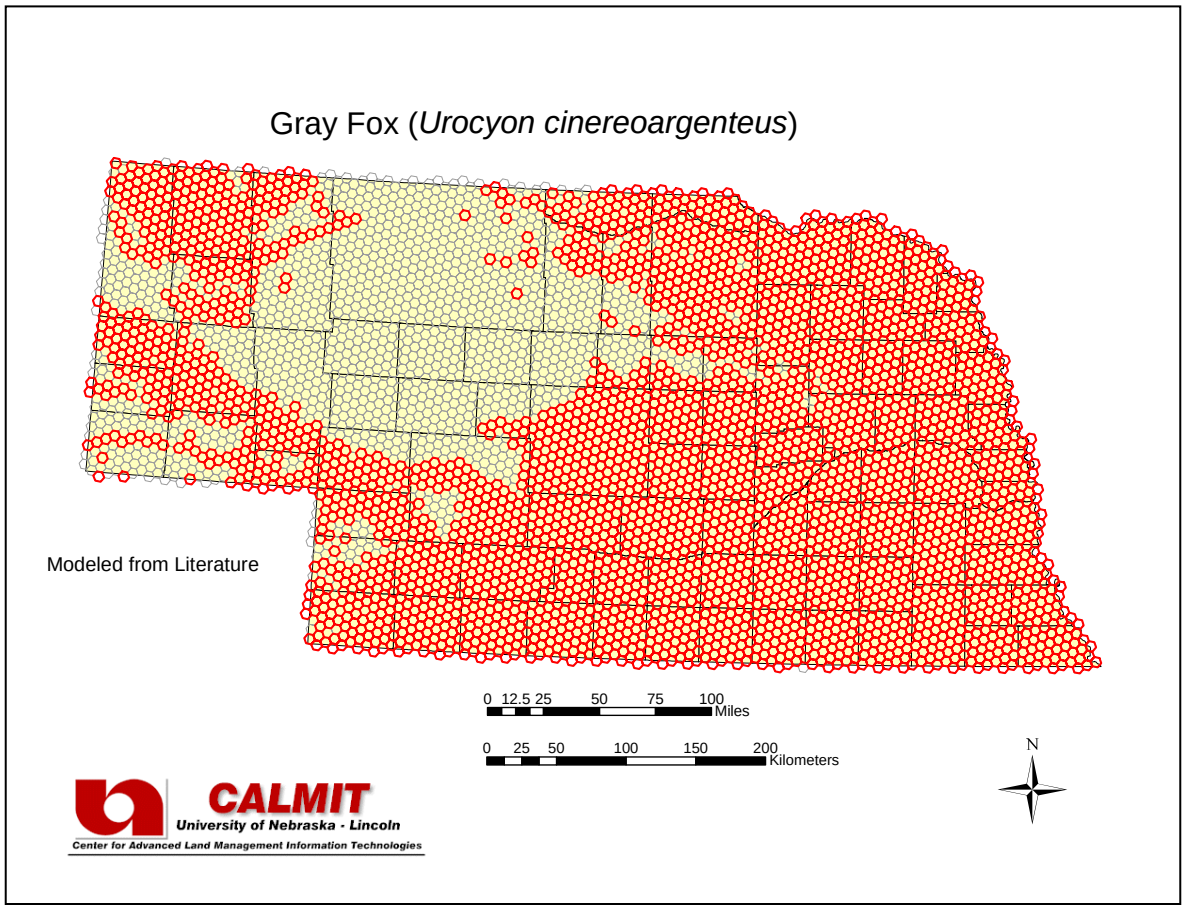
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Gray fox**	TNC Global Status:	G5
Scientific Name:	***Urocyon cinereoargenteus***	Federal Status:	-
TNC Element Code:	AMAJA04010	State (NE) Status:	S4

Habitat Description:
Varied habitat (Whitaker 1997). Gray foxes are animals of forest, woodland, or rocky and brush-covered country (Jones et al. 1983, Wilson and Ruff 1999). They are more associated with trees and wooded areas than the red fox (Jones et al. 1985). Occur primarily in wooded and brushy country in rocky or broken terrain; also marshes (Forsyth 1999). Avoid the drier, more open parts of the Great Plains (Jones et al. 1983).

Total Area of Modeled Habitat (ha): 1.44×10^7

Model Description:
Modeled from literature using the set of variables 'Land Cover class Ponderosa Pine Forests and Woodlands is present' OR 'Land Cover class Deciduous Forests and Woodlands is present' AND NOT 'Land Cover class Sandhills Upland Prairie > 50%'.



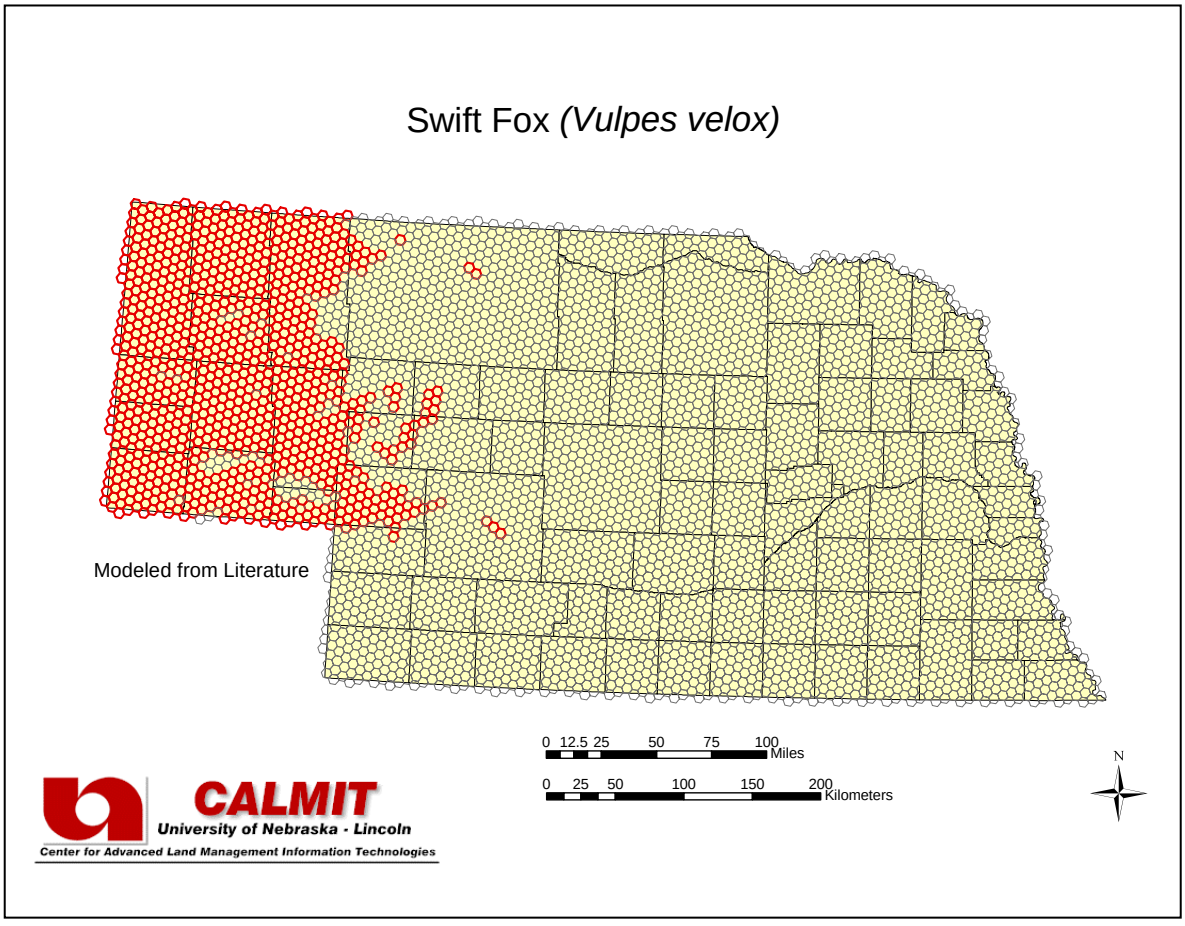
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Swift fox**	TNC Global Status:	G3
Scientific Name:	***Vulpes velox***	Federal Status:	-
TNC Element Code:	AMAJA03030	State (NE) Status:	S2

Habitat Description:
Species is listed as endangered in Nebraska (NGPC 2002). Arid short-grass/mixed-grass prairie, sand hills prairie, and shrubby deserts (Banfield 1974; Egoscue 1979; Lechleitner 1969; Snow 1973; Uresk 1986). Have been found in cultivated cropland and in pastures under moderate to heavy grazing. Open prairie and arid plains, including areas intermixed with winter wheat fields (NatureServe 2002). In Nebraska, Swift foxes live primarily in shortgrass prairies and deserts (Freeman 1998). They often form their dens in sandy soils on open prairies, along fences or in ploughed fields.

Total Area of Modeled Habitat (ha): 3,928,892

Model Description:
Modeled from literature using the variable 'Land Cover class Western Shortgrass Prairie > 7%'.



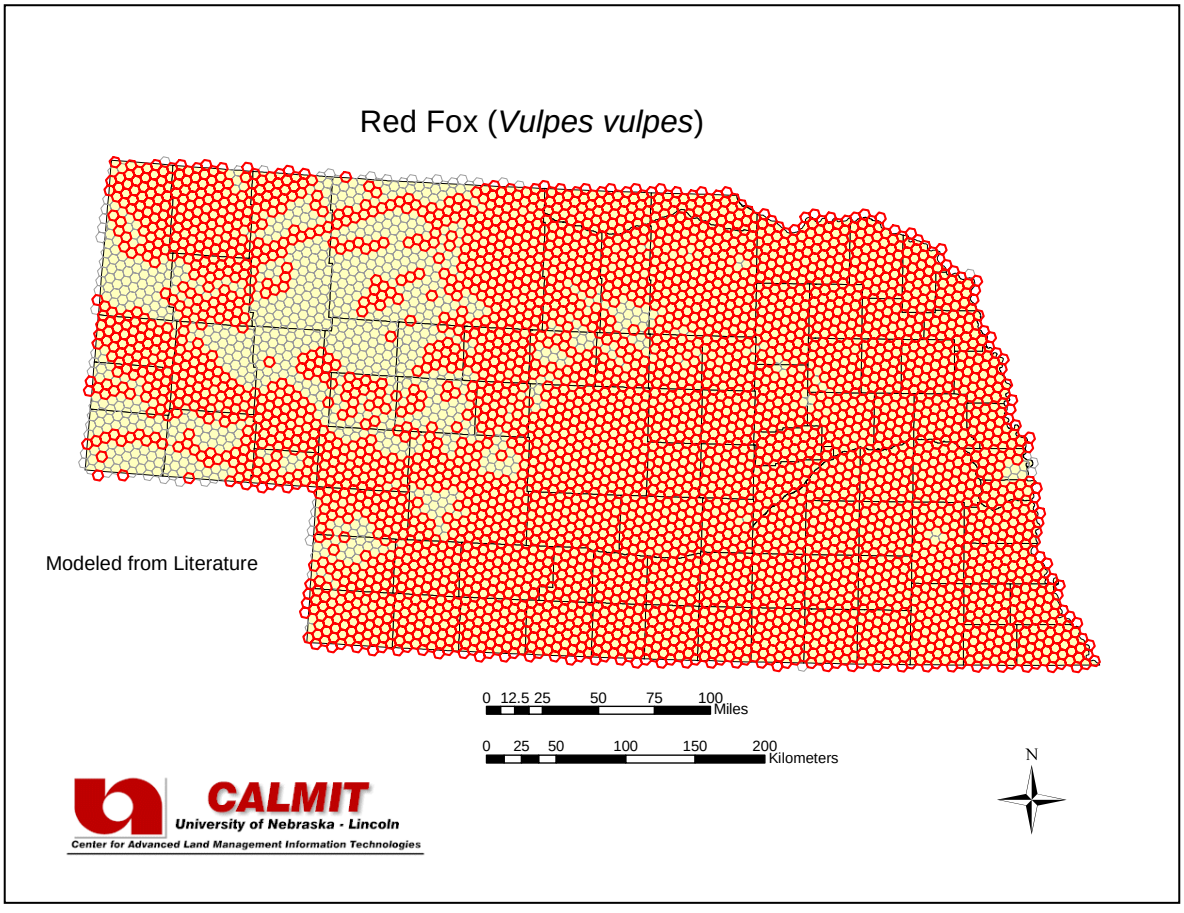
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Red fox**	TNC Global Status:	G5
Scientific Name:	***Vulpes vulpes***	Federal Status:	-
TNC Element Code:	AMAJA03010	State (NE) Status:	S5

Habitat Description:
Statewide distribution in Nebraska, although most common in the moist areas of the eastern part of the state (Freeman 1998). Mixed cultivated and wooded areas, and brushlands (Whitaker 1997). Common in wooded areas but does not require forest habitat, rather uses brushy cover at the forest edge for shelter and forages in brushy areas and thickets (Jones et al. 1985). Extensive distribution in riparian habitats in otherwise essentially treeless areas of the Great Plains (Jones et al. 1985). These foxes prosper in areas altered by man, although they seldom den close to settlements where domestic dogs run loose (Jones et al. 1983). Seldom found far from permanent water, either streams or ponds (Jones et al. 1983). Will not use dense, extensive forests. Prefer habitats with great diversity and use edges heavily (Wilson and Ruff 1999).

Total Area of Modeled Habitat (ha): 1.64×10^7

Model Description:
Modeled from literature using the set of variables 'Land Cover class Ponderosa Pine Forests and Woodlands is present' OR 'Land Cover class Deciduous Forests and Woodlands is present' OR Land Cover class Riparian Shrubland is present' OR 'Land Cover class Riparian Woodland is present' AND NOT 'Land Cover class High Intensity Residential/Commercial/Industrial/ Transportation > 10%'.



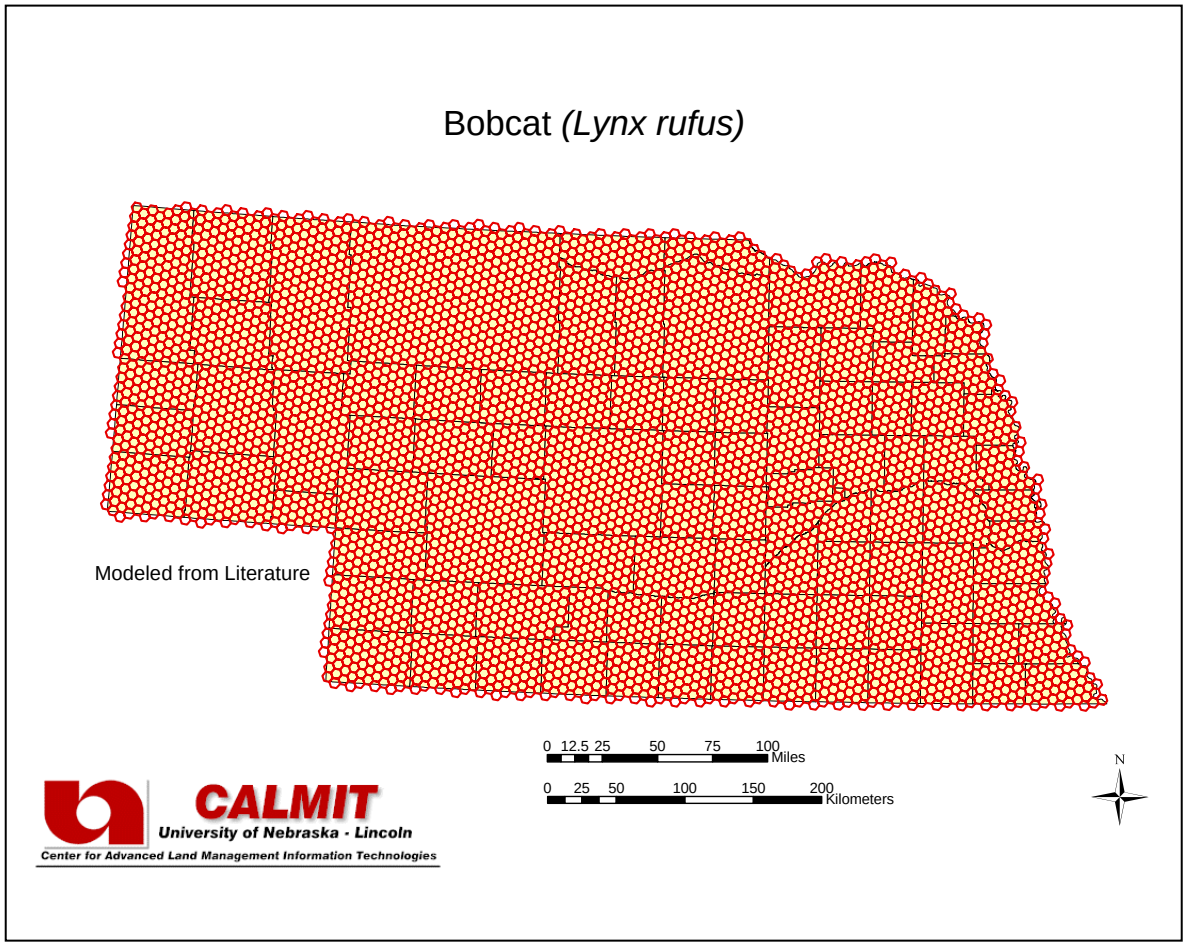
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Bobcat**	TNC Global Status:	G5
Scientific Name:	***Lynx rufus***	Federal Status:	-
TNC Element Code:	AMAJH03020	State (NE) Status:	S5

Habitat Description:
Habitat generalist, occurring in almost every terrestrial habitat type from deserts to swamps to mountains (Layne 1999). Broken country with dense cover and rocky cliffs are considered to be preferred habitat. May also be found in deciduous-coniferous woodlands and forest edge, hardwood forests, swamps, forested river bottomlands, brushlands, deserts, mountains, and other areas with thick undergrowth (Epperson 1978; Schwartz 1981; Rolley and Warde 1985; Boyle and Fendley 1987). Bobcats occur almost everywhere except on featureless plains (Jones et al. 1983). Species is statewide in distribution in Nebraska (Benedict et al. 2000), although uncommon in the Sand Hills (Freeman 1998).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



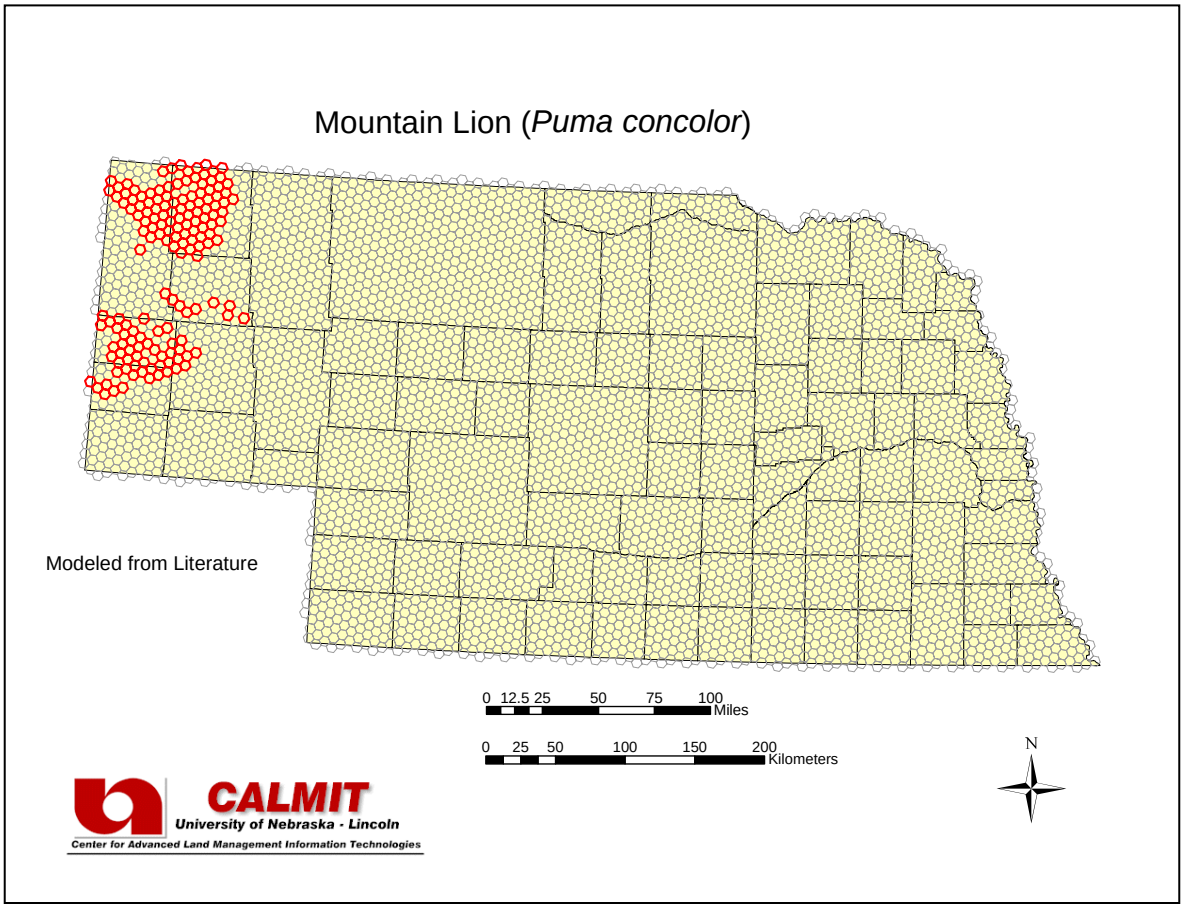
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Mountain lion**	TNC Global Status:	G5
Scientific Name:	***Puma concolor***	Federal Status:	-
TNC Element Code:	AMAJH04010	State (NE) Status:	S1

Habitat Description:
Mostly associated with mountainous terrain, the mountain lion can occur in a wide variety of habitats ranging from swamps, deserts, and wooded river valleys to dense coniferous forests; typically not found in grassland, although it will pass through in search of better hunting habitat (Armstrong 1978; Banfield 1974; Currier 1983; Fitzgerald 1994; Wilson and Ruff 1999). Avoids agricultural areas, flat shrubless deserts and other habitats that lack topographic or vegetative cover (Beier 1999). Free water is required. (Currier 1983). Recent reports suggest that the mountain lion is reclaiming some of its former geographic range in Nebraska (Benedict et al. 2000). Confirmed reports have been from Sioux, Box Butte and Scotts Bluff Counties in the Panhandle area in close proximity to Colorado, Wyoming, or South Dakota (NGPC 2002).

Total Area of Habitat (ha): 624,412

Model Description:
Modeled from literature using the set of variables 'Land Cover class Ponderosa Pine Forests and Woodlands is present' AND '30-year Average precipitation for July < 60 mm'.



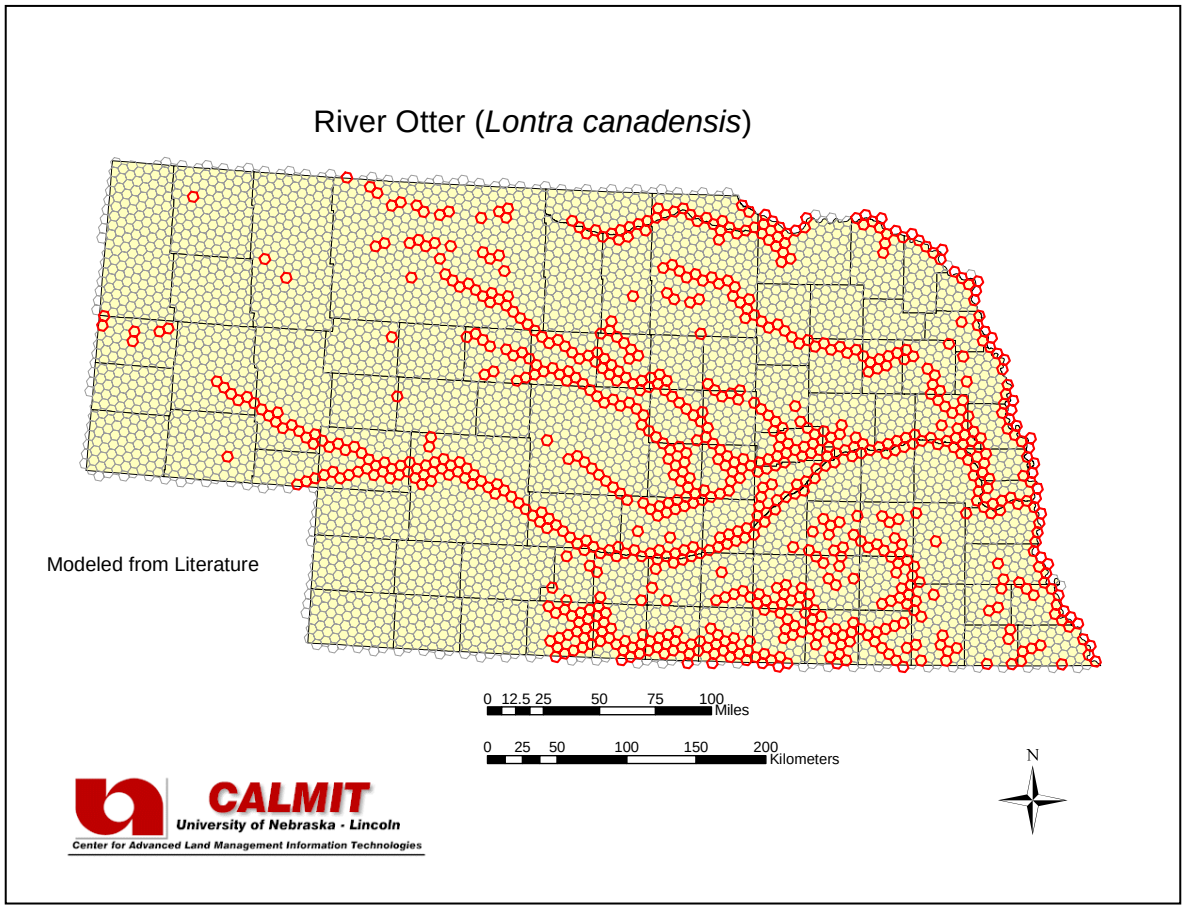
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**River otter**	TNC Global Status:	G5
Scientific Name:	***Lontra canadensis***	Federal Status:	-
TNC Element Code:	AMAJF10010	State (NE) Status:	S2

Habitat Description:
Had been extirpated from the state but are becoming re-established (Freeman 1998, Jones et al. 1983). The current distribution is unknown (Freeman, personal communication 2003). Listed as endangered in Nebraska (NGPC 2002). River otters are quite adaptable, utilizing a variety of habitat types. Although they frequent lakes and ponds, they typically live in marshes and along wooded rivers and streams with sloughs and backwater areas. Occurs mostly in wooded habitat but will live in open areas; yearly home range is between 50 and 100 miles of shoreline (Schwartz 1981; Knox 1988; Cahalane 1961; Jones et al. 1985; Hazard 1982). Requires permanent supply of water (Fitzgerald et al. 1994).

Total Area of Modeled Habitat (ha): 3,259,912

Model Description:
Modeled from literature using the set of variables 'Land Cover class Open Water is present' AND 'Land Cover class Riparian Woodland is present' OR 'Land Cover class Riparian Shrubland is present'.



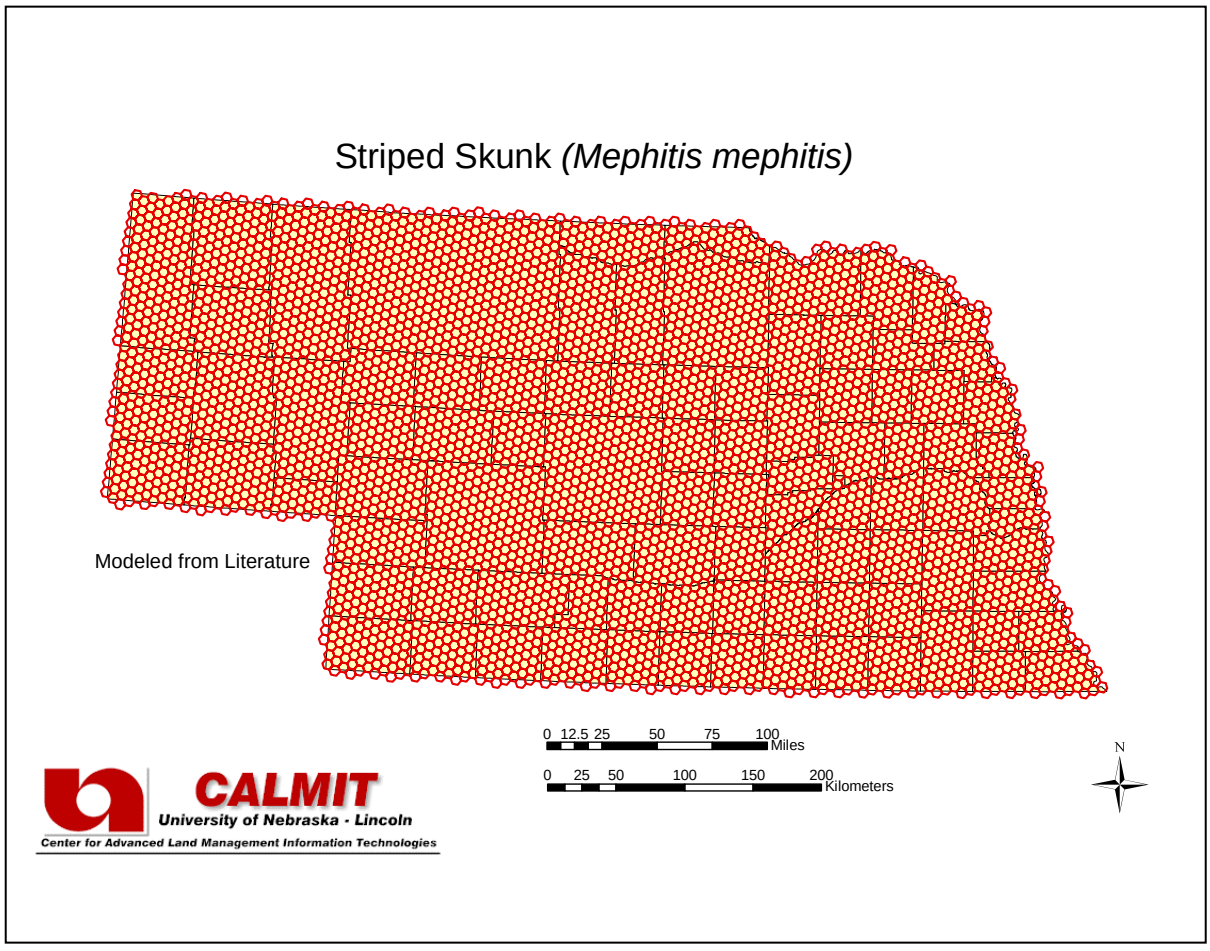
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Striped skunk**	TNC Global Status:	G5
Scientific Name:	***Mephitis mephitis***	Federal Status:	-
TNC Element Code:	AMAJF06010	State (NE) Status:	S5

Habitat Description:
Desert, woodlands, grassy plains, and suburbs (Whitaker 1997). Prefers areas of mixed woods, grasslands and open prairie, usually close to water; also found in mixed agricultural land tree-cleared land; thrives in suburban areas (Forsyth 1999). Will live almost anywhere they can gain adequate shelter (Jones et al. 1985). Statewide distribution in Nebraska, although it avoids dense forests and marshy areas where dry den sites are unavailable (Jones el al. 1983; 1985). *Mephitis mephitis* prefers somewhat open areas with a mixture of habitats such as woods, grasslands, and agricultural clearings. They are usually never found further than two miles from a water source.

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



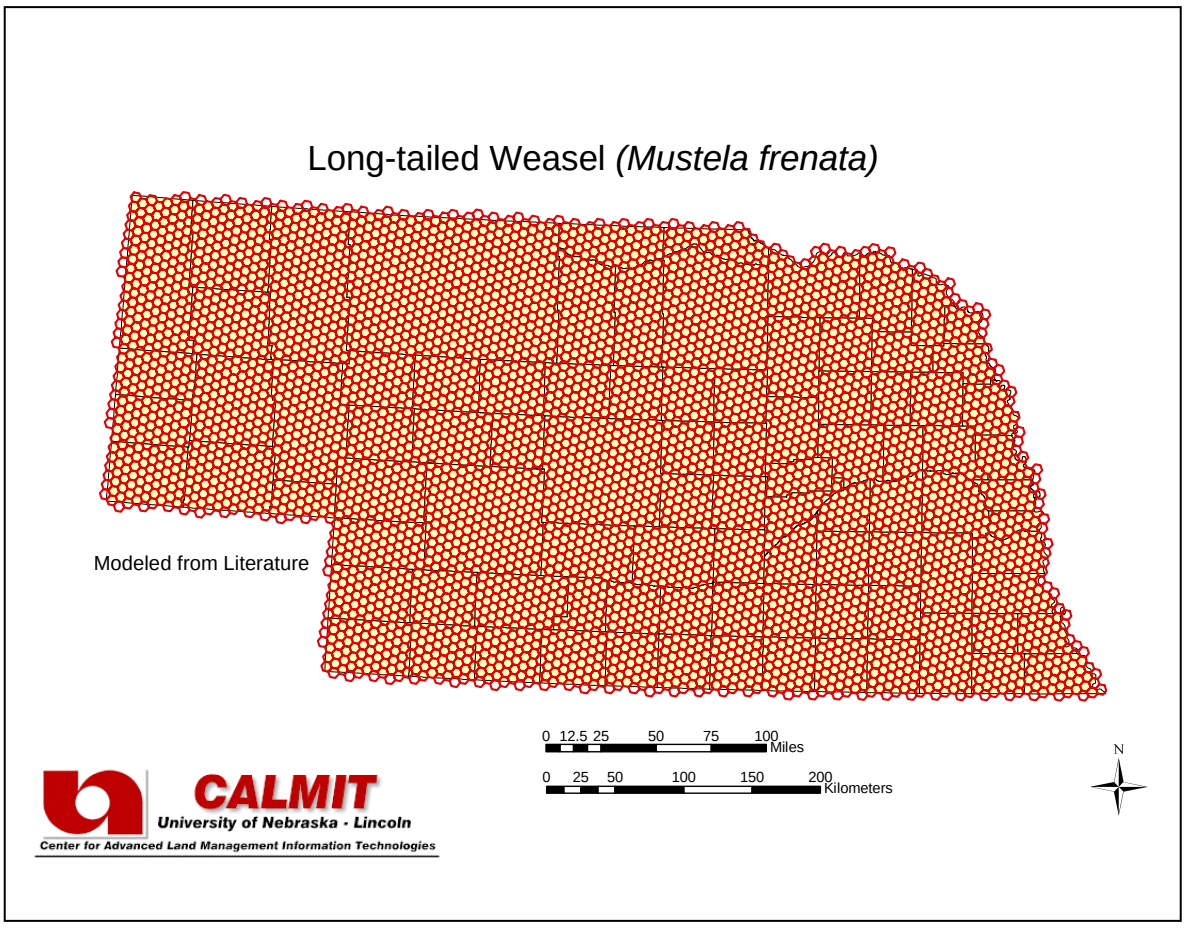
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Long-tailed weasel**	TNC Global Status:	G5
Scientific Name:	***Mustela frenata***	Federal Status:	-
TNC Element Code:	AMAJF02030	State (NE) Status:	-

Habitat Description:
Varied habitat; forested, brushy, and open areas, including farmland, preferably near water (Whitaker 1997). On the Plains, it typically is most abundant around marshes but can be found almost anywhere, often near a source of water (Jones et al. 1985). It has been reported to favor brushy and rocky areas and often is found near watercourses and lakes. They are not found in deserts or thick, dense forests (Natureserve 2002). Widespread in the Sand Hills of Nebraska (Freeman 1998).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



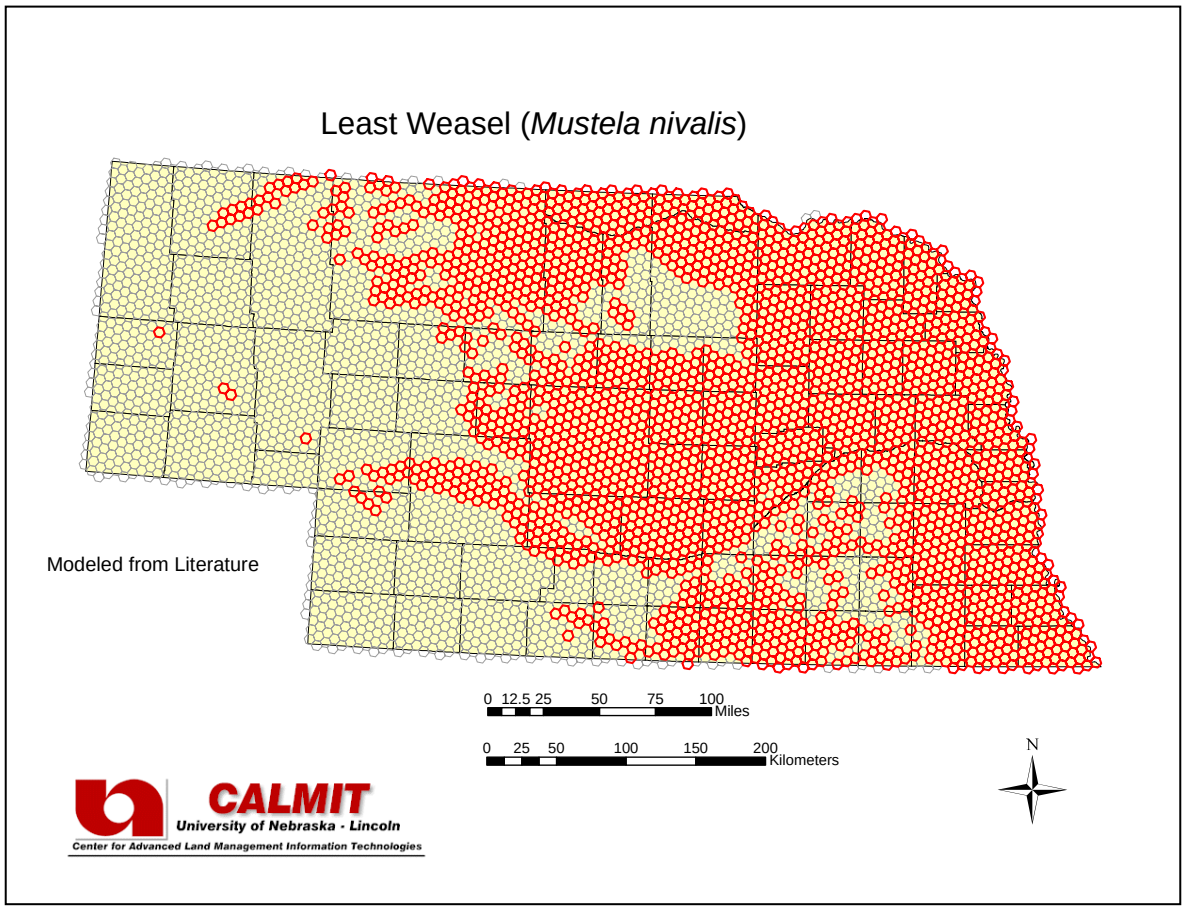
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Least weasel**	TNC Global Status:	G5
Scientific Name:	***Mustela nivalis***	Federal Status:	-
TNC Element Code:	AMAJF02020	State (NE) Status:	S5

Habitat Description:
Prefers low sparse ground cover such as pastures, stubble fields, and marshy areas (Schwartz 1981), open forests, farmlands, riparian woodlands, grassy fields, alpine meadows and forests, scrub, steppe and semi-deserts, and prairies. Avoids, deep, dense forests (Sheffield 1994). Habitat selection is determined by the distribution of small rodents. Local dissappearance is common with low rodent populations (Sheffield 1994). Range on the Northern Great Plains includes the eastern three fourths of Nebraska (Jones et al. 1983).Found most commonly in meadows and grasslands and reaches its greatest abundance in marshy areas.

Total Area of Modeled Habitat (ha): 1.09×10^7

Model Description:
Modeled from literature using the set of variables 'Land Cover class Little Bluestem-Gramma Mixedgrass Prairie > 5%' AND 'Land Cover class Lowland Tallgrass Prairie is present' OR 'Land Cover class Riparian Woodland > 0.5%' OR 'Land Cover class Upland Tallgrass Prairie is present'.



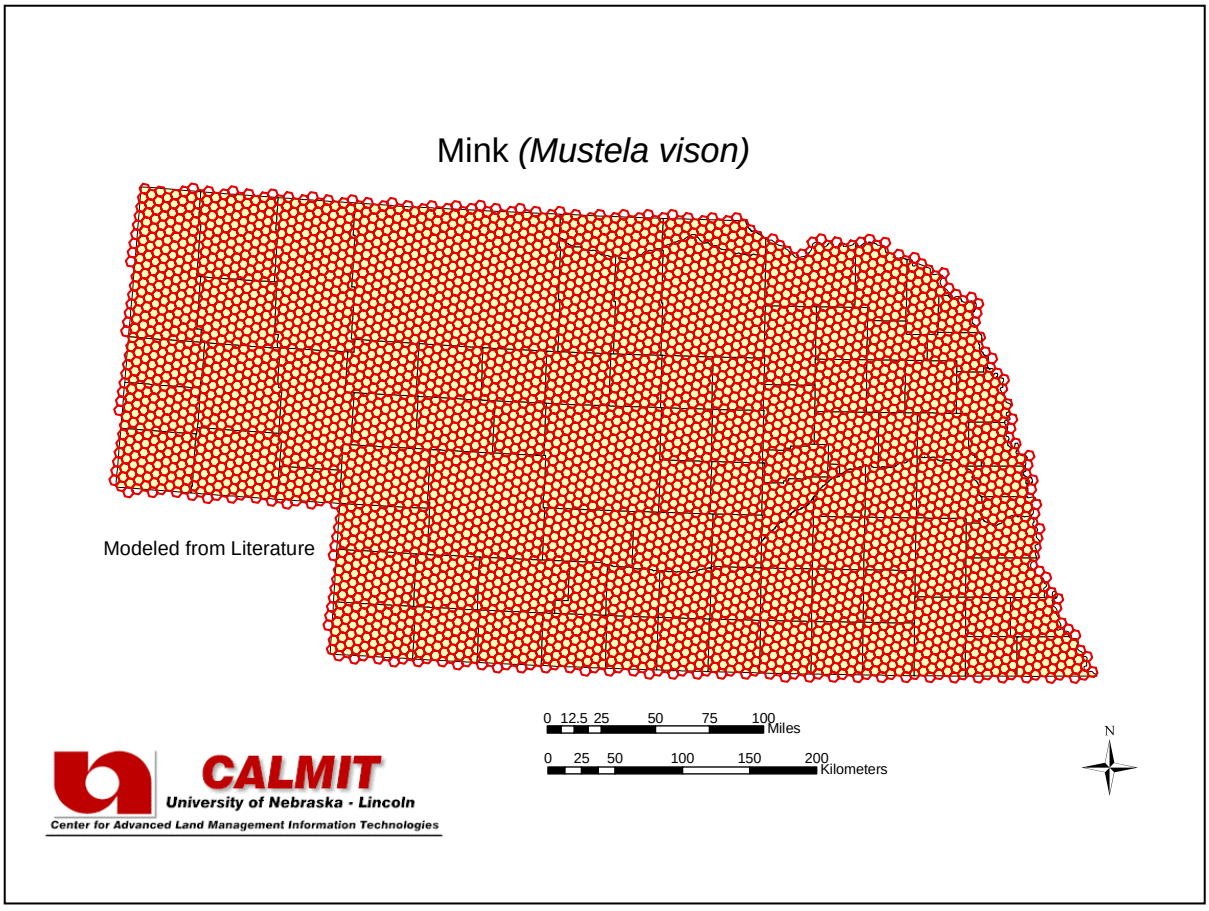
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Mink**	TNC Global Status:	G5
Scientific Name:	***Mustela vison***	Federal Status:	-
TNC Element Code:	AMAJF02050	State (NE) Status:	S5

Habitat Description:
Found along rivers, creeks, lakes, ponds, and marshes (Whitaker 1997). In the Plains region it is common near lakes, watercourses, and marshes, especially where stumps, driftwood, or muskrat lodges break the surface (Jones et al. 1985). Along streams and lakes in swamps and marshes; if it occurs away from water, it prefers second-growth cover of mixed shrubs, weeds and grasses and the edges of cultivated fields and pastures (Forsyth 1999).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



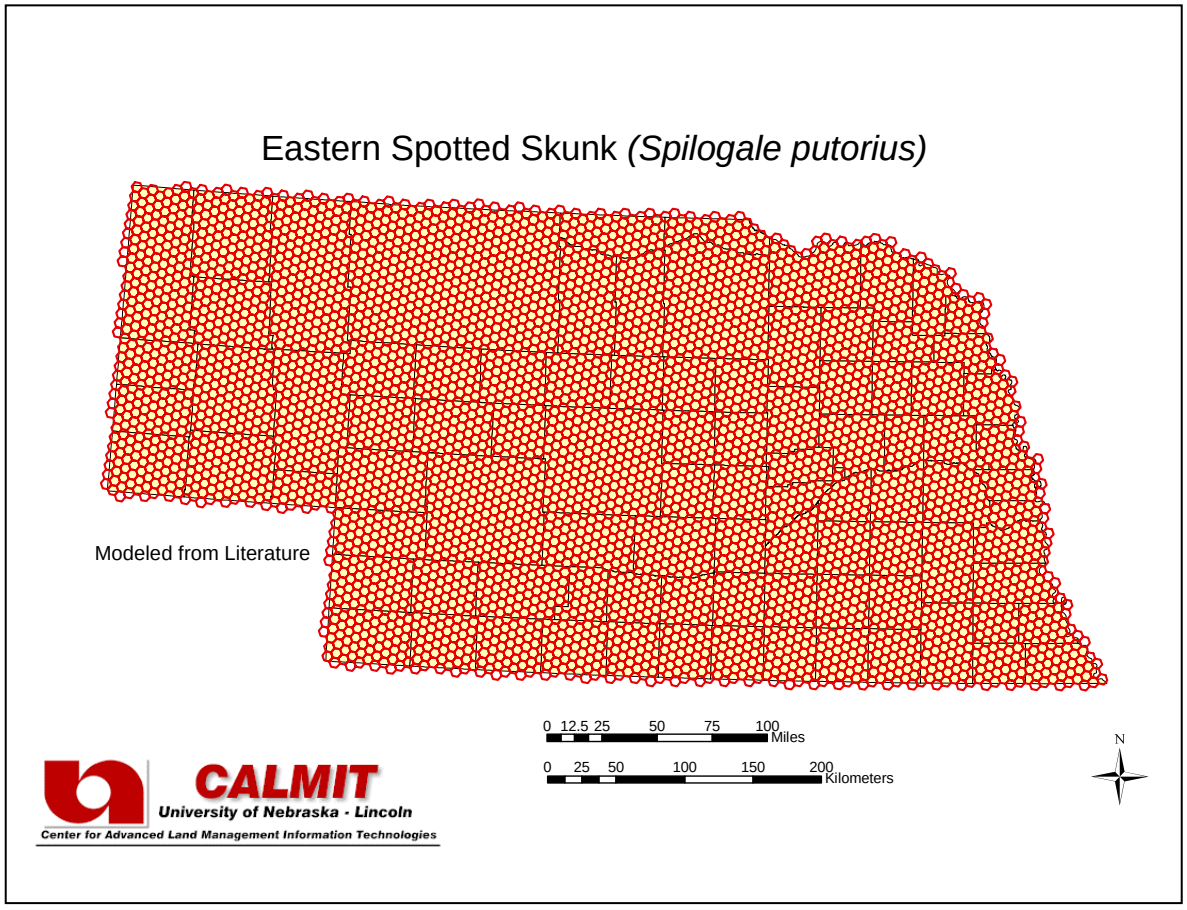
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Eastern spotted skunk**	TNC Global Status:	G5
Scientific Name:	***Spilogale putorius***	Federal Status:	-
TNC Element Code:	AMAJF05010	State (NE) Status:	S3

Habitat Description:
Mixed woodlands and open areas, scrub, and farmland (Whitaker 1997). In Plains States, it frequents riparian woodland, fencerows, and shelterbelts and is commensal with man around farms (Jones et al. 1985). Brushy, rocky and wooded habitats, scrubland, farmland, along streams and among boulders; avoids heavy forests and wetlands (Forsyth 1999). Seldom found in dense forests or marshy areas (Jones et al. 1985).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



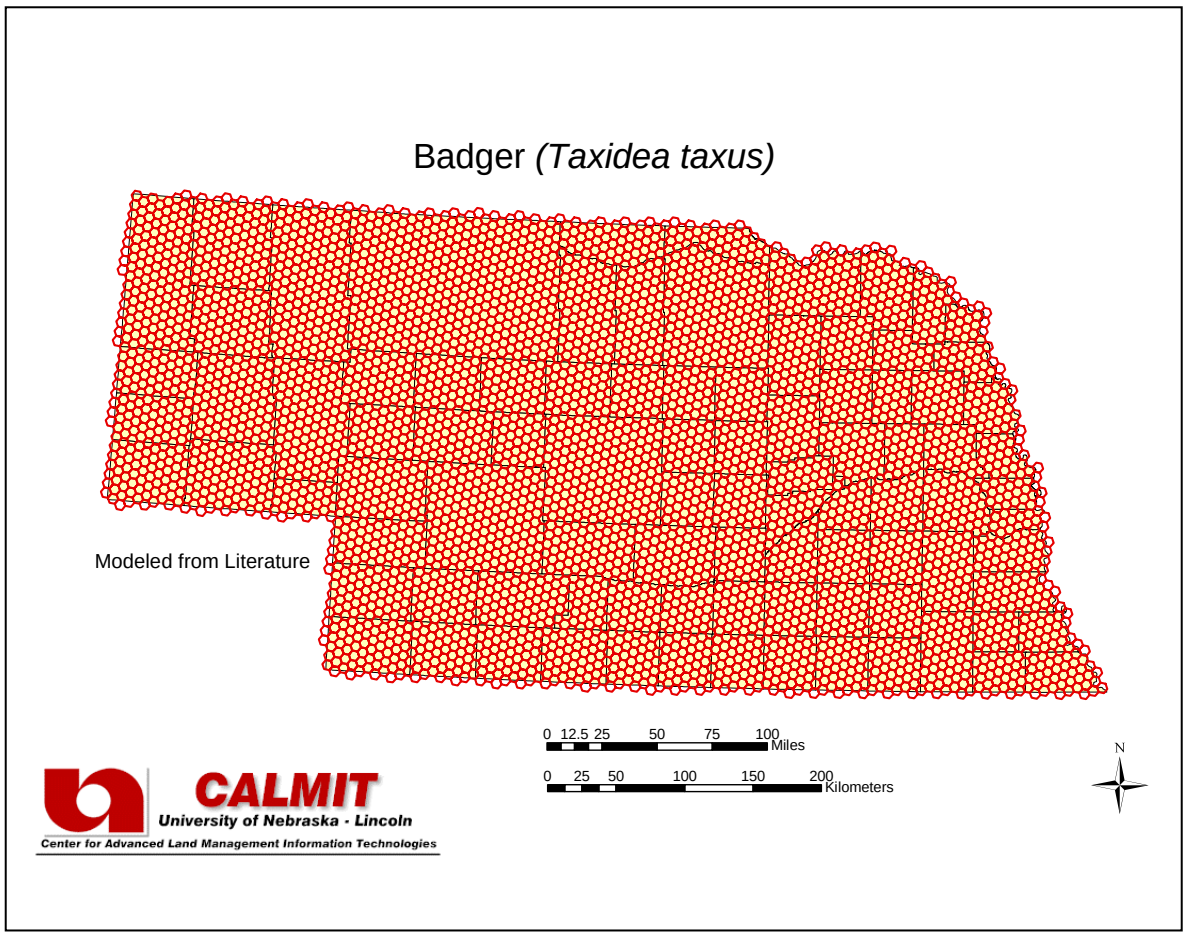
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Badger**	TNC Global Status:	G5
Scientific Name:	***Taxidea taxus***	Federal Status:	-
TNC Element Code:	AMAJF04010	State (NE) Status:	S5

Habitat Description:
Open plains and prairies, farmland, and sometimes edges of woods (Whitaker 1997). Typically inhabit grassland but also inhabit the edges of forests. They are most common where deep soil facilitates burrowing (Jones et al. 1985). Dry, open prairies, grasslands, farmlands and parklands; clay and sandy soils are suitable for its burrow (Forsyth 1999). Widespread in the Sandhills (Freeman 1998). Widespread distribution in Nebraska (Jones et al. 1983).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution



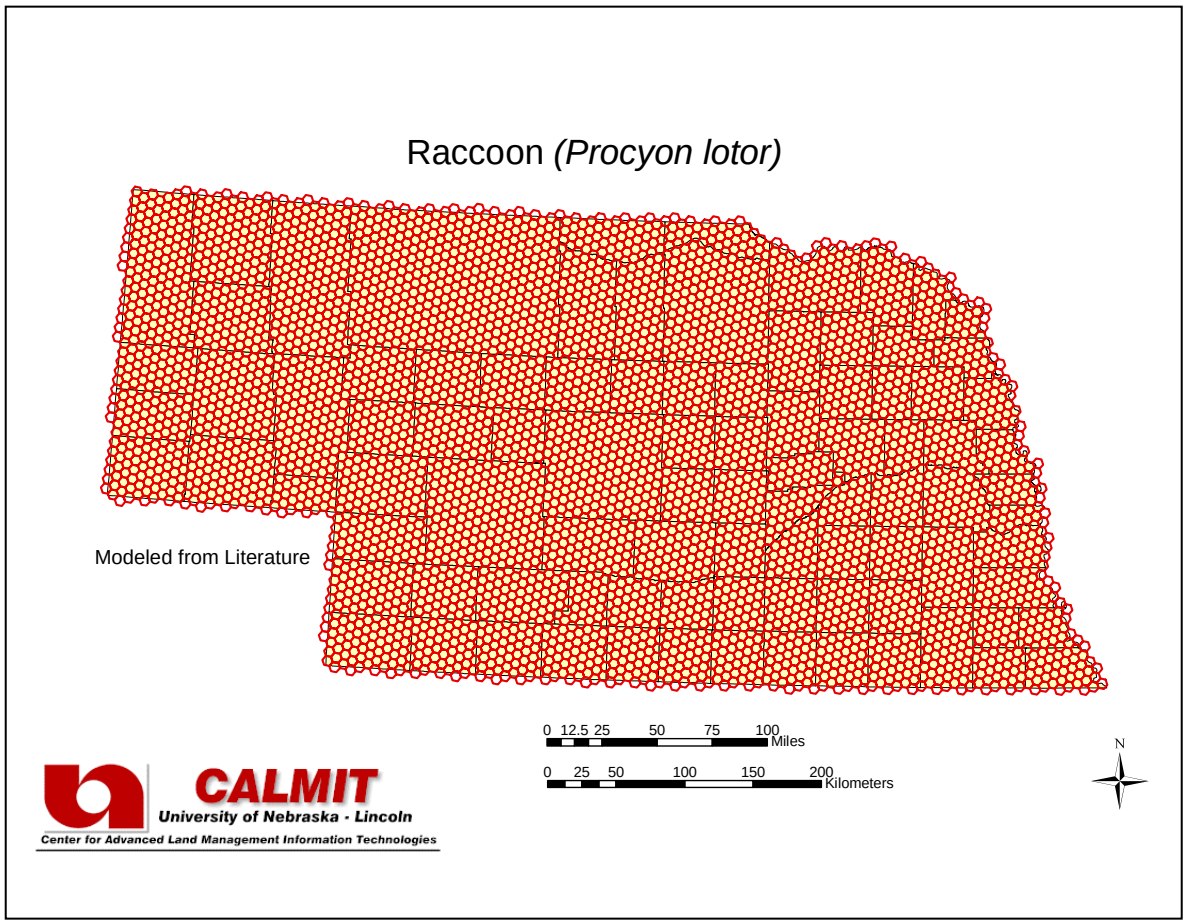
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Raccoon**	TNC Global Status:	G5
Scientific Name:	***Procyon lotor***	Federal Status:	-
TNC Element Code:	AMAJE02010	State (NE) Status:	S5

Habitat Description:
Currently, raccoons are common statewide although they remain more abundant in eastern Nebraska (NGPC 2002). In western and central Nebraska, raccoons are most abundant along major rivers and streams. Raccoons are primarily forest inhabitants and most trees in Nebraska grow near water, so raccoons here are usually associated with rivers and streams (riparian areas). Ideal raccoon habitat is a well-timbered area containing several large, mature trees and including a combination of grain crops and water. Often found in cities and suburbs as well as in rural areas (Whitaker 1997). Raccoons prefer timbered habitats, where they occupy dens in hollow trees and old squirrel nests (Jones et al. 1985). They also can live in treeless areas in ground dens (Jones et al. 1983).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



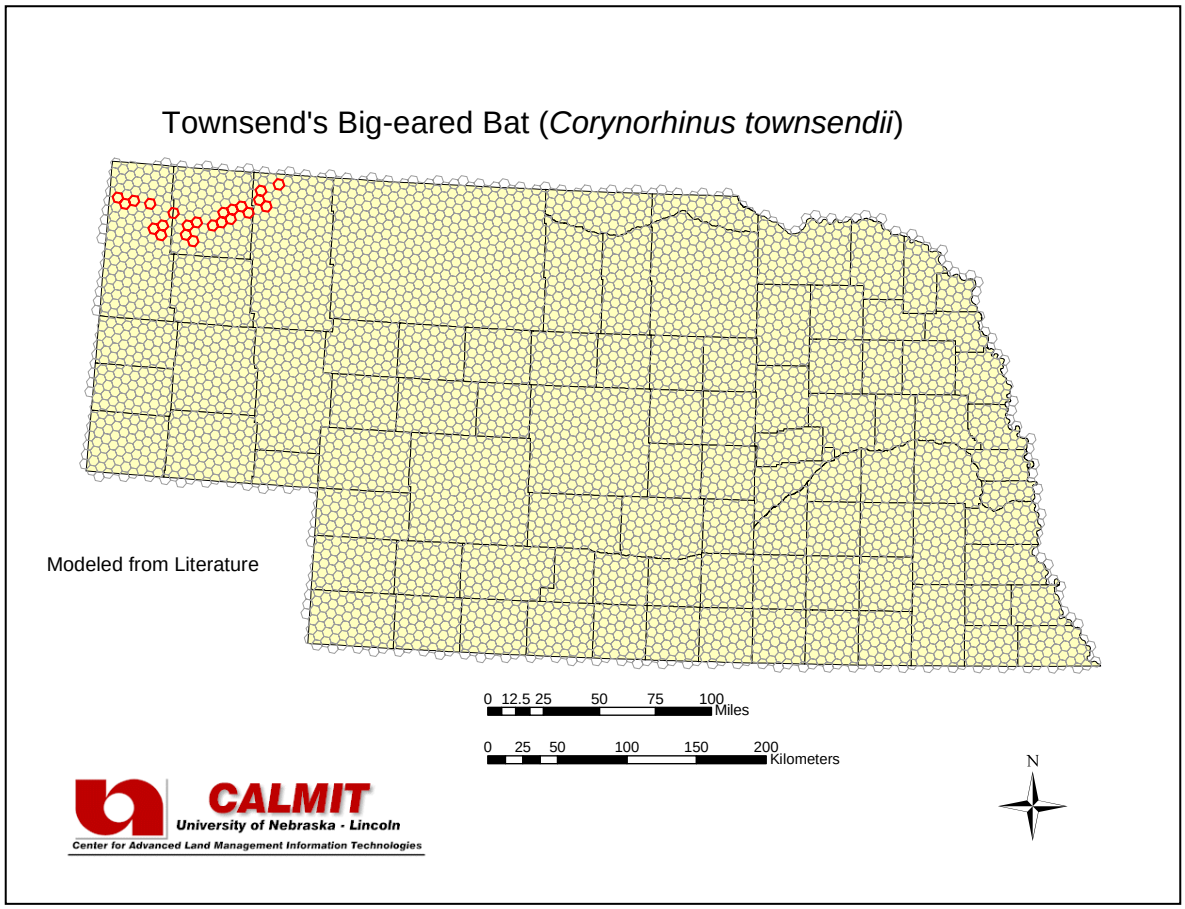
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Townsend's big-eared bat**	TNC Global Status:	G4
Scientific Name:	***Corynorhinus townsendii***	Federal Status:	-
TNC Element Code:	AMACC08010	State (NE) Status:	S1

Habitat Description:
Their most typical habitat is arid western desert scrub and pine forest regions (Bat Conservation International 2002). Known from only one location on the Pine Ridge in northwestern Nebraska (Jones et al. 1983). In the west, scrub deserts and pine and pinon-juniper forests. Usually roosts in caves, sometimes in buildings (Whitaker 1997). Cultivated valleys bordered by deciduous forests, brush, junipers or pine forest (Forsyth 1999).

Total Area of Modeled Habitat (ha): 93,258

Model Description:
Modeled from literature using the set of variables 'Land Cover class Ponderosa Pine Forests and Woodlands > 12.5%' AND 'Land Cover class Barren/Sand/Outcrop is present' AND 'Elevation > 900 m'.



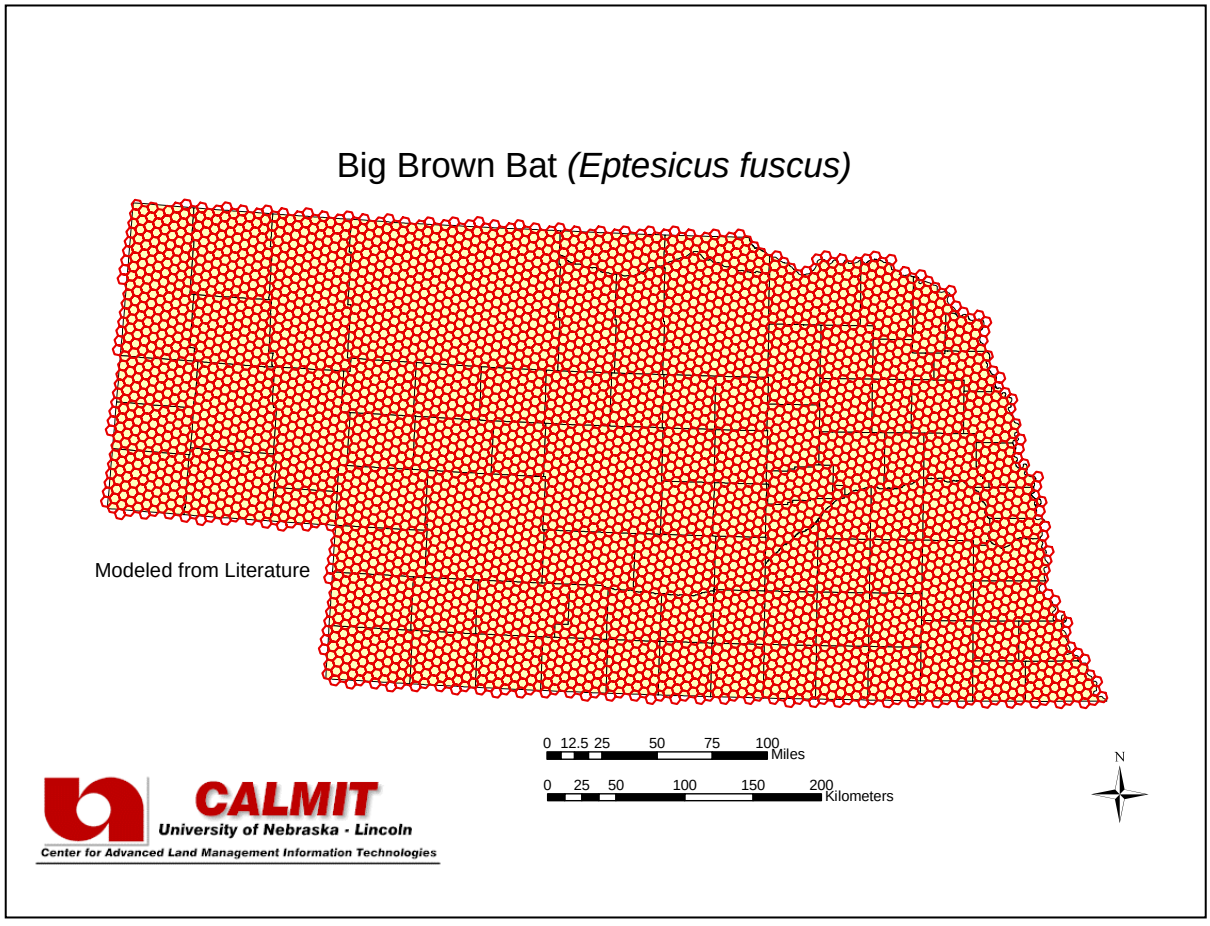
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Big brown bat**	TNC Global Status:	G5
Scientific Name:	***Eptesicus fuscus***	Federal Status:	-
TNC Element Code:	AMACC04010	State (NE) Status:	S5

Habitat Description:
Occurs primarily in woodlands; hibernates in caves, mines, or crevices, with summer colonies in buildings or hollow trees (Whitaker 1997). The big brown bat is found in virtually every American habitat ranging from timberline meadows to lowland deserts, though it is most abundant in deciduous forest areas. It is often abundant in suburban areas of mixed agricultural use (Bat Conservation International 2002), in urbanized areas, around farm buildings, pastures, meadows, creeks, ponds and wooded areas (Forsyth 1999). The big brown bat inhabits cities, towns, and rural areas, but is least commonly found in heavily forested regions (Kurta 1995). It is widespread in the Sand Hills (Freeman 1998).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



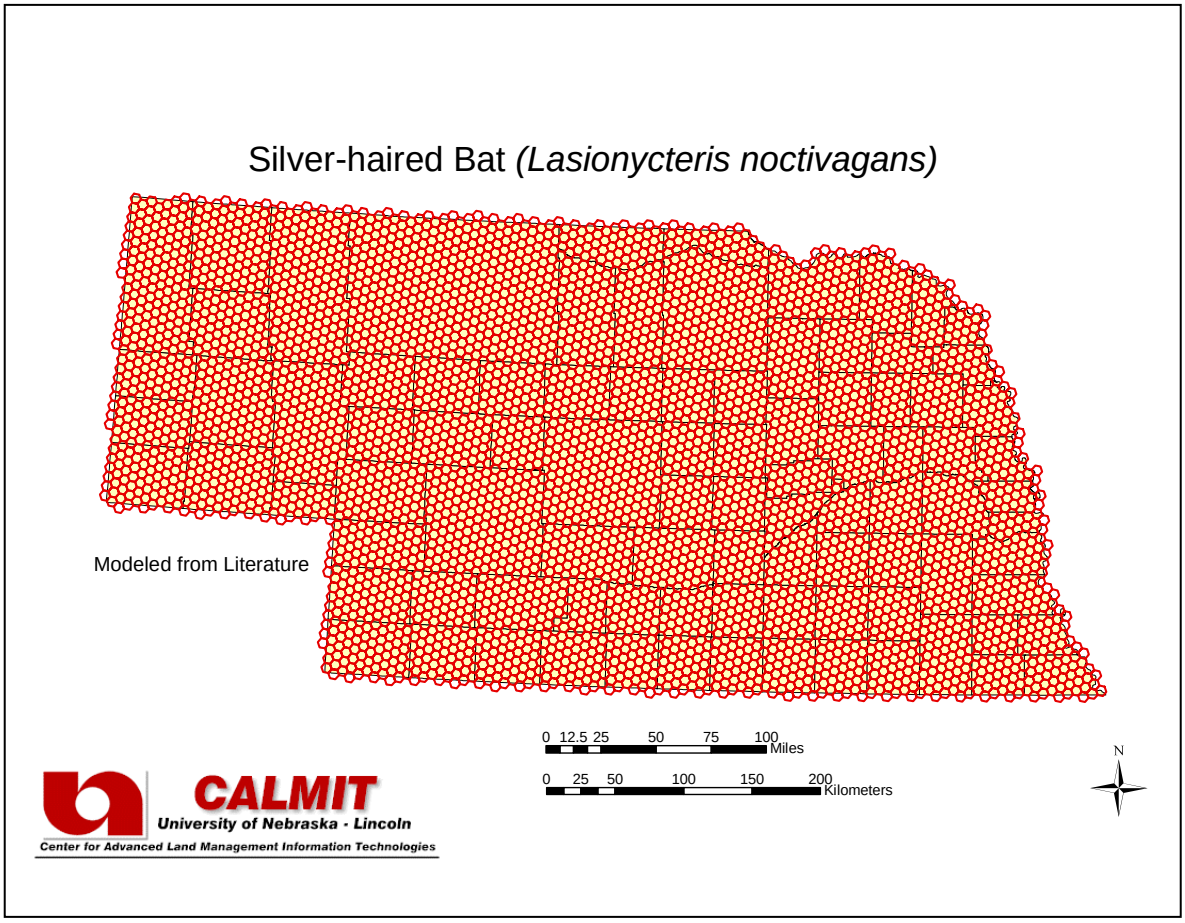
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Silver-haired bat**	TNC Global Status:	G5
Scientific Name:	***Lasionycteris noctivagans***	Federal Status:	-
TNC Element Code:	AMACC02010	State (NE) Status:	S5

Habitat Description:
Primarily a tree-inhabiting species, prefers forested areas adjacent to lakes, ponds, and streams (NatureServe 2002). Usually found flying over rivers and lakes in forests and along wooded watercourses. Among the most common bats in forested areas of North America, most closely associated with coniferous or mixed coniferous and deciduous forest types (BCI 2002). Usually roosts in dense foliage of trees but will also roost under bark or in hollow trees, caves, crevices of rocks, and buildings. Also associated with grassland habitats. (Banfield 1974; Jones and Birney 1988; Kunz 1982, 1999; Mattson et al. 1996; Schwartz 1981). Widespread in the Sand Hills (Freeman 1998). The silver-haired bat may be present in Nebraska only during their migrations north in the late spring and south in the late summer and early autumn (Jones 1964).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



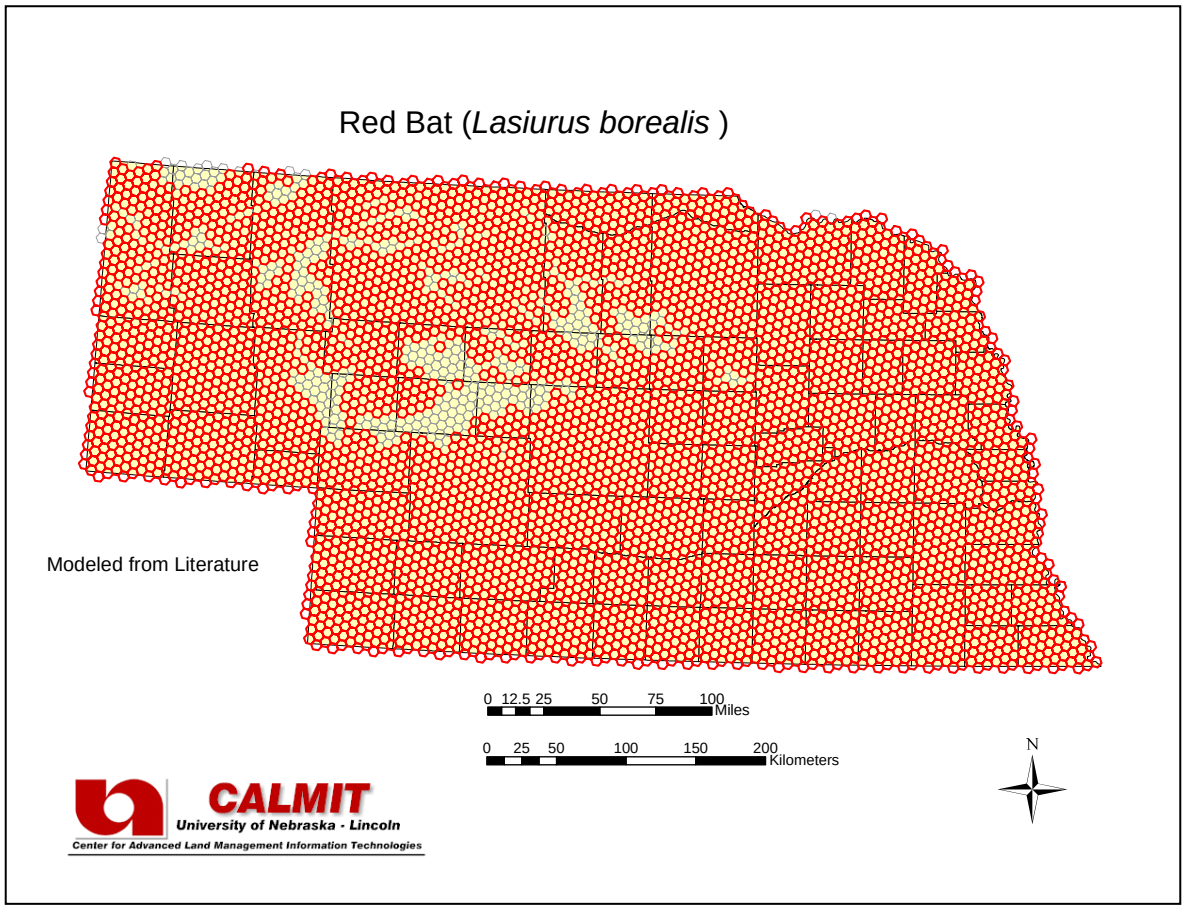
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Red bat**	TNC Global Status:	G5
Scientific Name:	***Lasiurus borealis***	Federal Status:	-
TNC Element Code:	AMACC05010	State (NE) Status:	S5

Habitat Description:
Forests, forest edges, hedgerows and other wooded areas; also adapted to villages and towns (Forsyth 1999). Open deciduous and coniferous forests provide suitable habitat (Benedict et al. 2000). Red bats roost in trees and occasionally in other vegetation and are among the most conspicuous bats in the eastern part of the Dakotas and Nebraska, where their preferred wooded habitat prevails. They are relatively rare in the western part of Nebraska (Jones et al. 1983), although more recent records indicate a westward expansion (Benedict et al. 2000). In the Sand Hills, red bats have been found only in the central Niobrara River valley (Freeman 1998).

Total Area of Modeled Habitat (ha): 1.87×10^7

Model Description:
Modeled from literature using the set of variables 'Land Cover class Deciduous Forests and Woodlands < 2.5 %' OR 'Land Cover class Juniper Woodlands > 2.5%'.



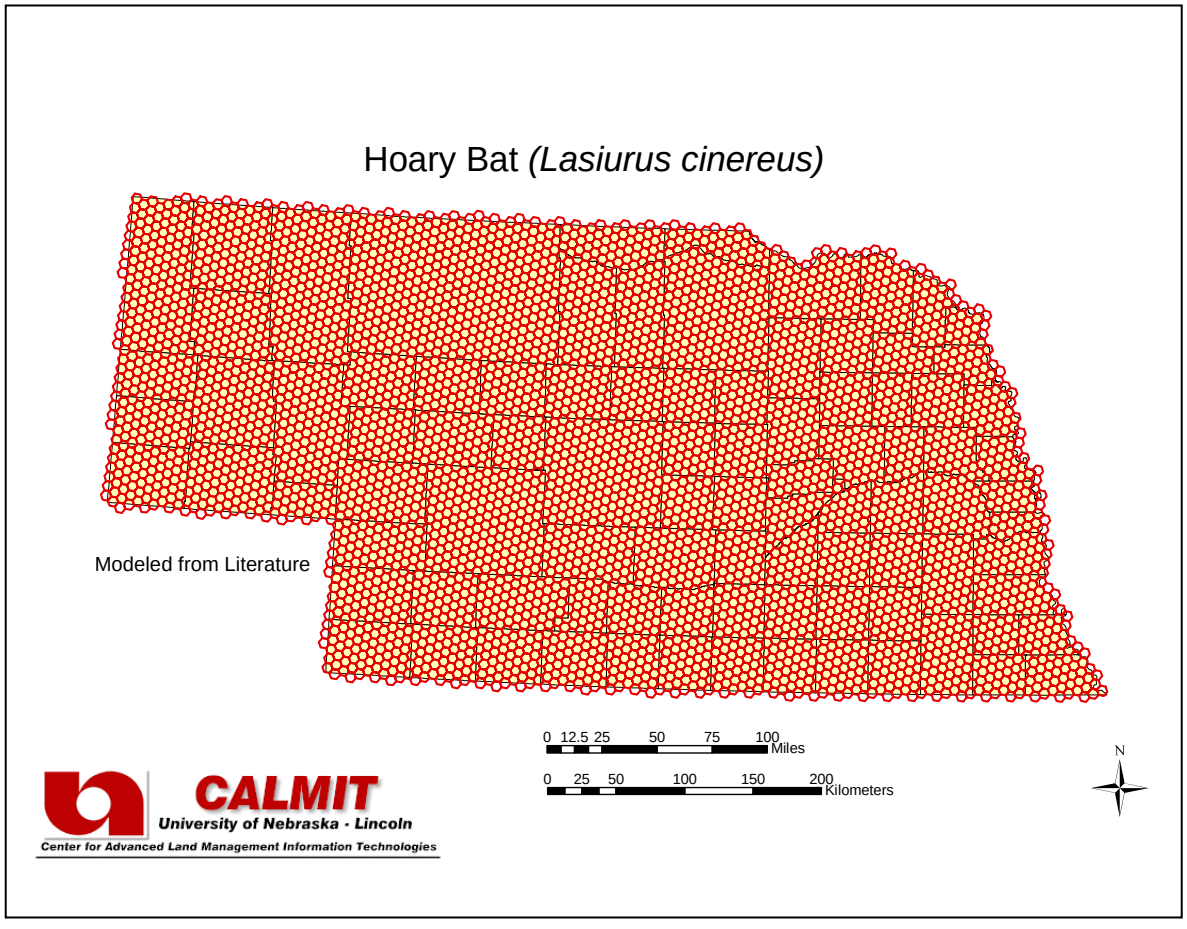
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Hoary bat**	TNC Global Status:	G5
Scientific Name:	***Lasiurus cinereus***	Federal Status:	-
TNC Element Code:	AMACC05030	State (NE) Status:	S5

Habitat Description:
Both deciduous and coniferous forests, as well as desert canyons. Roosts in foliage (Whitaker 1997). The usual roost is well covered above with vegetation, open below, and situation 10-15 feet above the ground (Jones et al. 1983). Wooded areas, especially coniferous regions (Forsyth 1999). Widespread in the Sand Hills (Freeman 1998).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



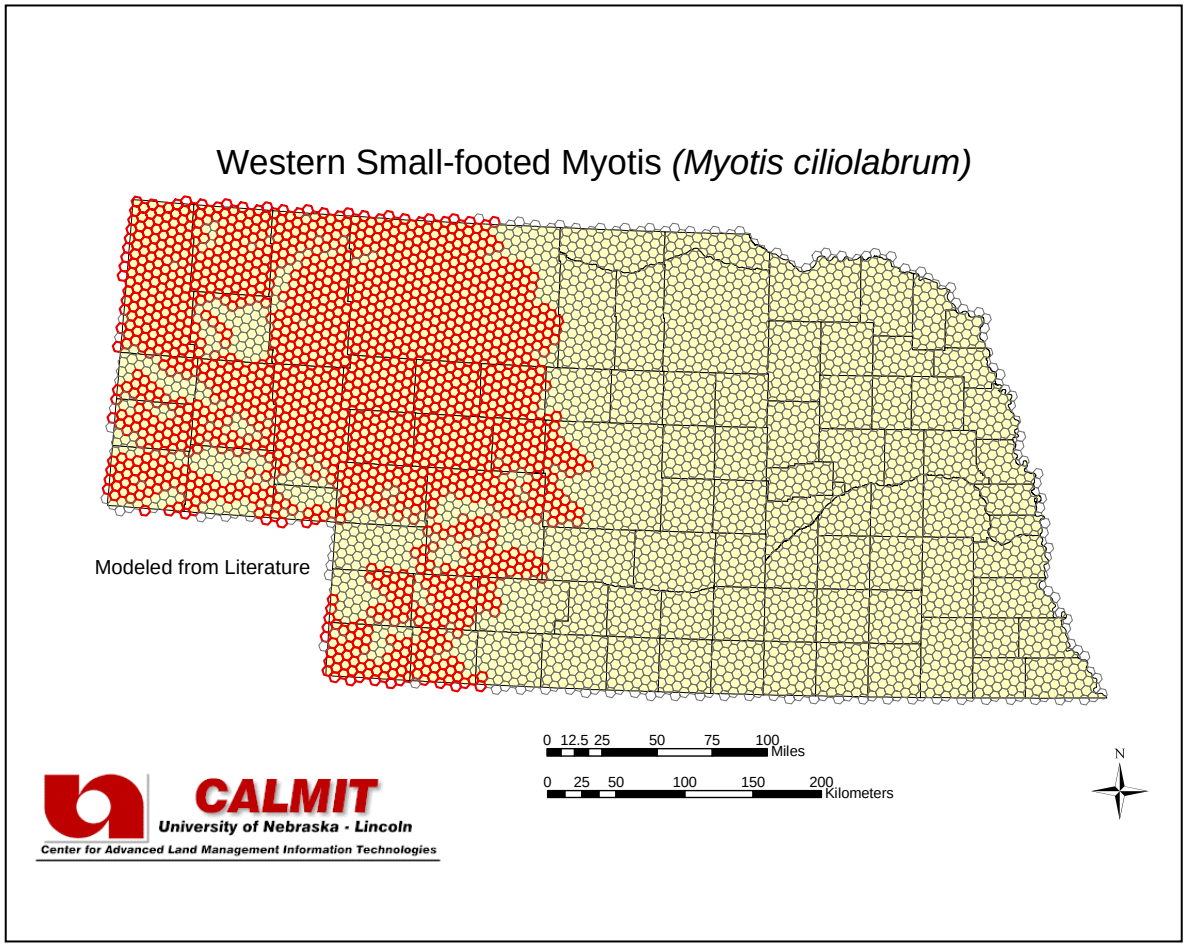
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Western small-footed myotis**	TNC Global Status:	G5
Scientific Name:	***Myotis ciliolabrum***	Federal Status:	-
TNC Element Code:	AMACC01140	State (NE) Status:	S4

Habitat Description:
Arid and shortgrass prairie regions; cliffs, talus, or clay buttes or riverbanks in prairie areas (Whitaker 1997). Its distribution is closely associated with rocky habitats and is discontinuous over much of the plains region. It is found on the Pine Ridge in Nebraska (Jones et al. 1985). Widespread in the Sand Hills (Freeman 2002). The small-footed myotis is closely associated with rocky habitats throughout much of its distribution. On the Northern Plains it occurs most frequently in areas with dissected breaks and badlands, ridges, cliffs, or major outcroppings prevalent in western North Dakota, South Dakota and Nebraska.

Total Area of Modeled Habitat (ha): 6,783,375

Model Description:
Modeled from literature using the set of variables 'Average Elevation > 850 m' AND 'Slope class 2-5 percent > 15%'.



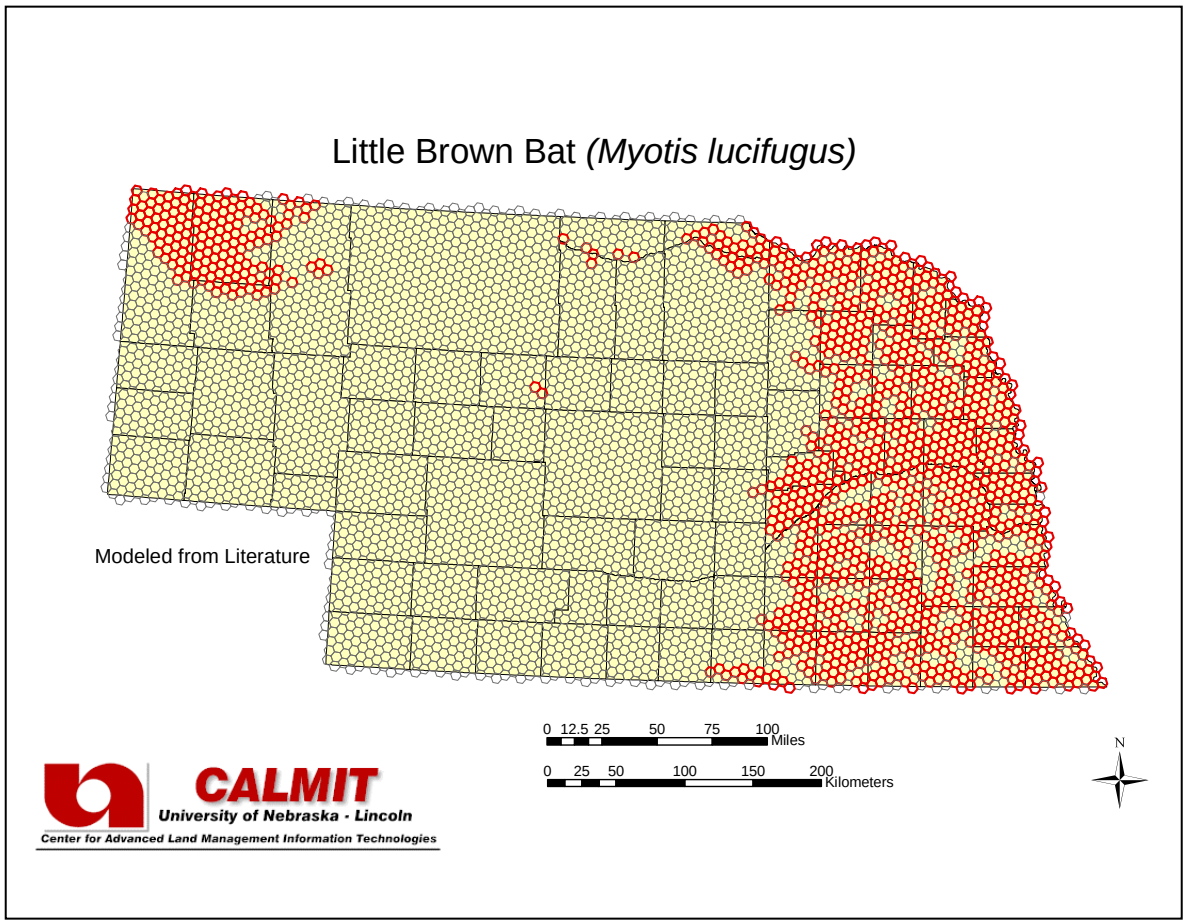
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Little brown bat**	TNC Global Status:	G5
Scientific Name:	***Myotis lucifugus***	Federal Status:	-
TNC Element Code:	AMACC01010	State (NE) Status:	S4

Habitat Description:
Areas along streams and lakes; in summer, forms nursery colonies, usually in buildings or other structures. In winter, hibernates in caves and mines in the East (Whitaker 1997). This bat is widespread and frequently inhabits man-made structures (Jones et al. 1985). Caves, mine tunnels, hollow trees; has adapted to urban life during summer months and uses buildings as roosting sites (Forsyth 1999). In Nebraska two subspecies have been tentatively identified as occurring in the northwestern corner (*M.l. carissima*) and eastern third (*M.l. lucifugus*) of the state (Jones et al. 1983). Colonies are usually found near a body of water, such as a lake, pond, or stream.

Total Area of Modeled Habitat (ha): 5,043,935

Model Description:
Modeled from literature using the set of variables ('Elevation < 550 m' AND Stream Class is present') OR ('Land Cover class Ponderosa Pine Forests and Woodlands > 20%' OR 'Land Cover class Western Wheatgrass Mixedgrass Prairie is present').



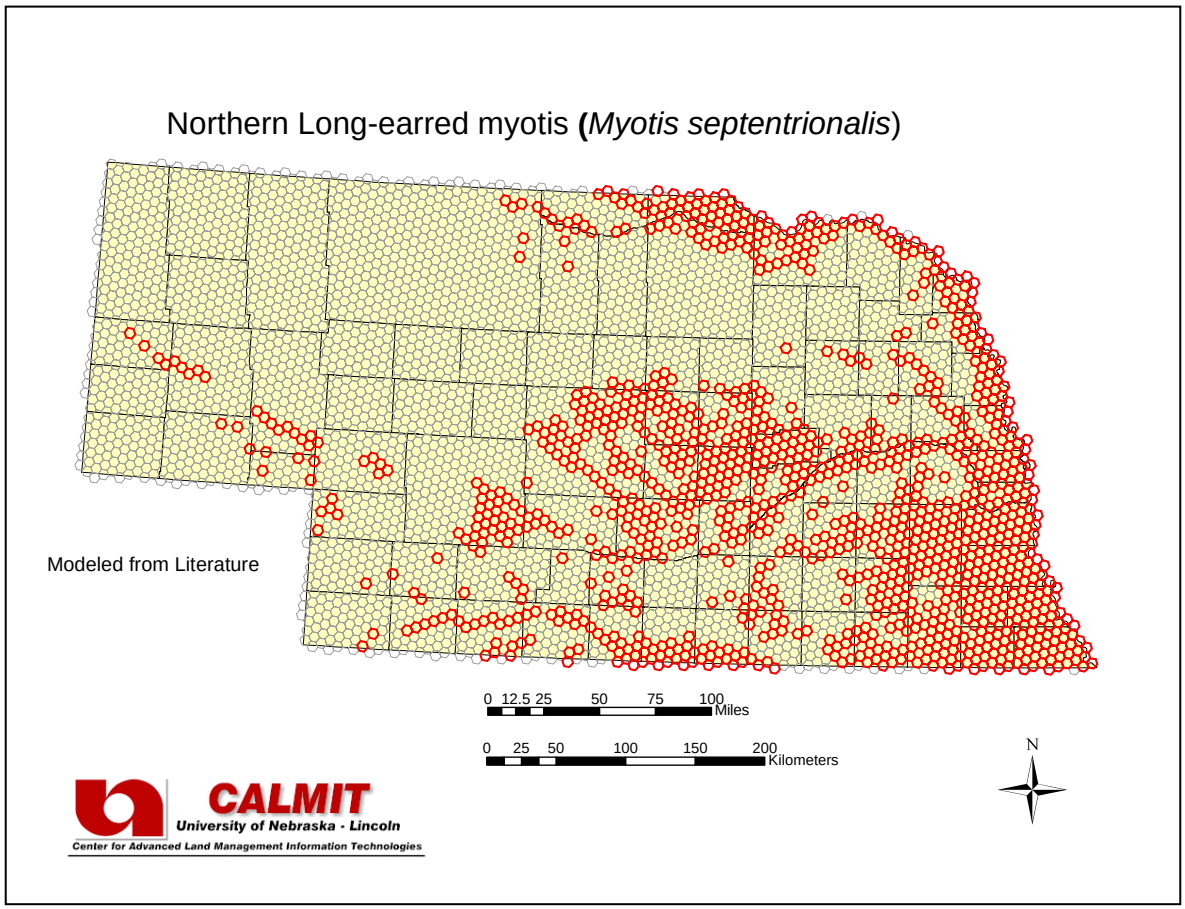
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Northern long-earred myotis**	TNC Global Status:	G4
Scientific Name:	***Myotis septentrionalis***	Federal Status:	-
TNC Element Code:	AMACC01150	State (NE) Status:	S3

Habitat Description:
Formerly *Myotis keenii* (BCI 2002). Woods and wooded streams. Hibernates in caves and mines in winter; usually roosts under loose bark, shutters, and shingles, but sometimes in buildings in summer (Whitaker 1997). Dry forests, coniferous boreal forests (Forsyth 1999). In winter they are often found roosting in caves and mines throughout their range (Wilson and Ruff 1999). Small, highly fragmented, or young forests that provide limited areas of subcanopy foraging habitat may not be suitable. Young forests may also lack appropriate nursery sites. A lack of suitable hibernacula may prevent occupancy of areas that otherwise have adequate habitat (Kurta 1982).

Total Area of Modeled Habitat (ha): 5,084,495

Model Description:
Modeled from literature using the set of variables 'Land Cover class Deciduous Forests and Woodlands > 2.5%' OR 'Land Cover class Juniper Woodlands > 2.5%' OR 'Land Cover class Emergent wetland > 0.5%' OR 'Land Cover class Riparian Woodland > 1%'.



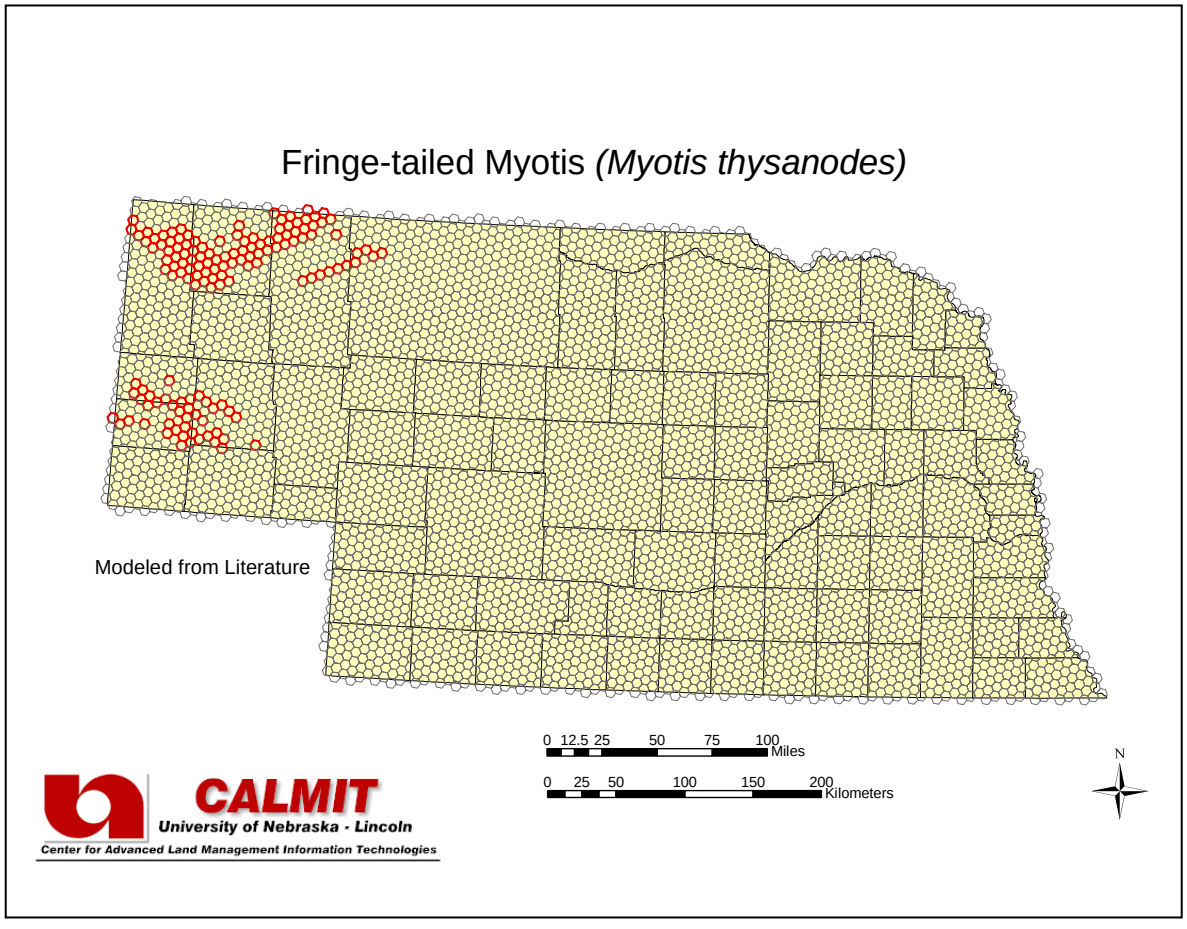
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Fringe-tailed myotis**	TNC Global Status:	G4G5
Scientific Name:	***Myotis thysanodes***	Federal Status:	-
TNC Element Code:	AMACC01090	State (NE) Status:	S1

Habitat Description:
Oak, pinyon, and juniper forests; desert scrub. Roosts in caves, mines, buildings, and other protected locations (Whitaker 1997). Found on the Pine Ridge and Wildcat Hills of the Nebraska Panhandle (Jones et al. 1985). Seems to prefer montane and upland forests (Jones el al. 1983).

Total Area of Modeled Habitat (ha): 571,704

Model Description:
Modeled from literature using the variables 'Land Cover class Ponderosa Pine Forests and Woodlands > 1%' AND 'Elevation > 995 m'.



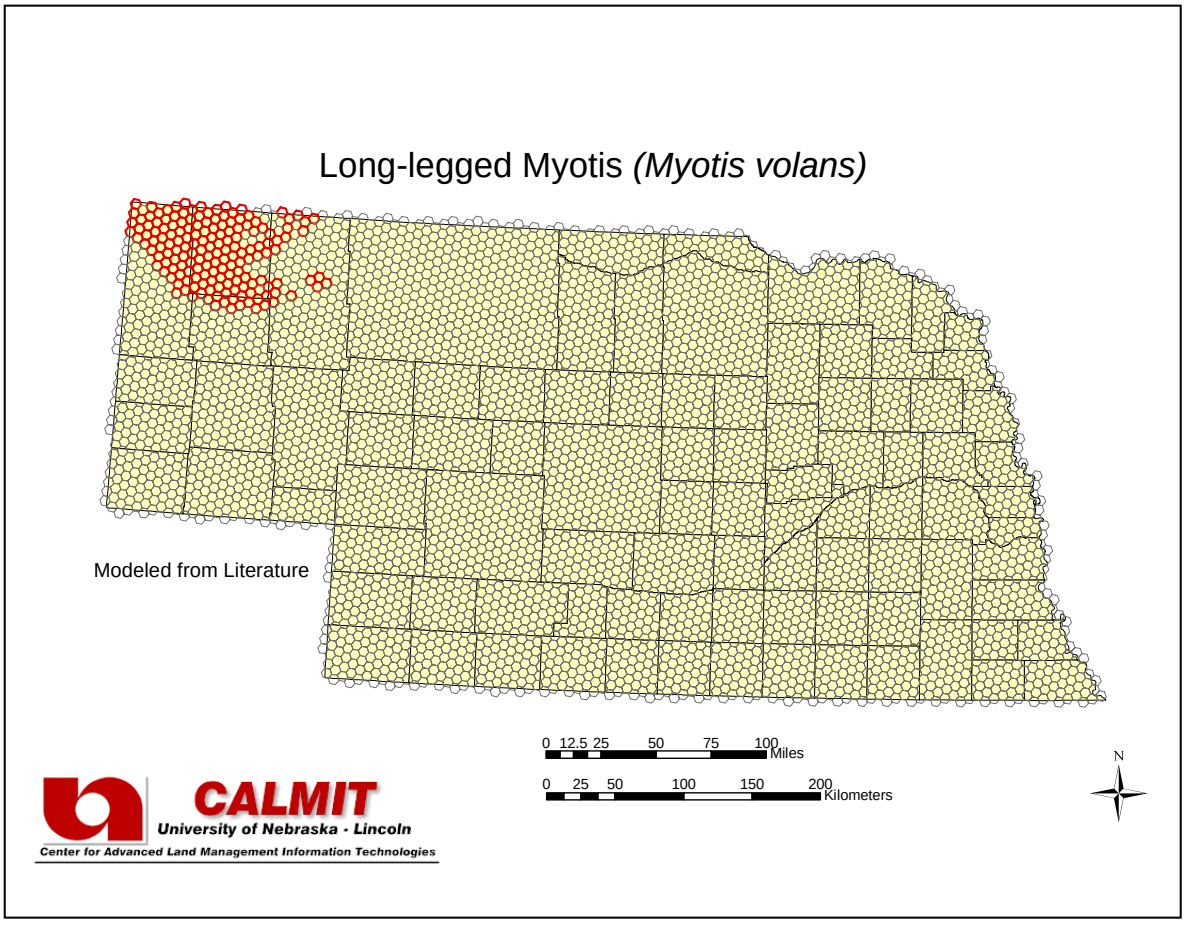
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Long-legged myotis**	TNC Global Status:	G5
Scientific Name:	***Myotis volans***	Federal Status:	-
TNC Element Code:	AMACC01110	State (NE) Status:	S2

Habitat Description:
Mainly coniferous forests; in summer, roosts in trees, crevices or buildings (Whitaker 1997). It principally inhabits open forest lands and appears to be the most common member of the genus on the Black Hills and on the pine-clad buttes of northwestern Nebraska (Jones et al. 1983). It seems to prefer open montane forests and often is common in coniferous habitats but is occasionally found in evergreen-deciduous forests and evidently tolerates the essentially treeless, barren badlands of northwestern Nebraska.

Total Area of Modeled Habitat (ha): 664,966

Model Description:
Modeled from literature using the set of variables 'Land Cover class Western Wheatgrass Mixedgrass Prairie is present' OR 'Land Cover class Ponderosa Pine Forests and Woodlands > 20%' AND 'Elevation > 1100 m'.



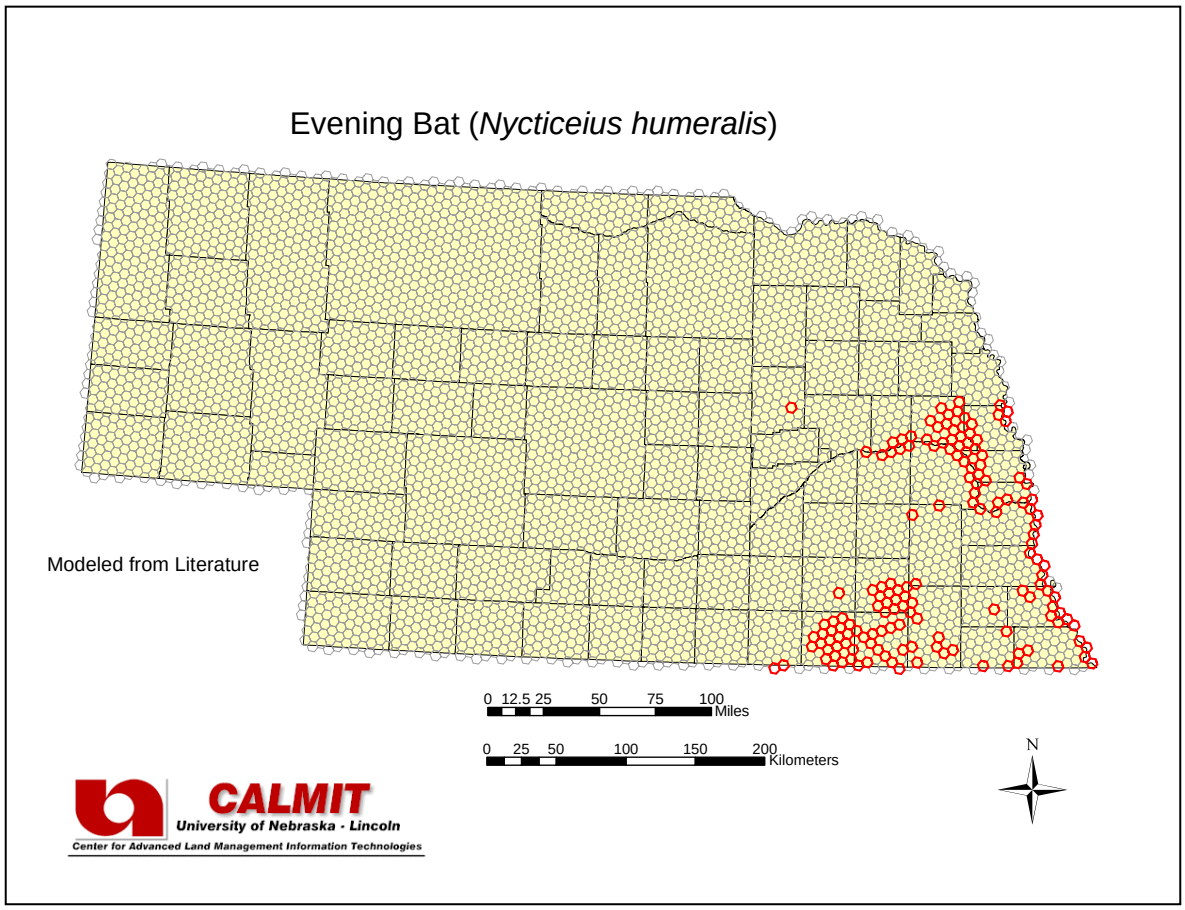
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Evening bat**	TNC Global Status:	G5
Scientific Name:	***Nycticeius humeralis***	Federal Status:	-
TNC Element Code:	AMACC06010	State (NE) Status:	S3

Habitat Description:
In Nebraska this bat is more or less restricted to riparian situations (Jones et al. 1985). The population of this bat is mostly found in the southeastern part of the state (Jones et al. 1983) but is expanding westward, probably in response to increasing woodlands along river systems (Benedict et al. 2000). Woodland or mixed woodland and open areas. In summer, roosts in buildings and hollow trees; winter residences not known (Whitaker 1997).

Total Area of Modeled Habitat (ha): 616,298

Model Description:
Modeled from literature using the set of variables 'Land Cover class Deciduous Forests and Woodlands is present' AND 'Land Cover class Riparian Woodland is present' AND '30-year Average Precipitation for August > 86 mm'.



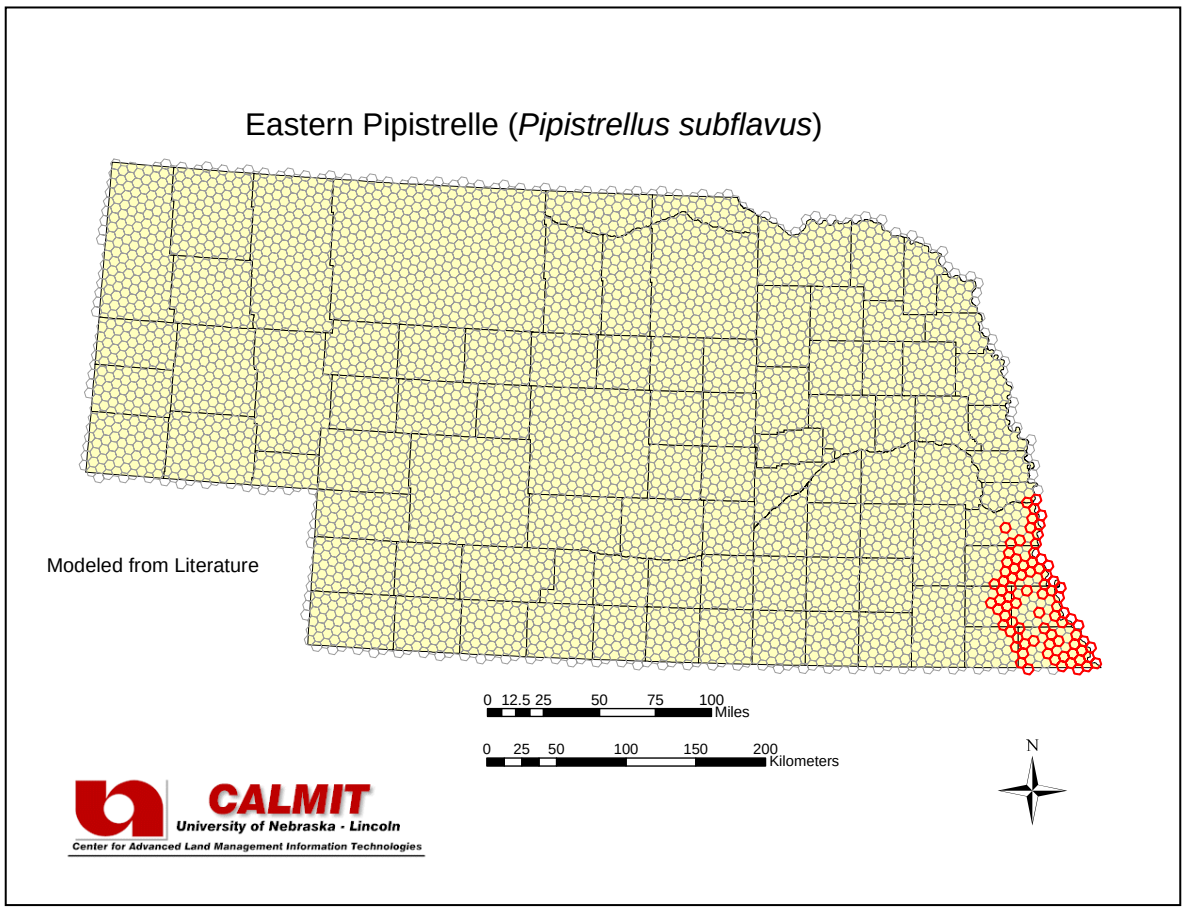
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Eastern pipistrelle**	TNC Global Status:	G5
Scientific Name:	***Pipistrellus subflavus***	Federal Status:	-
TNC Element Code:	AMACC03020	State (NE) Status:	S1

Habitat Description:
Little is known of its habitat in summer but individuals are thought to forage primarily in open wooded areas and along the borders of woodlands, frequently near or over water; rarely do these pipistrelles forage in deep woods or over open fields (Jones et al. 1983). Wooded areas along slow-moving streams or rivers; near water (Forsyth 1999). Distribution in Nebraska shown to be only southeastern corner of state (Bat Conservation International 2002).

Total Area of Modeled Habitat (ha): 336,536

Model Description:
Modeled from literature using the set of variables 'Land Cover class Riparian Woodland is present' AND '30-year Average Precipitation for July > 97 mm'.



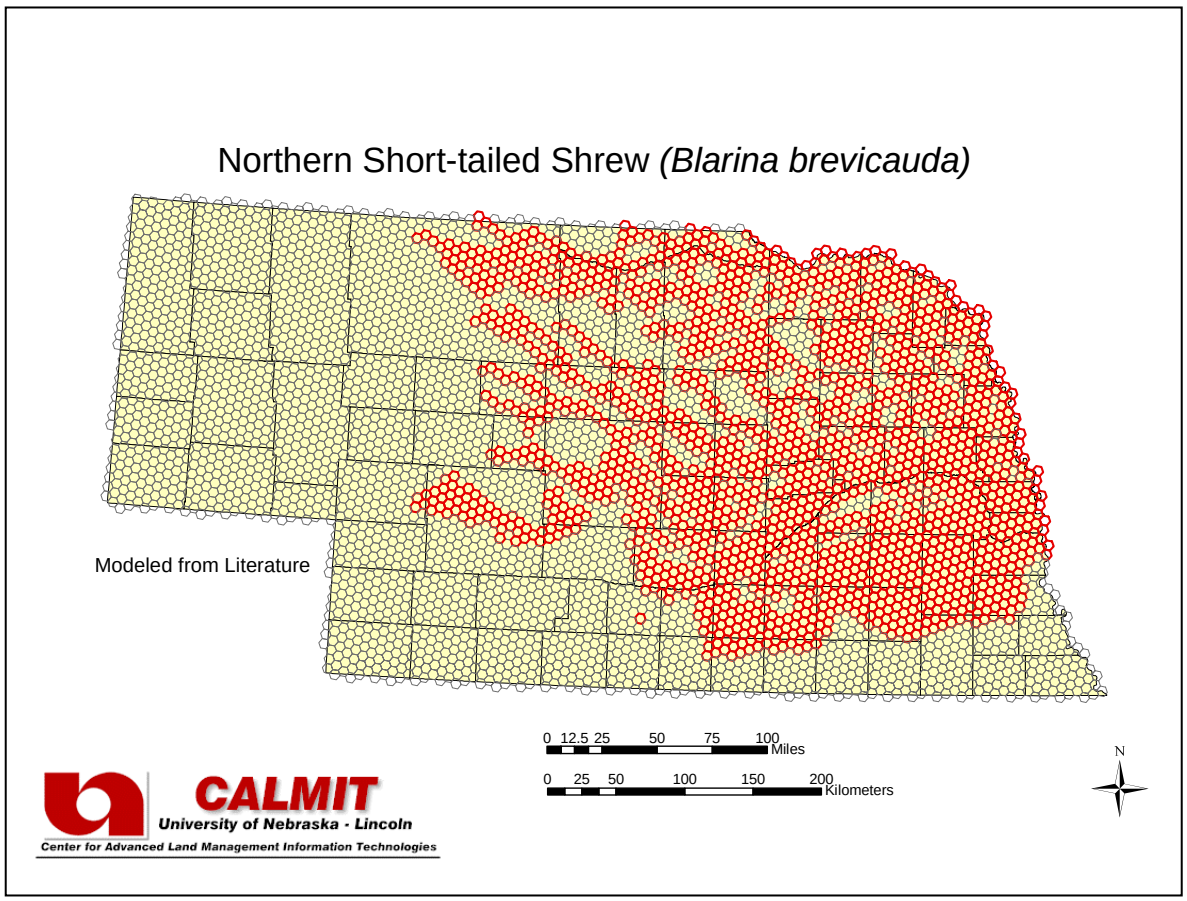
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Northern short-tailed Shrew**	TNC Global Status:	G5
Scientific Name:	***Blarina brevicauda***	Federal Status:	-
TNC Element Code:	AMABA03010	State (NE) Status:	S3

Habitat Description:
Short-tailed shrews are most common in areas with greater than 50% herbaceous cover (Getz 1989; Hazard 1982; Hamilton 1979; Jones et al.1988). They avoid areas with little cover and temperature extremes. Have high moisture requirements and are usually associated with wet habitats but can occur in a variety of habitats including grasslands, deciduous forests, marshy areas, bogs, and coniferous forests. Power line corridors seem to be a dispersal barrier for shrews. Within wooded habitats, food is the limiting factor (George et al.1986).

Total Area of Modeled Habitat (ha): 7,290,198

Model Description:
Modeled from literature using the set of variables ('30-year Average Maximum Temperature Coefficient of Variation for April > 6.5%' AND 'Stream class is present' AND 'Elevation < 950 m') OR ('30-year Average Maximum Temperature Coefficient of Variation for April <= 6.5%' AND '30-year Average Precipitation for March > 47.5 mm' AND '30-year Average Maximum Temperature Coefficient of Variation for March > 11.9%').



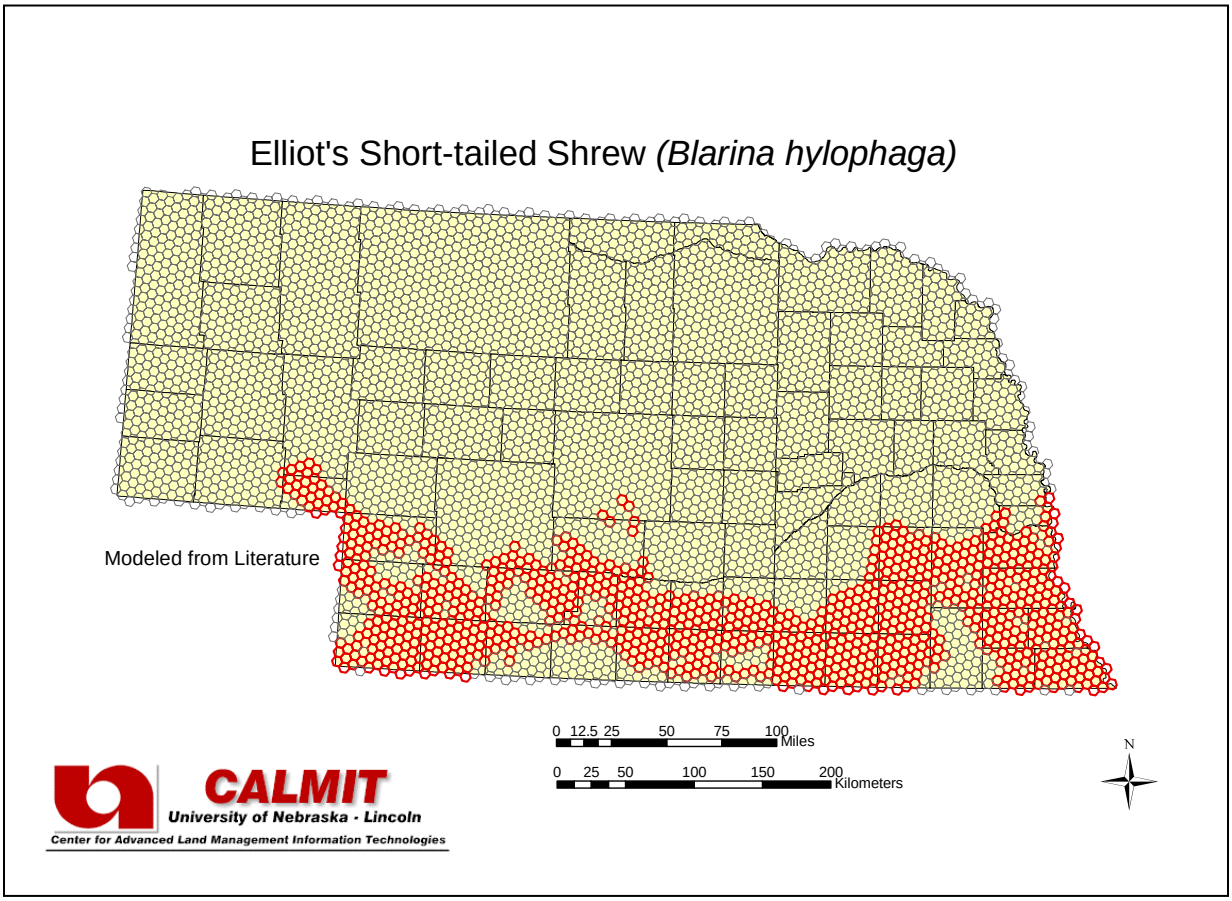
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Elliot's Short-tailed shrew**	TNC Global Status:	G5
Scientific Name:	***Blarina hylophaga***	Federal Status:	-
TNC Element Code:	AMABA03030	State (NE) Status:	S3

Habitat Description:
Oak-elm floodplain forest, wooded ravines, and grassy or weedy fields, sometimes in marshy areas or wet woods (Whitaker 1997). Positive association to habitats with well-developed plant litter layers (Kaufman et al. 2000). It is found in moist areas with good cover, most commonly tall, dense grass in ditches, riparian habitats, and along roadsides (Wilson and Ruff 1999). Found only in southern Nebraska (NatureServe 2002).

Total Area of Modeled Habitat (ha): 4,046,537

Model Description:
Modeled from literature using the set of variables '30-year Average Maximum Temperature for April <= 6.5ºC' AND '30-year Average Maximum Temperature for March < 13ºC' AND 'Hydric Soils are present'.

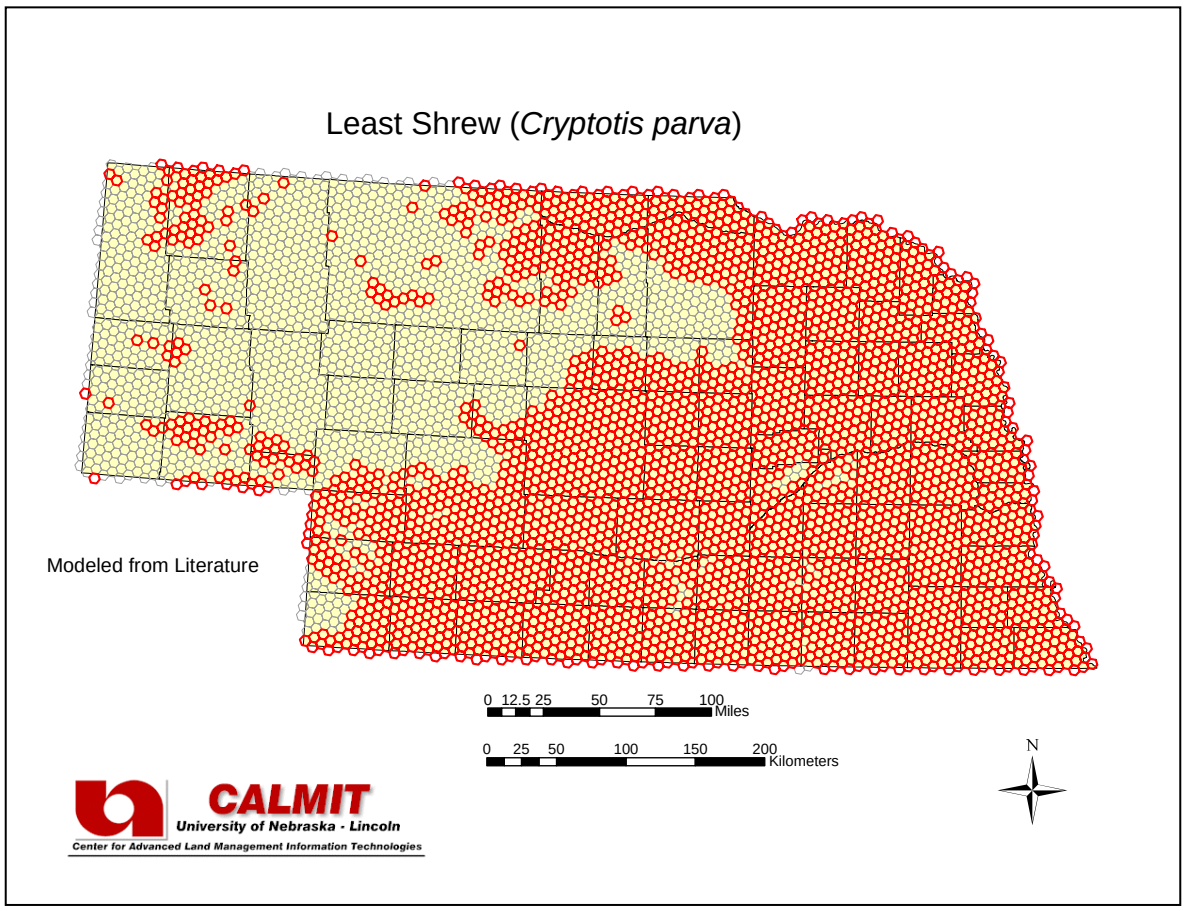


Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Least shrew**	TNC Global Status:	G5
Scientific Name:	***Cryptotis parva***	Federal Status:	-
TNC Element Code:	AMABA04010	State (NE) Status:	S4

Habitat Description:
The distribution is more extensive in the southern portion of the state (Jones 1964). Generally prefers upland prairies, weedy fencerows and fields, meadows, and grassy roadsides. Occasionally trapped in riparian, woodland, and marshy areas. Occurs from sea level to about 2950 m (George et al. 1994; Hamilton 1979; Hazard 1982; Jones 1988; Whitaker 1999). Needs dense herbaceous ground cover, especially grasses (Whitaker 1999).
Total Area of Modeled Habitat (ha): 1.32×10^7

Model Description:
Modeled from literature using the set of variables 'Land Cover class Upland Tallgrass Prairie is present' OR 'Land Cover class Little Bluestem-Gramma Mixedgrass Prairie < 1.5%'.



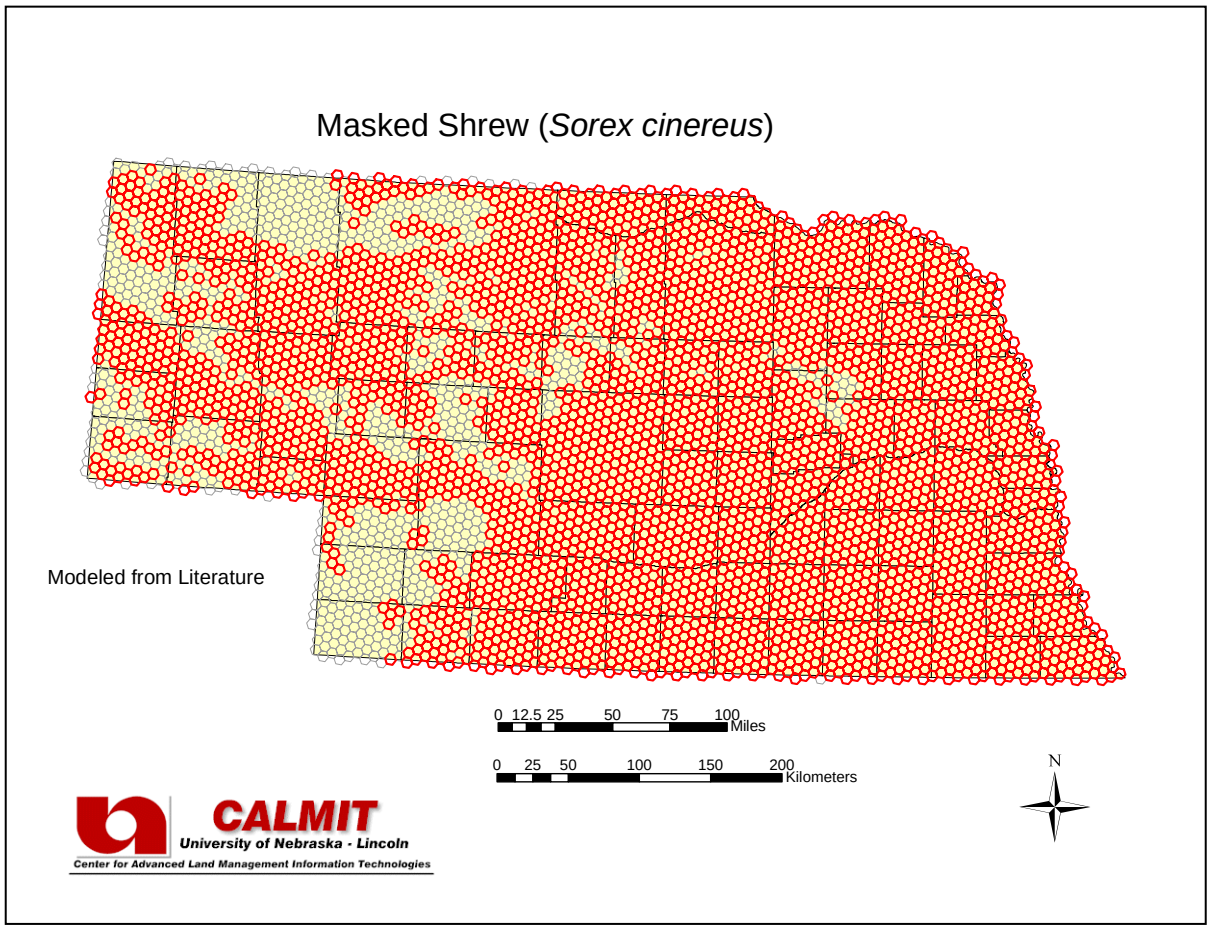
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Masked shrew**	TNC Global Status:	G5
Scientific Name:	***Sorex cinereus***	Federal Status:	-
TNC Element Code:	AMABA01010	State (NE) Status:	S4

Habitat Description:
Wet areas of the Sand Hills (Freeman 1998). Widely distributed and common in the coniferous and northern deciduous forest biomes up to timberline. It is found in a variety of habitats ranging from wet to quite dry, including forests, shrub thickets, and grassy and herbaceous areas (Wilson and Ruff 1999). Numerous habitats; most common in moist fields, bogs, marshes, and moist woods (Whitaker 1997). Moist or dry woods, willow-alder thickets and brushland (Forsyth 1999). No records of occurrence for southwestern Nebraska (Benedict et al. 2000).

Total Area of Modeled Habitat (ha): 1.62×10^7

Model Description:
Modeled from literature using the set of variables 'Land Cover class Emergent Wetland > 0.5%' OR 'Land Cover class Deciduous Forests and Woodlands > 0.1%' OR 'Land Cover class Juniper Woodlands > 0.1%' AND NOT 'Land Cover class Sandsage Shrubland is present'.



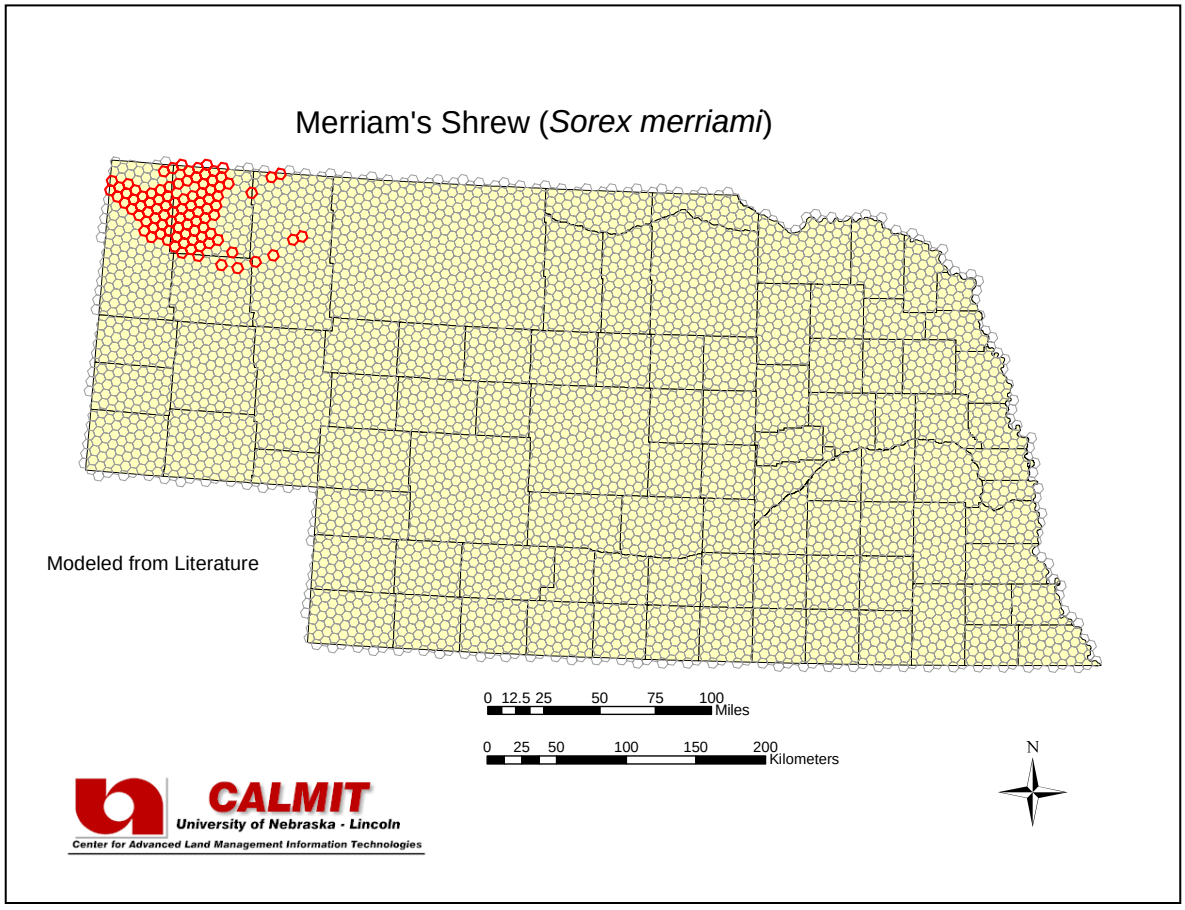
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Merriam's shrew**	TNC Global Status:	G5
Scientific Name:	***Sorex merriami***	Federal Status:	-
TNC Element Code:	AMABA01230	State (NE) Status:	S1

Habitat Description:
Prefers a much drier habitat than most shrews: sagebrush, grasslands, and woodlands (Whitaker 1997). Relatively dry habitats with sagebrush steppe being most common habitat but have also been found in semiarid grasslands, pinyon-juniper woodland, montane brushlands, and even mesic mixed woodlands of ponderosa pine, Douglas fir, and cottonwood (Wilson and Ruff 1999). In several western states it appears to be most common in areas of sagebrush and bunchgrasses (Jones et al. 1985). Most recent specimens have been from the northwestern corner of the state, in areas of grassland surrounded by open stands of Ponderosa Pine (Benedict et al. 1999).

Total Area of Modeled Habitat (ha): 389,249

Model Description:
Modeled from literature using the set of variables 'Land Cover class Western Wheatgrass Mixedgrass Prairie is present' AND 'Land Cover class Ponderosa Pine Forests and Woodlands is present'.



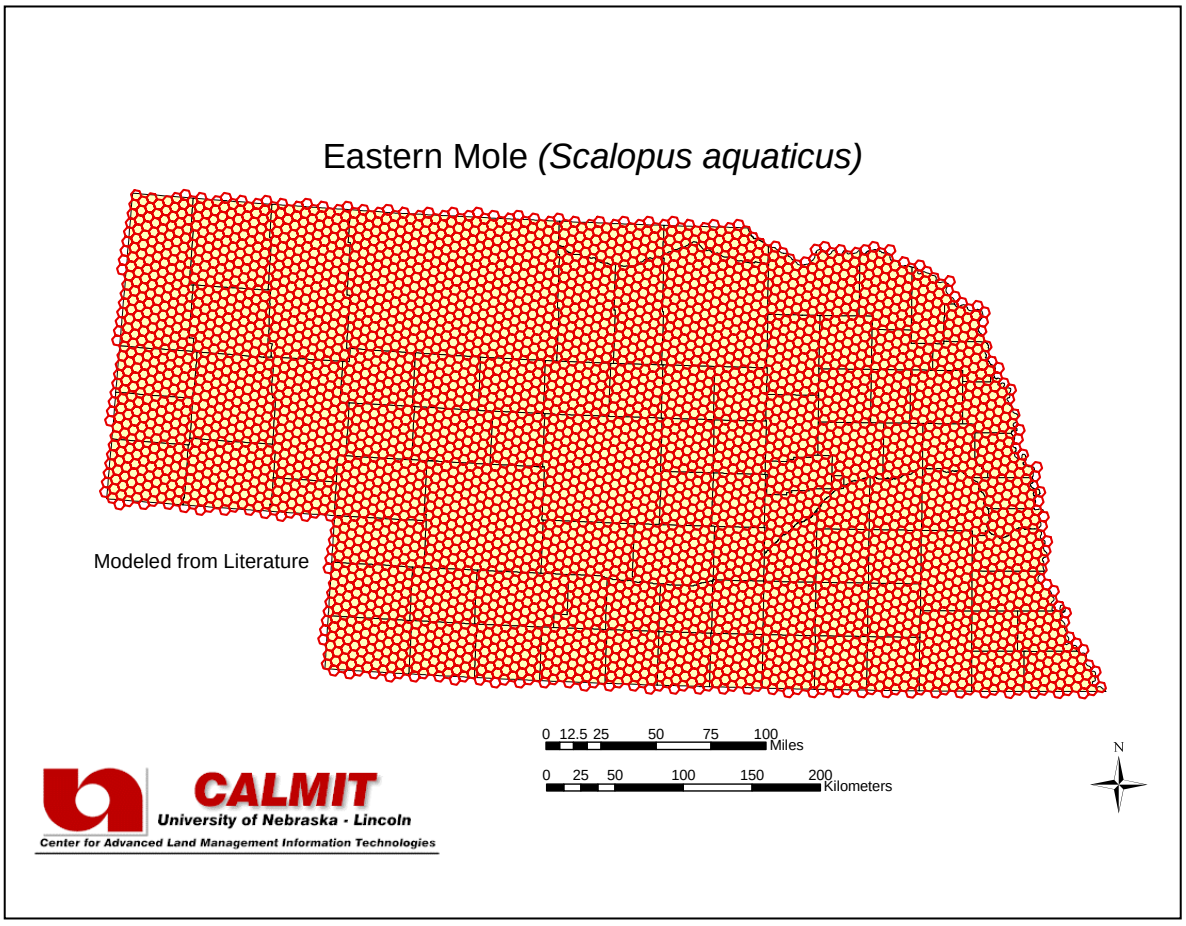
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Eastern mole**	TNC Global Status:	G5
Scientific Name:	***Scalopus aquaticus***	Federal Status:	-
TNC Element Code:	AMABB04010	State (NE) Status:	S5

Habitat Description:
In the western part of the state, these animals area found mostly along rivers and streams and around permanent ponds and lakes; they also colonize irrigated fields and such well-watered areas such as gardens, lawns, cemeteries and golf courses (Jones et al. 1983). Prefers moist loamy or sandy soils (Wilson and Ruff 1999). Usually trapped in riparian habitats (Freeman 1998). Open fields, waste areas, lawns, gardens and sometimes woods, in well-drained loose soil (Whitaker 1997). Is scarce or absent in heavy clay, stony, or gravelly soils, and avoids otherwise suitable soils that are too wet or too dry (Wilson and Ruff 1999).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



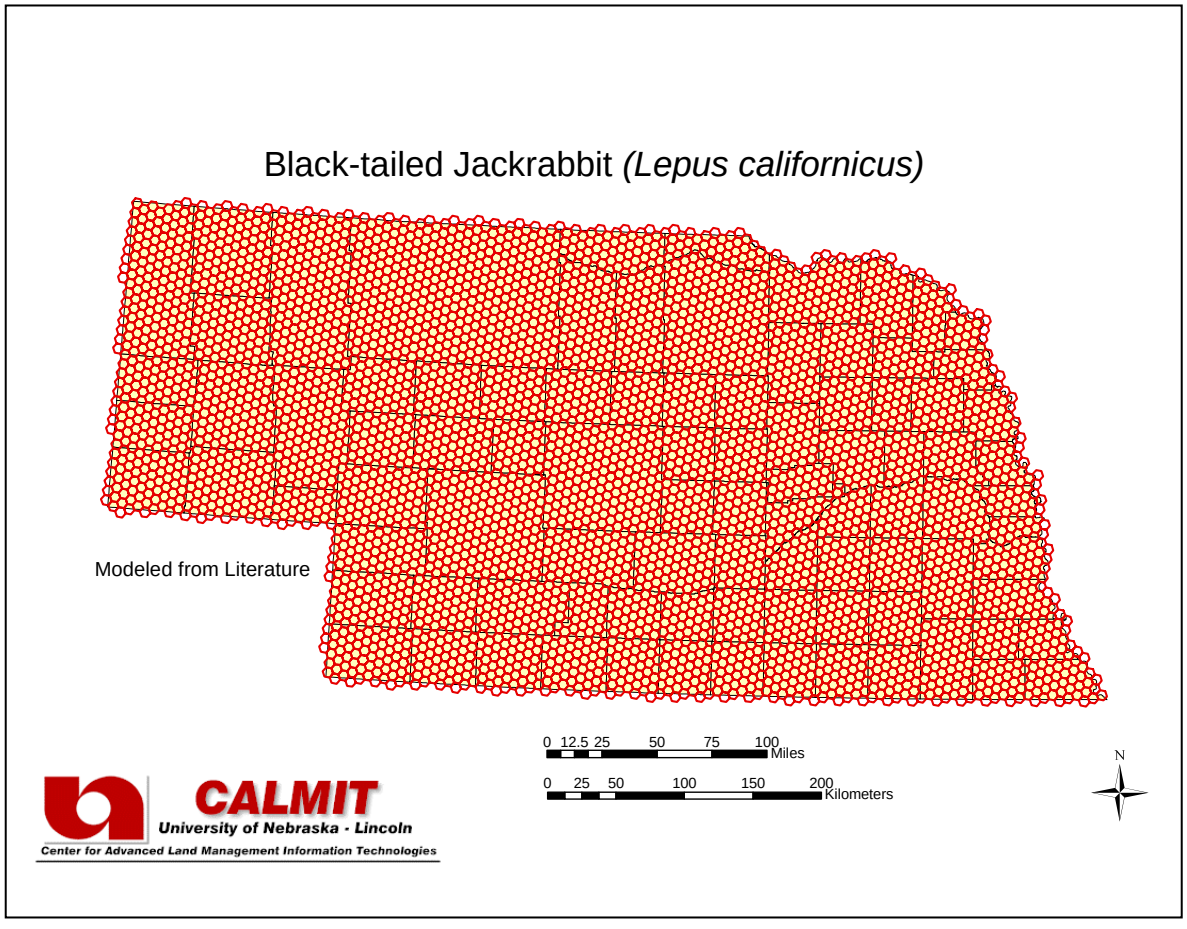
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Black-tailed jackrabbit**	TNC Global Status:	G5
Scientific Name:	***Lepus californicus***	Federal Status:	-
TNC Element Code:	AMAEB03050	State (NE) Status:	S5

Habitat Description:
Found all over Nebraska but more common in the southern part of the state (Jones 1964). Found in the Sand Hills (Freeman 1998), barren areas and prairies, meadows, and cultivated fields (Whitaker 1997). They do not move into areas of tall grass or forest where visibililty is obscured (Jones et al. 1983). Inhabits open plains, fields and deserts; open country with scattered thickets or patches of shrubs (Caire et al. 1989).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.

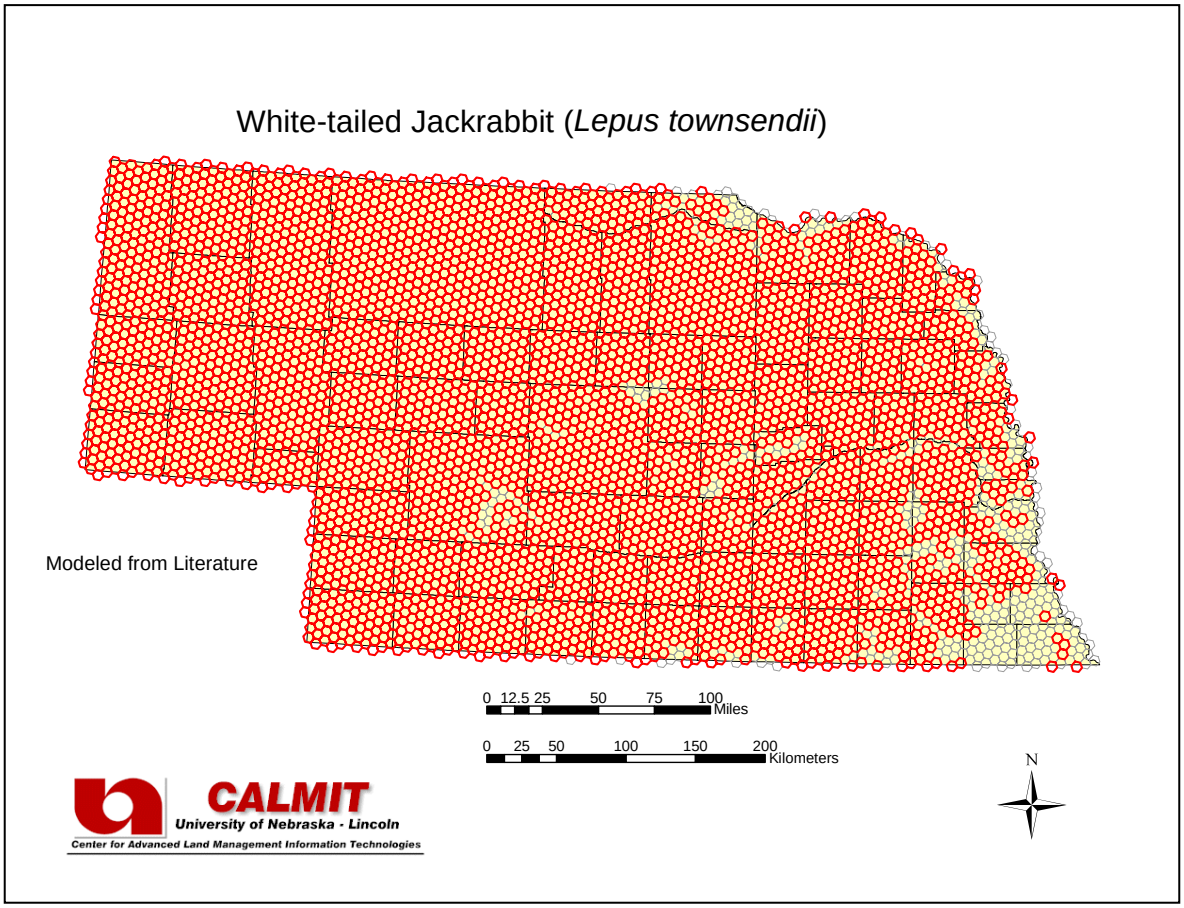


Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**White-tailed jackrabbit**	TNC Global Status:	G5
Scientific Name:	***Lepus townsendii***	Federal Status:	-
TNC Element Code:	AMAEB03040	State (NE) Status:	S4

Habitat Description:
Formerly found all over Nebraska excep in the extreme southeastern part (Jones 1964). Today it is more common in the northern part of the state, mostly north of the Platte River (Jones 1964) and is also found in the Sand Hills (Freeman 1998). Barren, grazed, or cultivated lands; grasslands (Whitaker 1997). Occur in open grasslands and sagebrush (Jones et al. 1985). Avoid forests and woodland (Jones et al. 1985). White-tailed jackrabbits prefer open grasslands but also thrive in pastures and fields.
Total Area of Modeled Habitat (ha): 1.86×10^7

Model Description:
Modeled from literature using the set of variables 'Land Cover class Agricultural Fields is present' OR 'Land Cover class Sandhills Upland Prairie is present' AND NOT 'Land Cover class Deciduous Forests and Woodlands > 5%'.



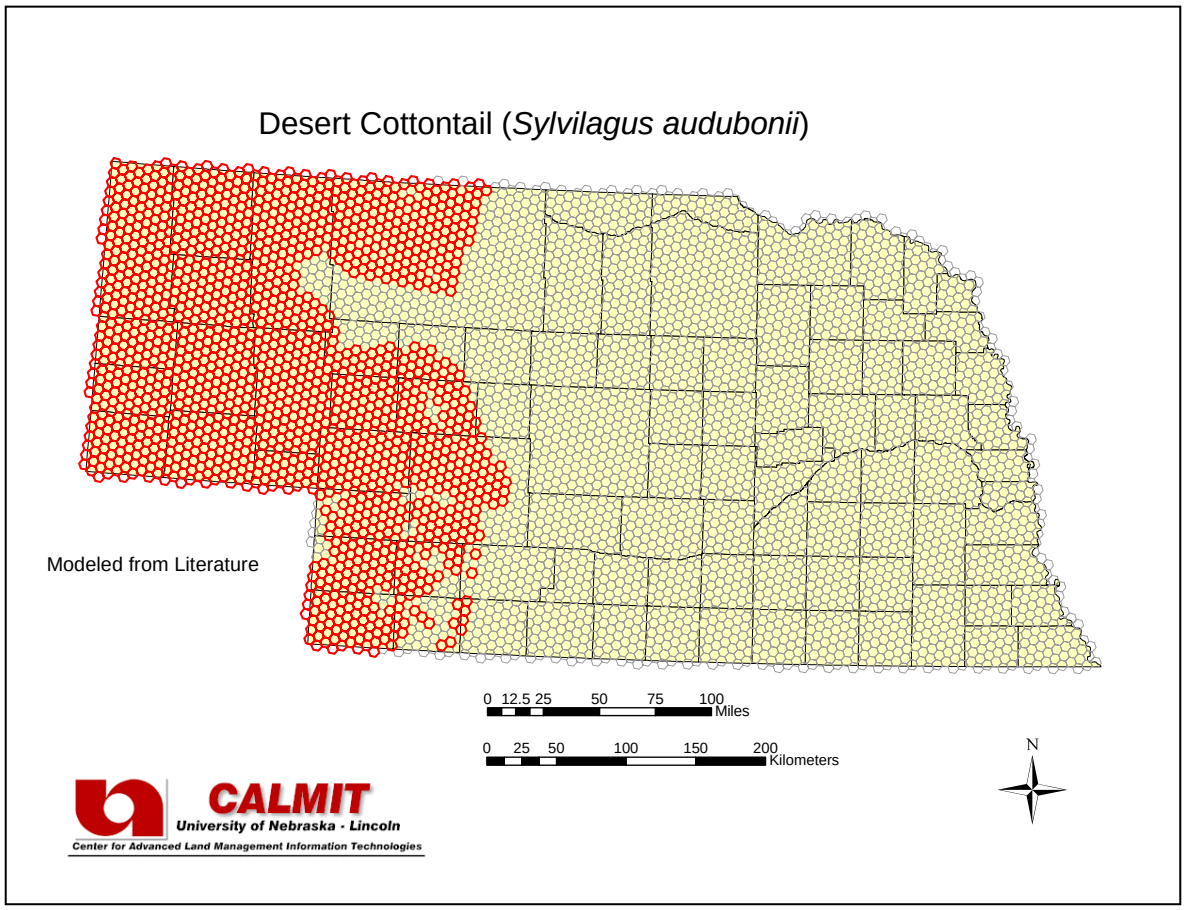
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Desert cottontail**	TNC Global Status:	G5
Scientific Name:	***Sylvilagus audubonii***	Federal Status:	-
TNC Element Code:	AMAEB01070	State (NE) Status:	S4

Habitat Description:
Found in grasslands to creosote brush and deserts (Whitaker 1997), weedy margins of upland fields and pastures, brushy country, and thickets in dry ravines (Jones et al. 1985). Along rivers it is associated with riparian brush-like willows, in uplands with pinyon-juniper stands, and in desert areas with sagebrush, rabbitbrush, and a variety of cacti (Wilson and Ruff 1999). Although desert cottontails occurred in a wider range of habitats, they were found consistently in only upland breaks and upland grasslands (Bergeron and Seabloom 1981). Not found in the dry upland habitat (microclimate) of the Sand Hills (Freeman 1998). In Nebraska, the desert cottontail occupies dry uplands in the western part of the state (Jones 1964; Jones et al. 1983).

Total Area of Modeled Habitat (ha): 6,523,850

Model Description:
Modeled from literature using the set of variables 'Land Cover class Western Mixedgrass Prairie is present' OR 'Land Cover class Sandsage Shrubland is present'.



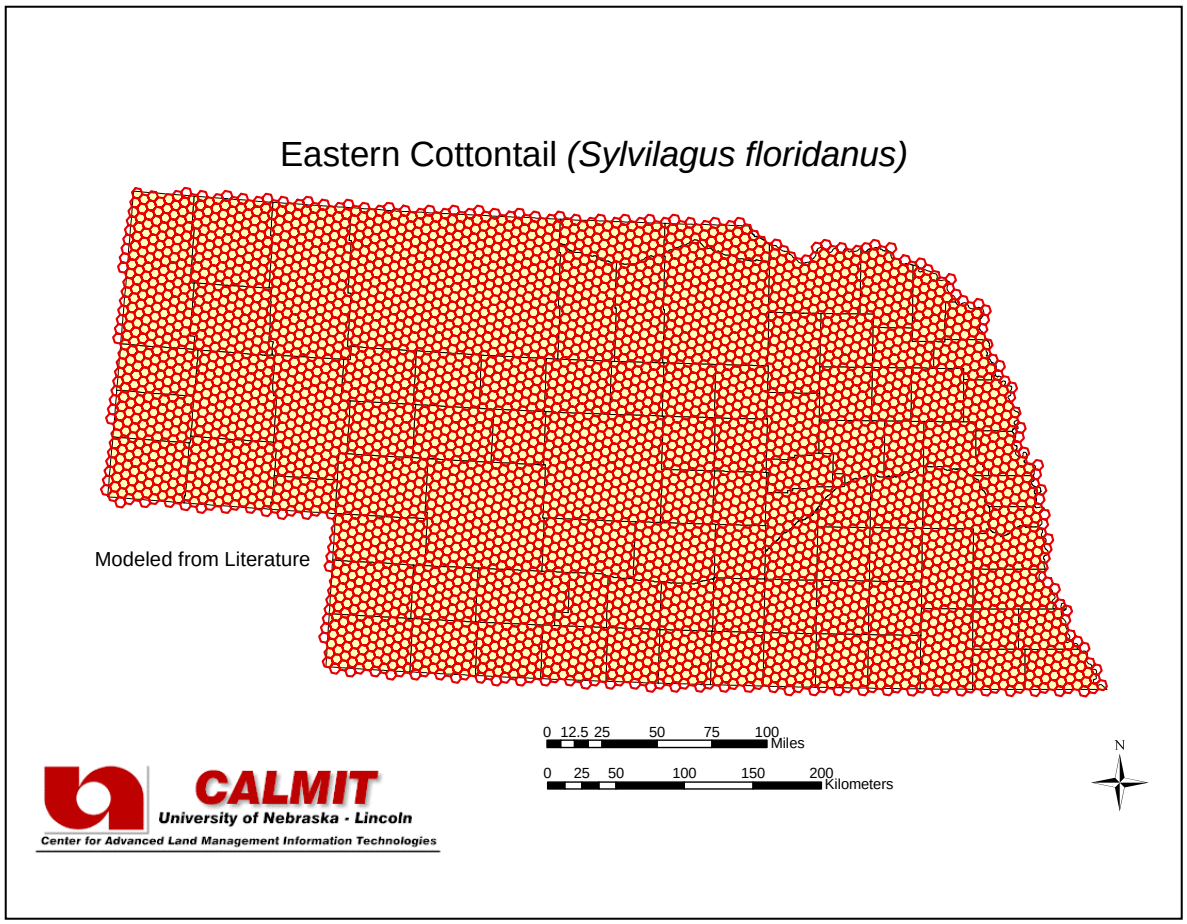
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Eastern cottontail**	TNC Global Status:	G5
Scientific Name:	***Sylvilagus floridanus***	Federal Status:	-
TNC Element Code:	AMACB01040	State (NE) Status:	S5

Habitat Description:
Suitable habitat in the Plains states is increasingly restricted westward to riparian ecosystems (Jones 1964; Jones et al. 1985). Locally restricted to mesic situations in riparian communities or adjacent agricultural situations with dense plant growth (Jones et al. 1983). Brushy areas, old fields, woods, and cultivated areas, especially around thickets and brush piles (Whitaker 1997). Occurred in brushy areas of river bottoms, terraces and hardwood draws (Bergeron and Seabloom 1981). Common in the Sand Hills but found primarily in the area's riparian or agricultural communities (Freeman 1998).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



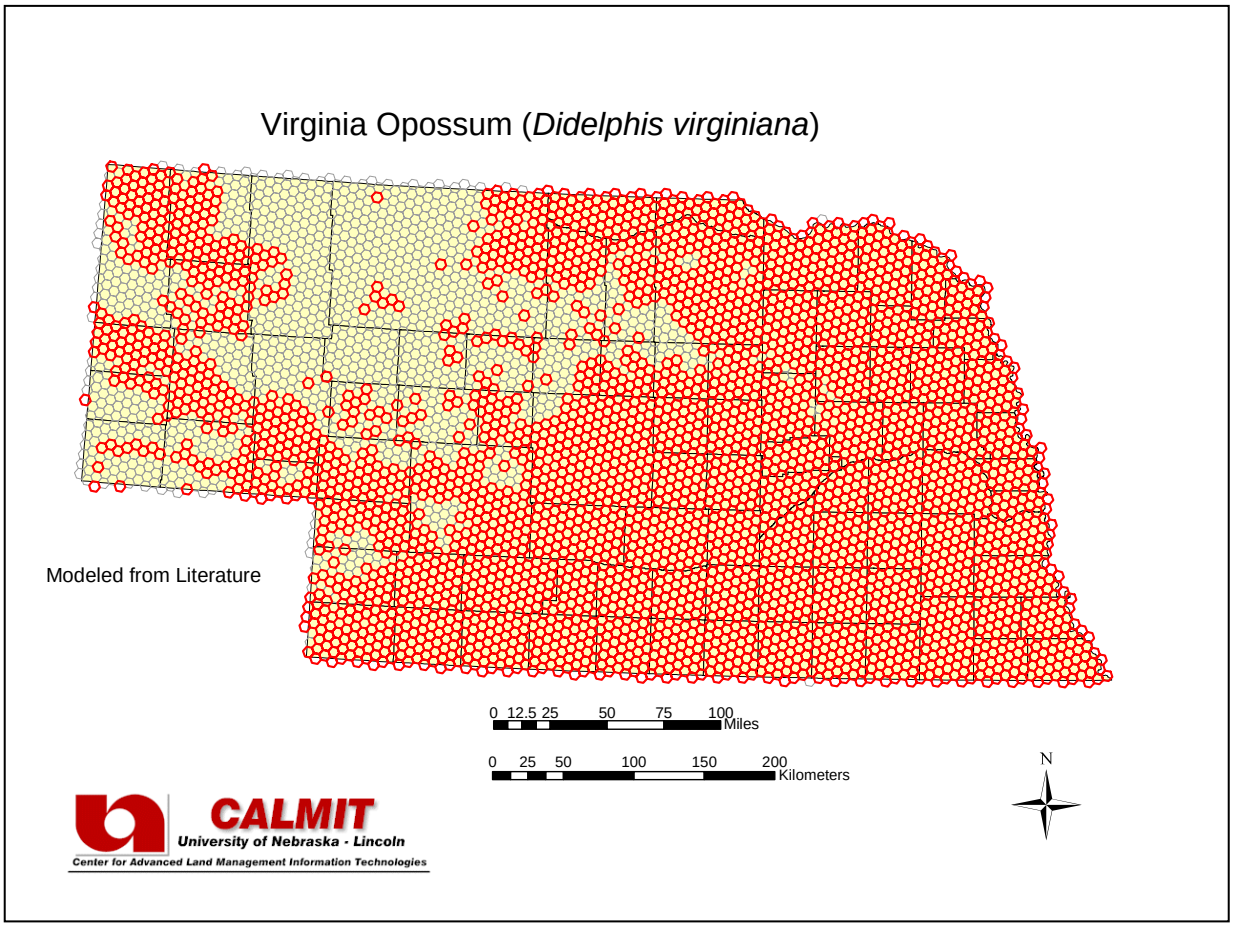
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Virginia opossum**	TNC Global Status:	G5
Scientific Name:	***Didelphis virginiana***	Federal Status:	-
TNC Element Code:	AMAAA01010	State (NE) Status:	S5

Habitat Description:
Prefers deciduous woodlands in association with streams and lakes, but all habitats within their range of ecological tolerances are used. Opossum have been found in forested, grassland, agricultural, and suburban habitats. Lowest densities are found within residential, agricultural, and grassland habitats, respectively (Gardner 1982; Llewellyn and Dale 1964; McManus 1974). Extreme southeastern Nebraska was part of the opossum's presettlement range and it is now common in southern and eastern Nebraska. In the Sandhills and Panhandle, opossums are restricted to major drainages such as the Loup, Niobrara and North Platte rivers (NGPC 2002). Good habitat includes a combination of large trees and shrub thickets, abundant water and crop fields. Few records from the Sand Hills (Freeman 1998). Northern and elevational limits appear to be controlled by climate, the availability of den sites and winter food. Approximate limit of range is slightly north of the –7°C January isotherm (Gardner 1982; Hossler 1994; Harder 1994; McManus 1974).

Total Area of Modeled Habitat (ha): 1.50×10^7

Model Description:
Modeled from literature using the set of variables ‘Land Cover class Deciduous Forests and Woodlands is present’ AND ‘Land Cover class Agricultural Fields is present’.



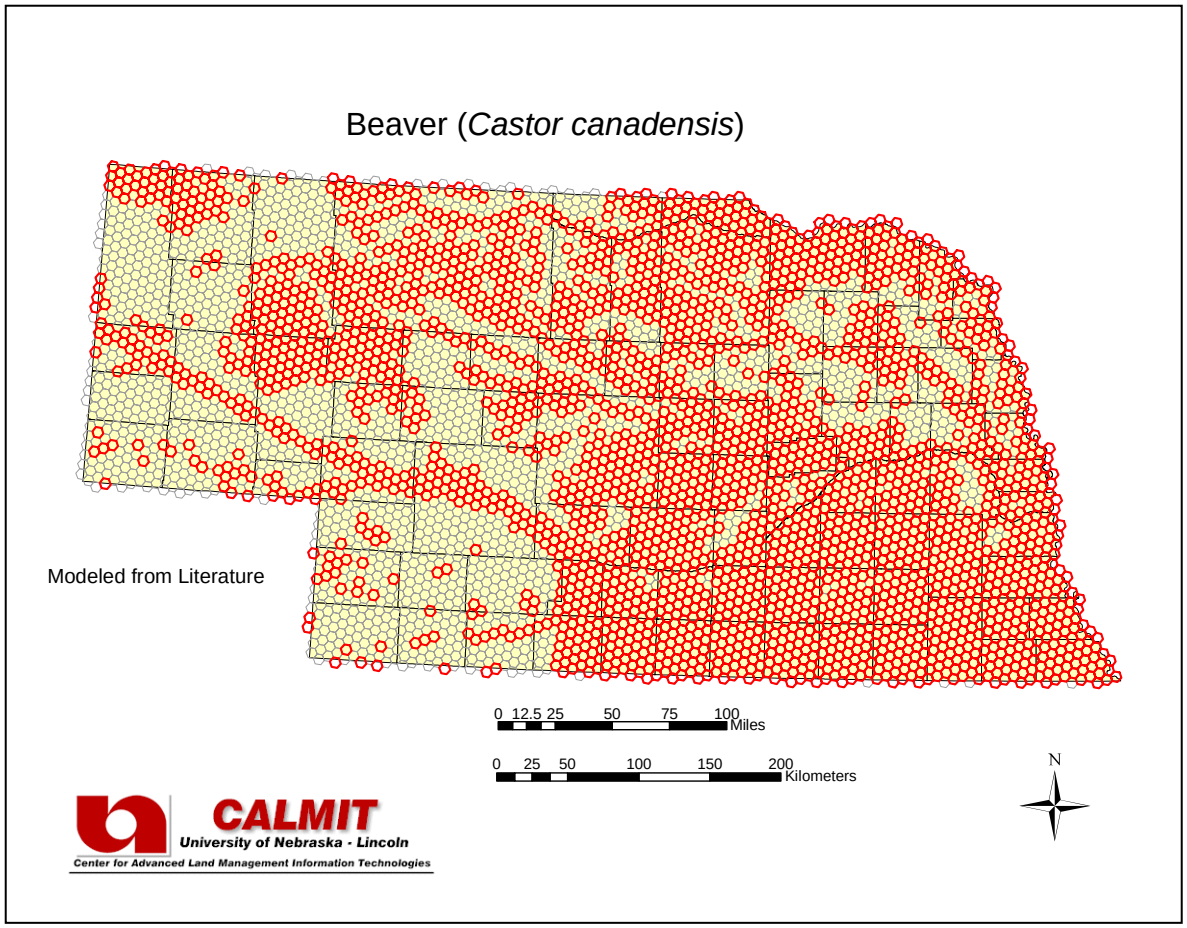
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Beaver**	TNC Global Status:	G5
Scientific Name:	***Castor canadensis***	Federal Status:	-
TNC Element Code:	AMAFE01010	State (NE) Status:	S5

Habitat Description:
Beaver are found in the vicinity of aquatic habitats such as steams, marshes, ponds, and the margins of large lakes throughout North America (Allen 1982; Suzuki and McComb 1998; Smith 1999) and in Nebraska they occur in every county of the state (Jones 1964). Valleys wider than the stream channel are preferred -widths of 46m (150ft) or more are considered the most suitable. (Allen 1982). Found on the major waterways in the Sand Hills (Freeman 1998). Require a permanent supply of water and prefer a seasonably stable water level (Slough and Sadleir 1976).

Total Area of Modeled Habitat (ha): 1.16×10^7

Model Description:
Modeled from literature using the set of variables 'Land Cover class Open Water is present' OR 'Land Cover class Aquatic Bed Wetland is present'.



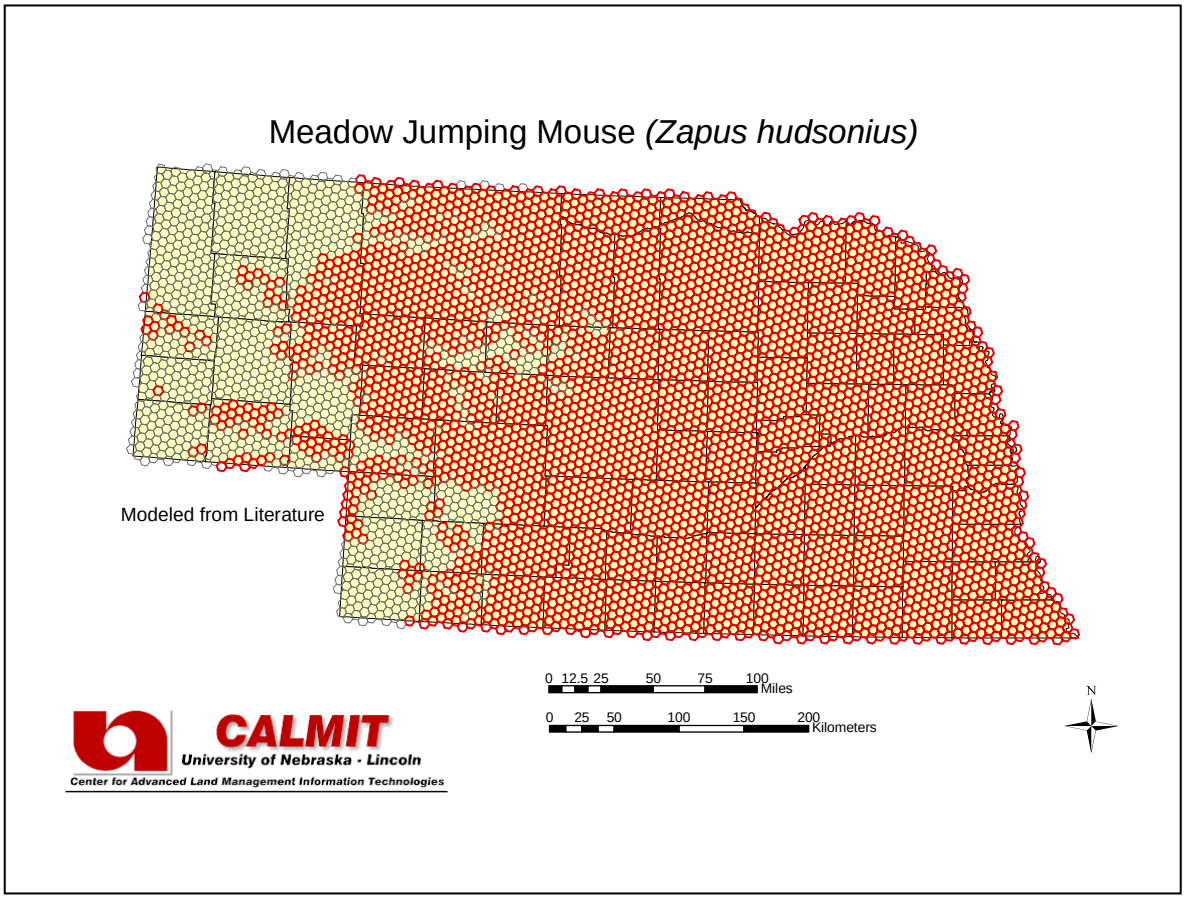
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Meadow jumping mouse**	TNC Global Status:	G5
Scientific Name:	***Zapus hudsonius***	Federal Status:	-
TNC Element Code:	AMAFH01010	State (NE) Status:	S5

Habitat Description:
Occurs in a variety of habitats ranging from grassy fields, meadows, fencerows, thick vegetation along streams, edges of ponds and marshes, and herbaceous cover bordering woodlands. May also occur in woods. Especially abundant in stands of *Impatiens.* Frequents moist areas more than dry areas (Banfield 1974; Hamilton and Whitaker 1995; Jones 1988; Schwartz 1981; Whitaker 1972). In the western part of its range in Nebraska it is found only in the riparian communitieis that border rivers and lakes (Jones 1964). Occurs in wet areas of the Sand Hills, but not in upland Sand Hill areas (Freeman 1998). Adequate herbaceous ground cover necessary for maintenance of populations (Whitaker 1972). On the Northern Plains, usually restricted primarily to riparian habitats (Jones et al. 1998). Has not been found to occur in the northwestern or southwestern corners of the state.

Total Area of Modeled Habitat (ha): 16,007,646

Model Description:
Modeled from literature using the set of variables ('Land Cover class Agricultural Fields is present' OR 'Land Cover class Emergent Wetlands is present') AND NOT ('Land Cover class Western Shortgrass Prairie > 15%' OR 'Land Cover class Sandsage Shrubland is present').



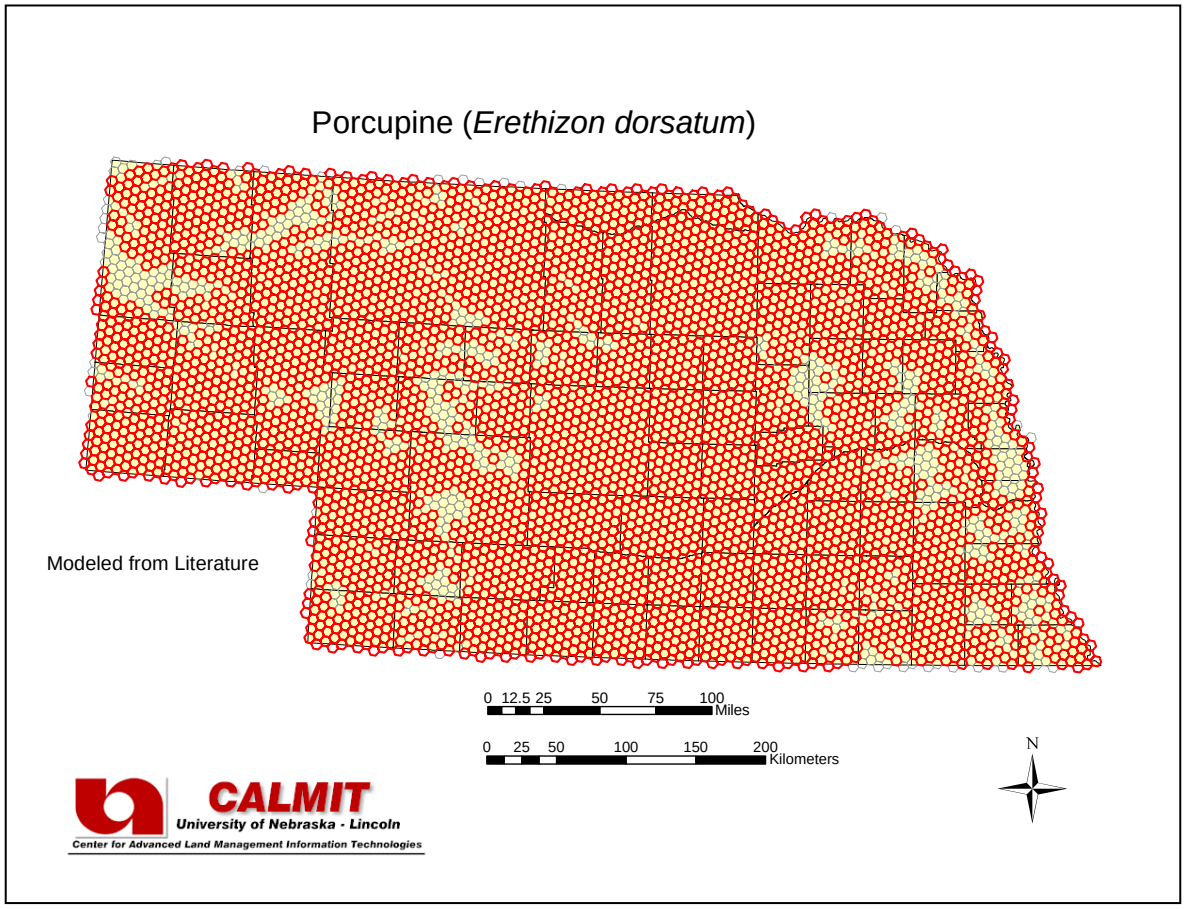
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Porcupine**	TNC Global Status:	G5
Scientific Name:	***Erethizon dorsatum***	Federal Status:	-
TNC Element Code:	AMAFJ01010	State (NE) Status:	S4

Habitat Description:
Boreal and coniferous forests are the preferred habitat. Range includes habitats varying from northern forests to open tundra, grasslands and deserts. Because of food demands, porcupines are limited to vegetated riparian habitats where they occupy areas away from forests (Hazard 1982; Knox 1988; Tyler 1997; Wood 1973). In Nebraska, it is most common in the coniferous western forest of the Pine Ridge and along waterways that extend eastward into the Sand Hills (Freeman 1998). Species is present statewide, although not common (Benedict 2000), especially in eastern Nebraska (Jones 1964).

Total Area of Modeled Habitat (ha): 1.71×10^7

Model Description:
Modeled from literature using the set of variables 'Land Cover class Juniper Woodlands is present' OR 'Land Cover class Ponderosa Pine Forests and Woodlands is present' OR 'Land Cover class Riparian Woodland is present'.



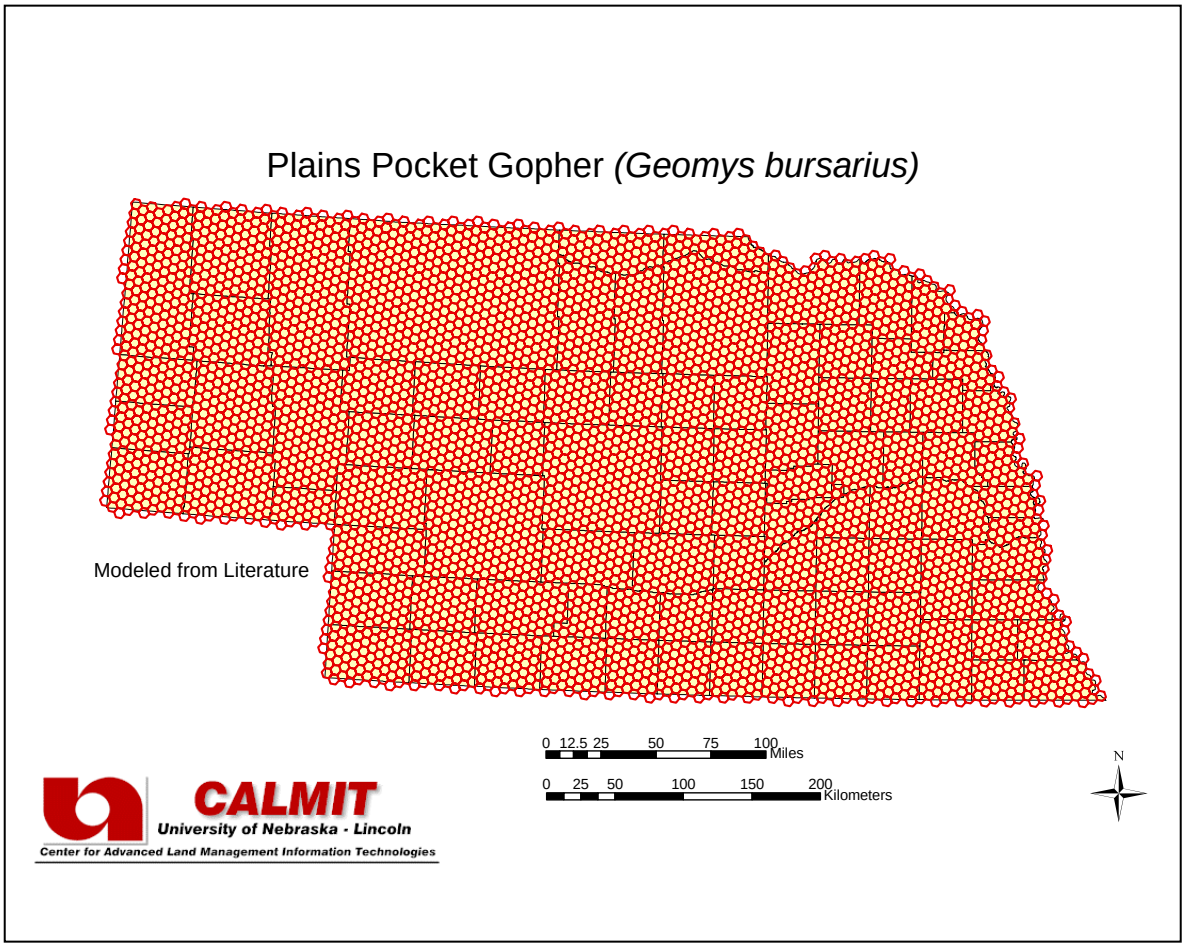
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Plains pocket gopher**	TNC Global Status:	G5
Scientific Name:	***Geomys bursarius***	Federal Status:	-
TNC Element Code:	AMAFC02010	State (NE) Status:	S5

Habitat Description:
A grassland species, abundant in the drier upland Sand Hills (Freeman 1998). Prairie areas with sandy loam or loam soils; pastures; sometimes-plowed ground (Whitaker 1997). Occupies hayfields, roadside ditches, pastures, and bottomlands (Jones et al. 1985). A soil suitable for the species occur mainly in meadows, at forest edges, along rivers and streams, and on the higher terraces on floodplains, also occurs in sandy soils in some areas (Jones et al. 1983). Prefers moist, deep, sandy loam and avoids continuously cultivated fields (Jones et al. 1983, 1985). In the eastern, intensely cultivated part of the state the species now occurs mostly in pastures and other fallow lands, and in alfalfa fields (Jones 1964).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



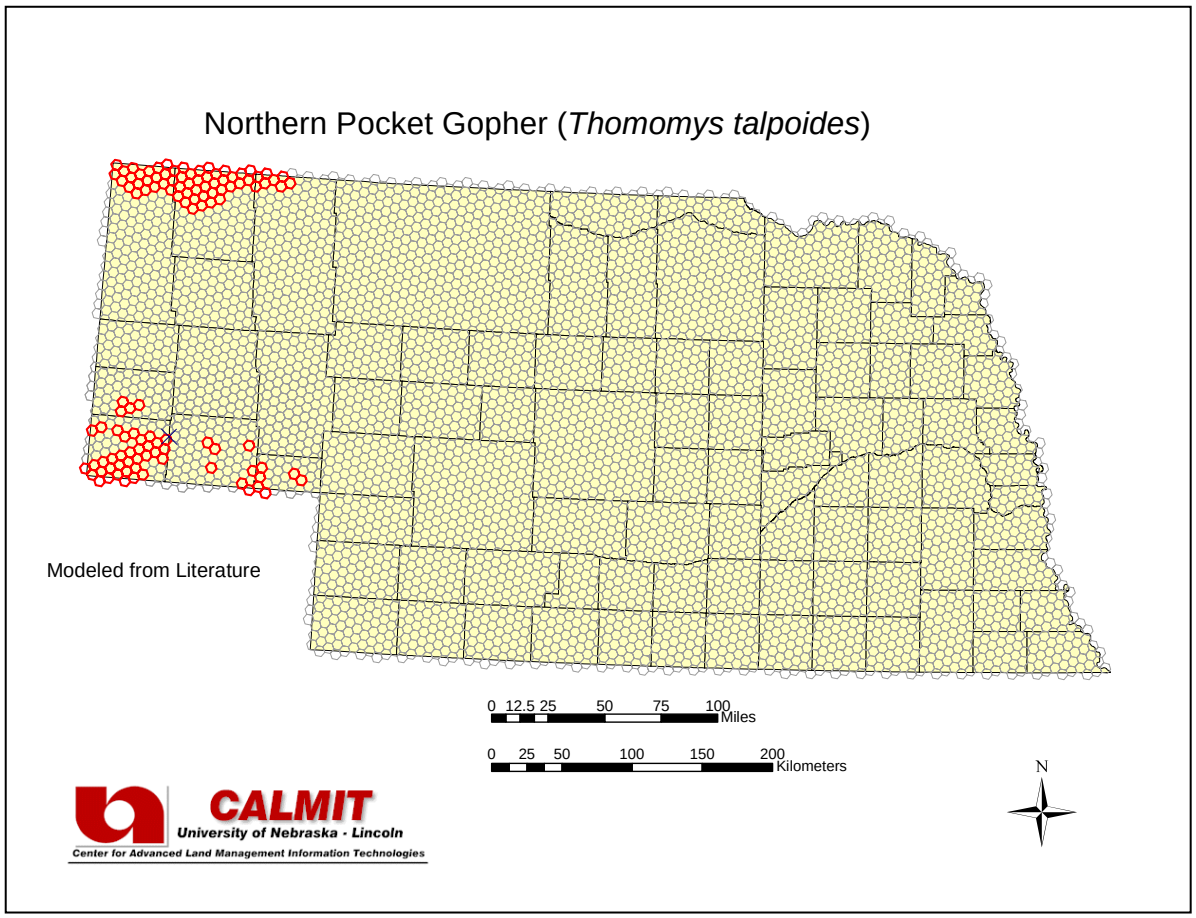
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Northern pocket gopher**	TNC Global Status:	G5
Scientific Name:	***Thomomys talpoides***	Federal Status:	-
TNC Element Code:	AMAFC01040	State (NE) Status:	S4

Habitat Description:
Usually, good soils in meadows or along streams; most often in mountains but also in lowlands (Whitaker 1997). Soil type is more important that vegetation for the distribution of pocket gophers. It occurs on rocky soils and heavy clay in western Nebraska (Jones et al. 1985). Restricted to relatively thin and rocky upland soils. Grassy prairies, fields, brushy areas, riverbanks and open pine forests; broad range of soil tolerance, prefers moist soils (Forsyth 1999). In Nebraska limited to extreme northwestern corner of the state and southwestern corner of the Panhandle (Jones 1964; Jones et al. 1983).

Total Area of Modeled Habitat (ha): 462,227

Model Description:
Modeled from literature using the set of variables 'Land Cover class Western Shortgrass Prairie is present' AND 'Percentage of Fine Textured Soils is present' OR 'Percentage of Medium-textured Soils > 80%' AND 'Land Cover class Western Shortgrass Prairie > 25%', clipped to limit distribution to area of verified reports in northwestern and southwestern Nebraska (Jones et al. 1983).



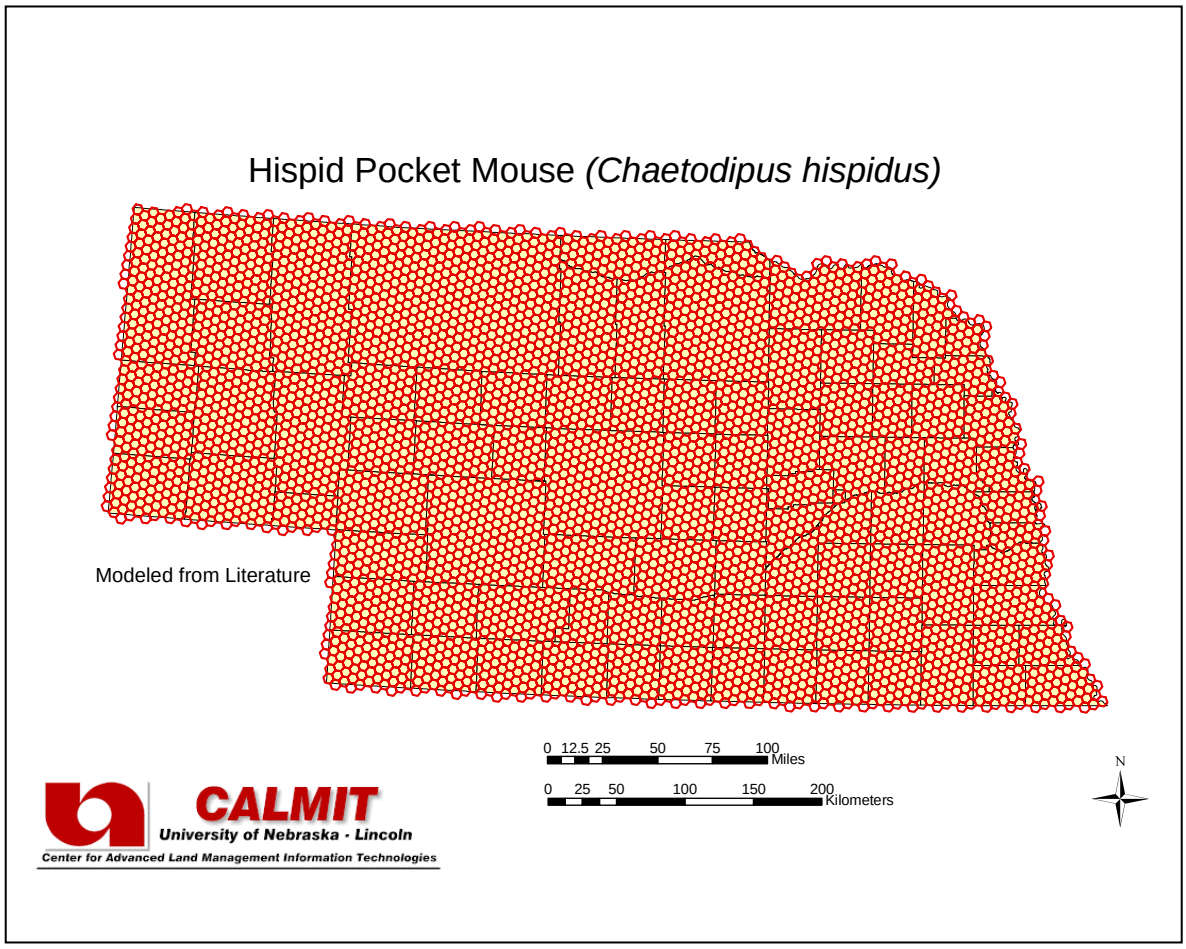
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Hispid Pocket Mouse**	TNC Global Status:	G5
Scientific Name:	***Chaetodipus hispidus***	Federal Status:	-
TNC Element Code:	AMAFD05050	State (NE) Status:	S5

Habitat Description:
Has been reported to occur in rocky and loamy soils, but is most abundant where soil is sandy and scattered open areas permit dusting. It inhabits various upland habitats, including those characterized by tall or short grasses, forbs, shrubs, cacti, or yucca, but seemingly avoids dune sands and riparian habitats (Jones et al. 1985). Prefers sandy soils but will live in soils with higher clay content (Wilson and Ruff 1999). Within the Sand Hills, it is more restricted to dense grass-forb areas (Freeman 1998).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.

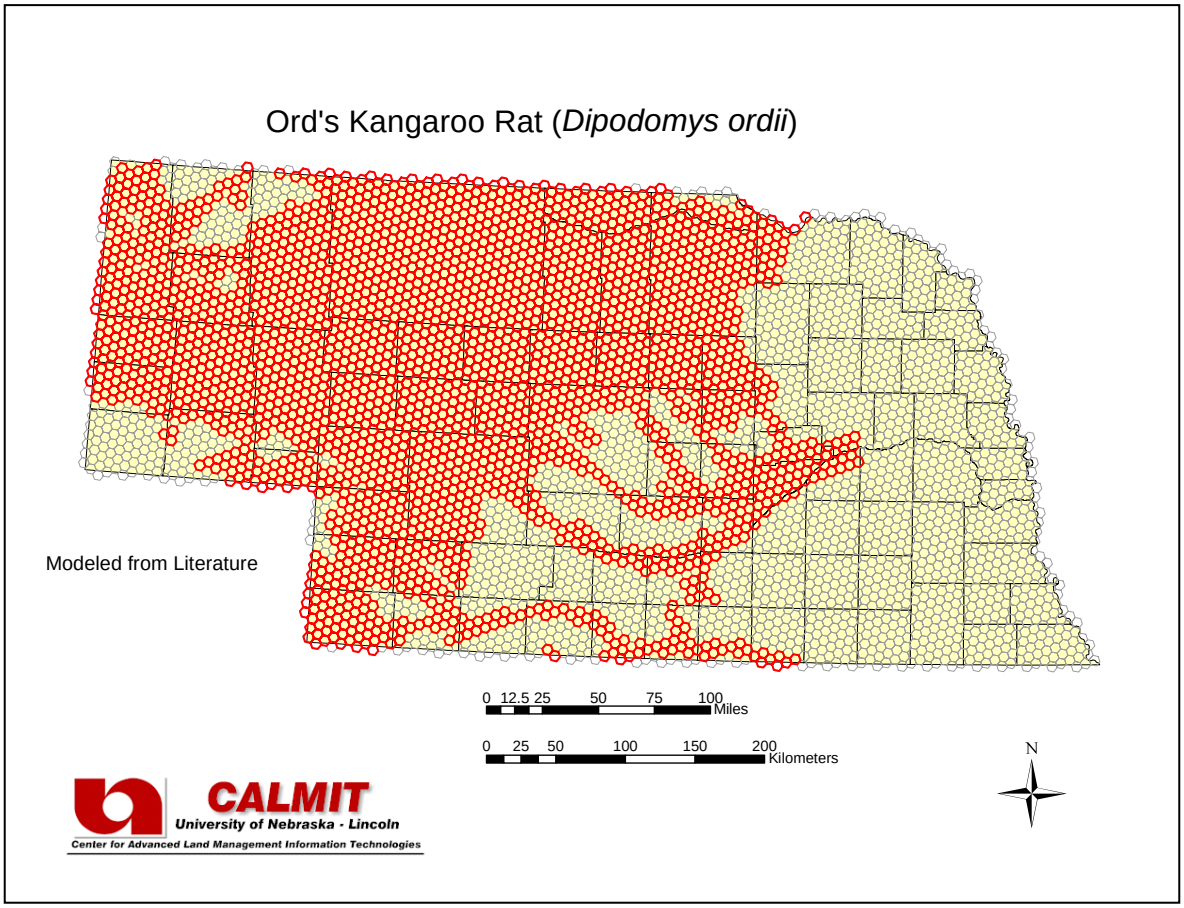


Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Ord's kangaroo rat**	TNC Global Status:	G5
Scientific Name:	***Dipodomys ordii***	Federal Status:	-
TNC Element Code:	AMAFD03010	State (NE) Status:	S5

Habitat Description:
Abundant in the drier upland Sand Hills with the open areas, such as ridge tops and blowouts being the most favored microhabitat (Freeman 1998). Varied habitat includes sandy waste areas, sand dunes, and sometimes hard-packed soil (Whitaker 1997). Closely associated with sandy soil, is abundant on the Nebraska Sand Hills and in other areas where bare sand permits dusting (Jones et al. 1983, 1985). Occupies the western two-thirds of Nebraska (Jones et al. 1983), the eastern distribution nearly coincides with the 98th meridian (Jones 1964). Sandy soils in open areas with sparse brush or grass (Lemen and Freeman 1986; Forsyth 1999).
Total Area of Modeled Habitat (ha): 1.11 x 10^7

Model Description:
Modeled from literature using the set of variables 'Percentage Coarse-textured Soils is present' AND NOT 'Land Cover class Upland Tallgrass Prairie is present'.



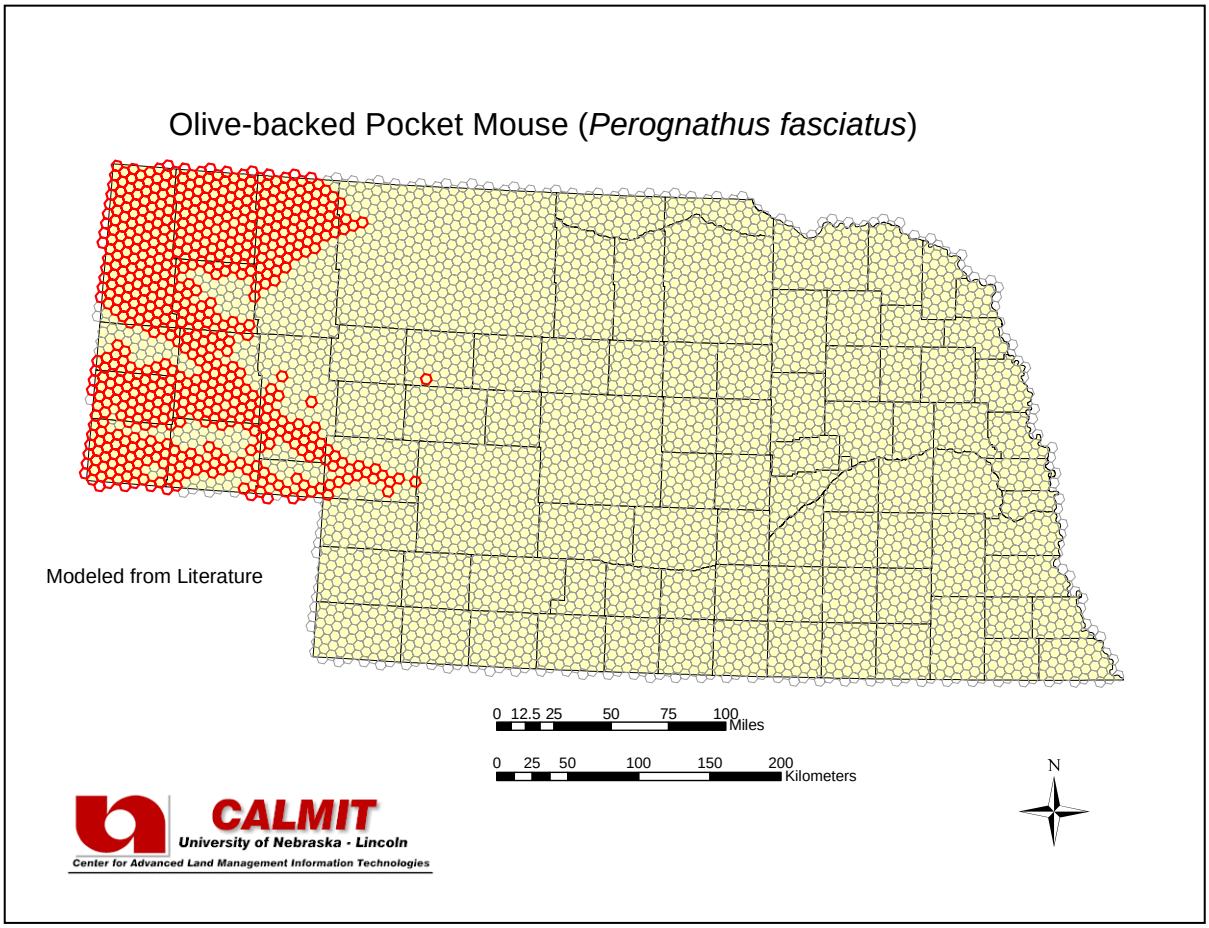
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Olive-backed pocket mouse**	TNC Global Status:	G5
Scientific Name:	***Perognathus fasciatus***	Federal Status:	-
TNC Element Code:	AMAFD01010	State (NE) Status:	S3

Habitat Description:
Principle habitat is short-grass rangeland (Jones et al. 1985). Occur in open grasslands with sandy loam; also found on the edge of aspen parklands (Forsyth 1999). Prefer dry sandy grasslands with little vegetation (Whitaker 1997). Grassland, riparian, and sagebrush communities showed the greatest rodent abundance and species diversity (MacCracken 1985). Found north of the Niobrara River in Cherry County and in the Panhandle, but evidently do not inhabit the Sand Hills (Jones 1964; Freeman 1998).

Total Area of Modeled Habitat (ha): 2,615,213

Model Description:
Modeled from literature using the variable 'Land Cover class Western Shortgrass Prairie > 25%'.

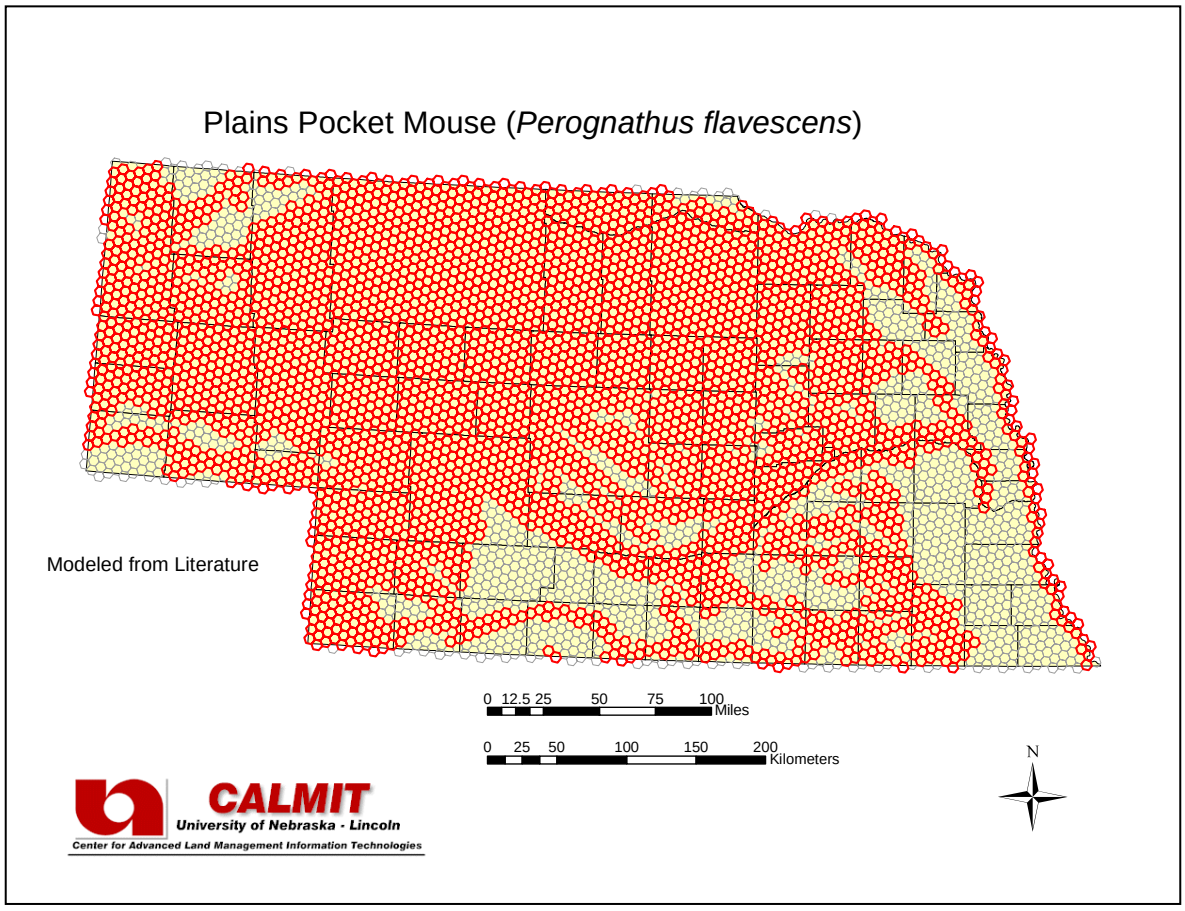


Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Plains pocket mouse**	TNC Global Status:	G5
Scientific Name:	***Perognathus flavescens***	Federal Status:	-
TNC Element Code:	AMAFD01020	State (NE) Status:	S5

Habitat Description:
Sand dunes and stabilized sand soils (Wilson and Ruff 1999). In areas of sandy soils, with cover of grasses or grasses mixed with sagebrush or yucca. Often found in grain fields. The grazing lands of the Nebraska Sand Hills seem to be the center of abundance (Jones et al. 1983). Sandy plains with sparse vegetation, sand dunes, and shifting sands (Whitaker 1997). Abundant in the drier upland Sand Hills (Freeman 1998). Absent only in the Pine Ridge area and the extreme southeastern part of the state (Jones 1964).
Total Area of Modeled Habitat (ha): 1.49×10^7

Model Description:
Modeled from literature using the set of variables 'Percentage of Coarse-textured Soils is present' OR 'Percentage of Moderately Coarse-textured Soils is present'.



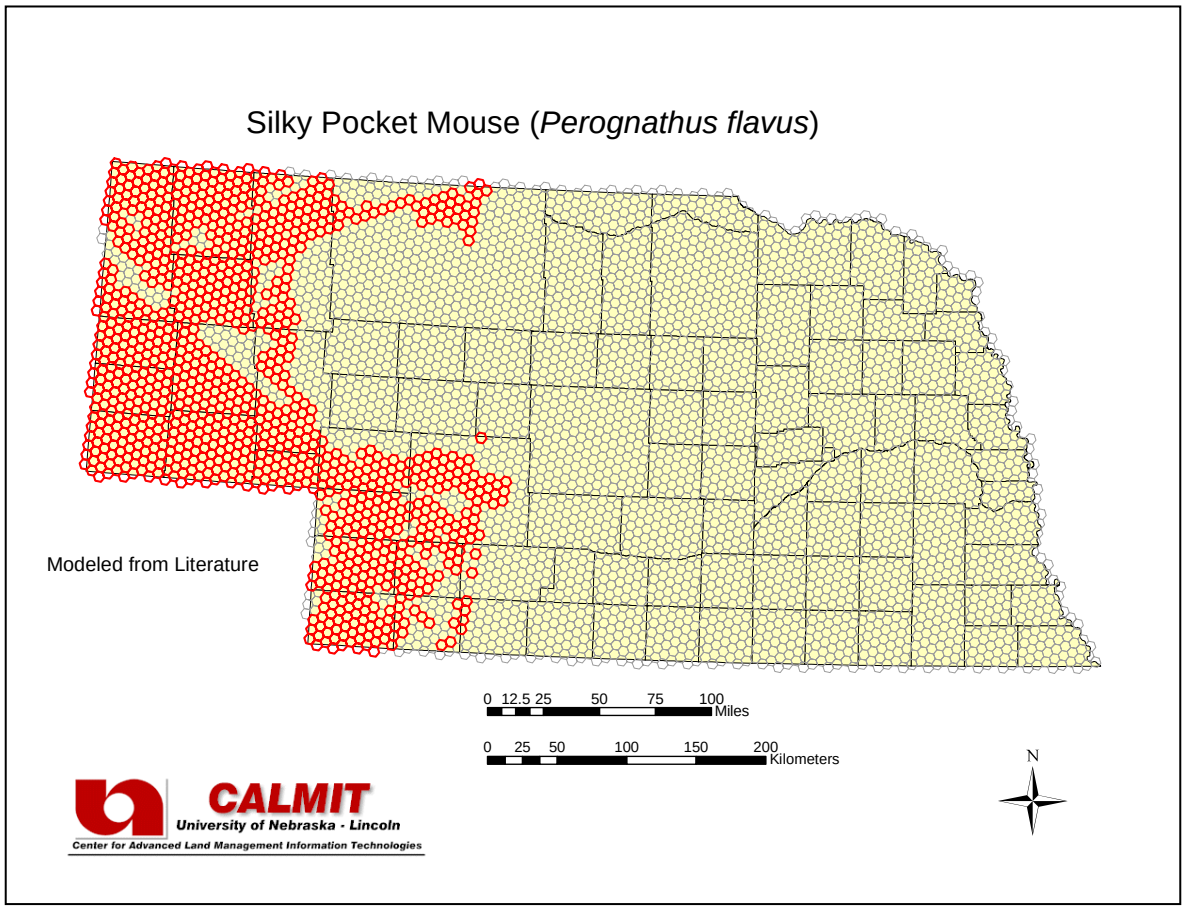
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Silky pocket mouse**	TNC Global Status:	G5
Scientific Name:	***Perognathus flavus***	Federal Status:	-
TNC Element Code:	AMAFD01030	State (NE) Status:	S4

Habitat Description:
A species of the semidesert grasslands of the Central and Southern Great Plains (Jones et al. 1983. It reaches its northern limits in western Nebraska and is most abundant on loamy soils with a cover of grasses and a minimum of bare soil. Found in areas with thin, low grasses and a minimum of bare soil (Wilson and Ruff 1999). Occurs in prairies in sandy, gravelly, or rocky areas with sparse vegetation of various grasses and forbs (Whitaker 1997). Rare in Nebraska overall (Jones 1964) and has only been caught in the western part of the state (Freeman 1998).

Total Area of Modeled Habitat (ha): 4,431,668

Model Description:
Modeled from literature using the set of variables 'Percentage of Medium-textured Soils is present' AND ('Land Cover class Western Shortgrass Prairie is present' OR 'Land Cover class Sandsage Shrubland is present').



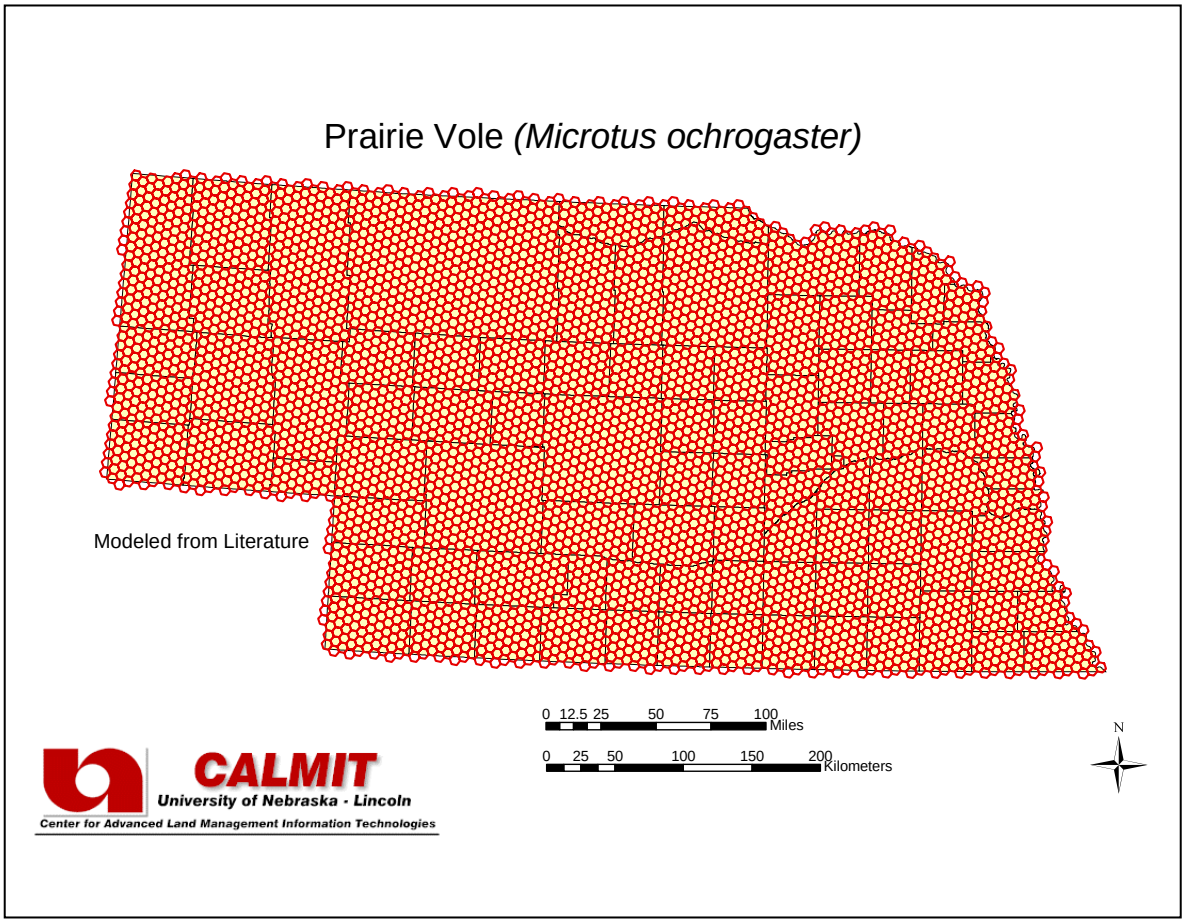
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Prairie vole**	TNC Global Status:	G5
Scientific Name:	***Microtus ochrogaster***	Federal Status:	-
TNC Element Code:	AMAFF11140	State (NE) Status:	S5

Habitat Description:
Typically inhabits upland prairies and is widely distributed in the eastern part of the state (Jones 1964), although it also may occur in swales and riparian grassland (Jones et al. 1983), especially in the western part of the state (Jones 1964). Occupies dry grassy areas and areas around lakes; abundant in the drier upland Sand Hills (Freeman 1998). Dry grass prairie or mixed grass-weedy situations (Whitaker 1997). Open habitats with lots of vegetation for cover; not usually found in wooded or damp areas but does occur in hayfields and along field borders (Forsyth 1999). Inhabits primarily tall-grass communities. On the northern plains, they often are restricted to upland habitats by another vole, *M. pennsylvanicus*, which occupies lush lowland and swales (Jones et al. 1985). Occupies the dense grass areas of the Sand Hills (Lemen and Freeman 1986). Lives in upland herbaceous fields; grasslands, old agricultural lands and thickets; places where there is suitable cover for runways (NatureServe 2002).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



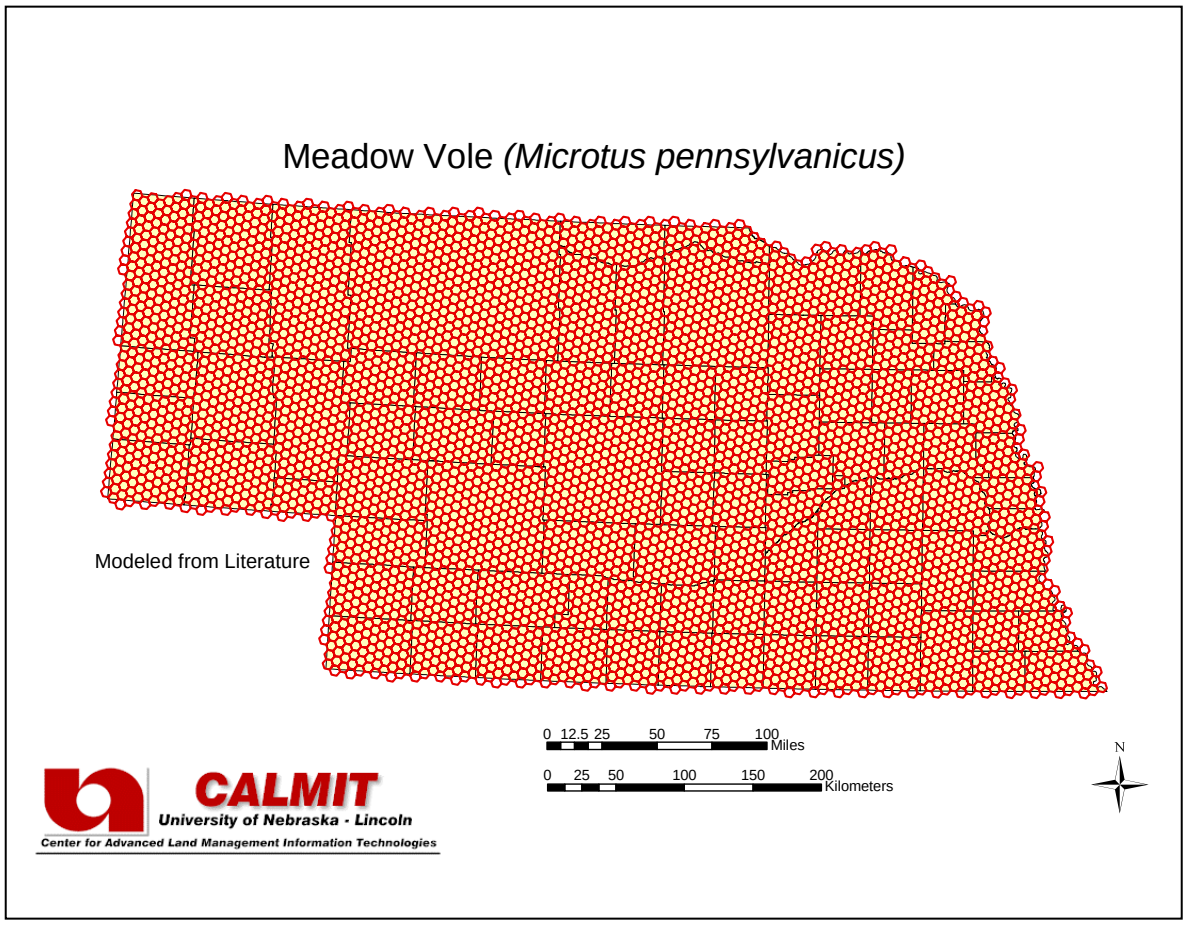
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Meadow vole**	TNC Global Status:	G5
Scientific Name:	***Microtus pennsylvanicus***	Federal Status:	-
TNC Element Code:	AMAFF11010	State (NE) Status:	S5

Habitat Description:
Has the widest distribution in North America of any *Microtus* (Jones et al. 1983). It is associated with wet meadows scattered in a patchy fashion throughout its distribution. On the Northern Plains meadow voles occur throughout the region, except for most of southwestern Nebraska.. An isolated population may be found in Dundy County, in the central and western part of the county (Benedict et al. 2000). Found in wet areas of the Sand Hills (Freeman 1998). Requires water, therefore typically inhabits moist meadows, marshes, and other communities characterized by lush grasses, sedges, and rushes (Jones et al. 1985).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



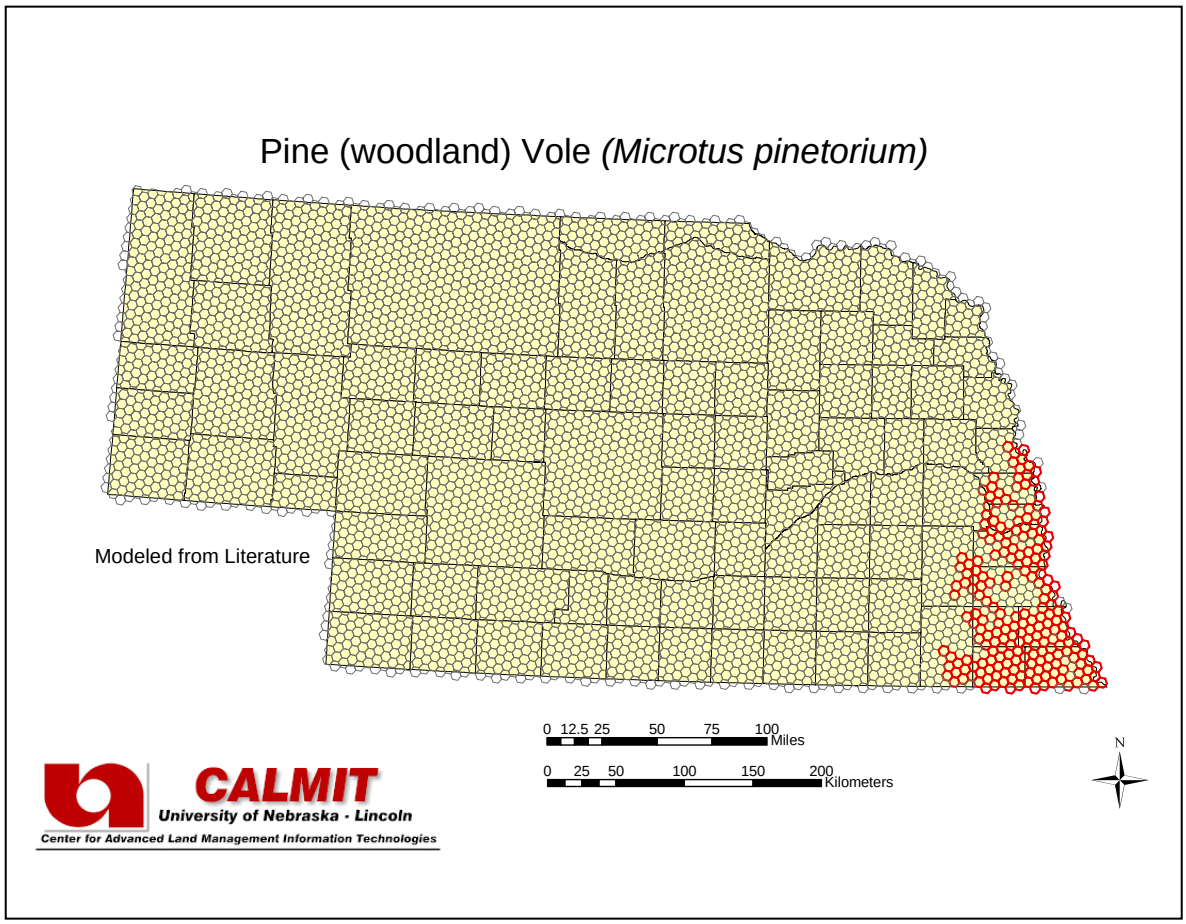
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Pine (woodland) vole**	TNC Global Status:	G5
Scientific Name:	***Microtus pinetorum***	Federal Status:	-
TNC Element Code:	AMAFF11150	State (NE) Status:	S4

Habitat Description:
Dwells primarily in wooded areas and burrows beneath leaf litter and among the roots of trees. Well-drained wooded slopes seem to be the favored natural habitat, but woodland voles also become established in old fields or pastures containing successional woody vegetation (Jones et al. 1985). In southeastern Nebraska it is found in oak-hickory forest along the Missouri River and its tributary streams. Well-drained slopes with dense ground cover appear to be favored (Jones et al. 1983). Primarily inhabits upland deciduous forests and is restricted to the extreme southeastern corner of the state (Benedict et al. 2000).

Total Area of Modeled Habitat (ha): 823,089

Model Description:
Modeled from literature using the variable 'Land Cover class Deciduous Forests and Woodlands > 5%', trimmed to the southeastern corner of the state and north along the Missouri River, the area of reported distribution (Benedict et al. 2000).



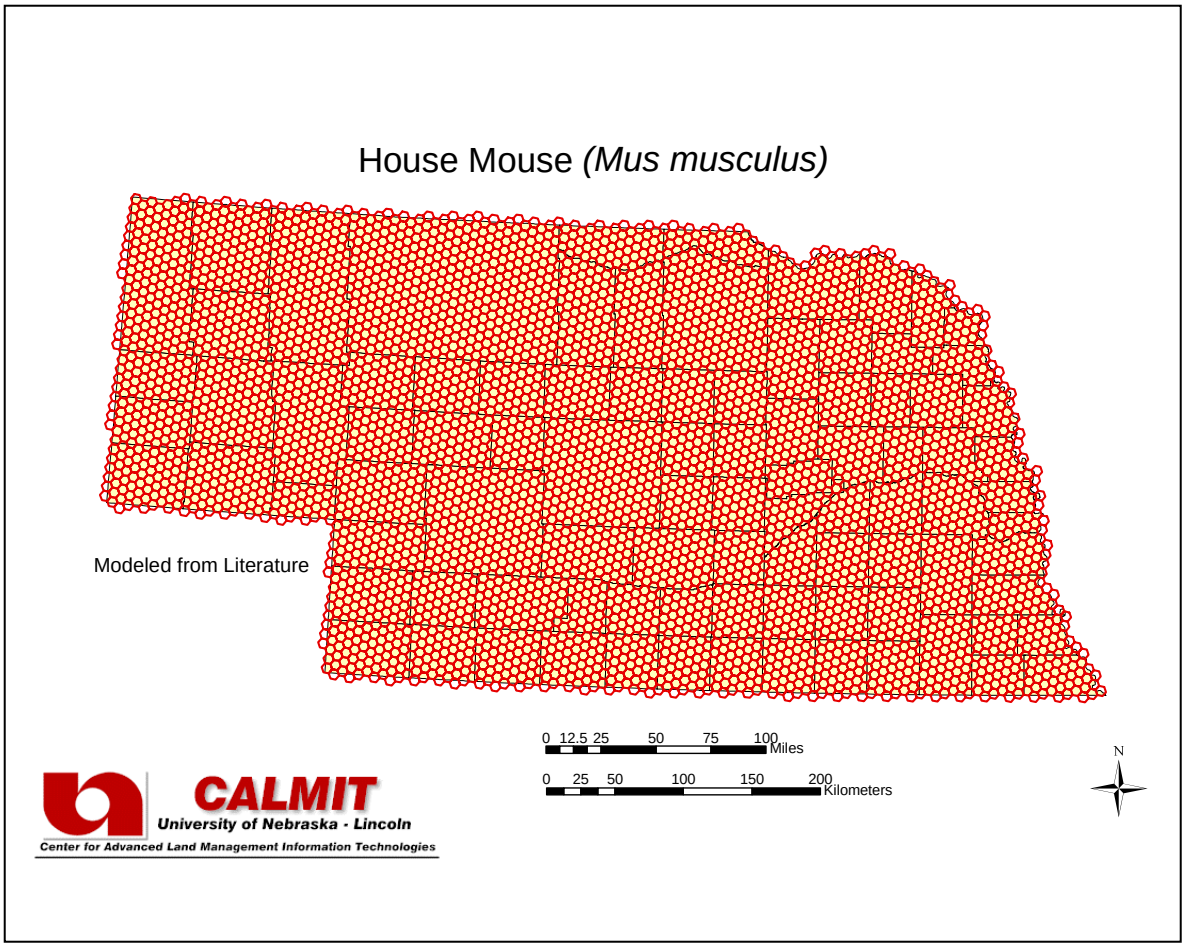
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**House mouse**	TNC Global Status:	G5
Scientific Name:	***Mus musculus***	Federal Status:	--
TNC Element Code:	AMAFF22010	State (NE) Status:	SE

Habitat Description:
Not native to North America. Occupies buildings/other structures, as well as natural habitats such as fields, cropland, beaches, and sometimes high elevation forest and scrub (Natureserve 2002). A common, often abundant resident in and near habitations of people throughout the Northern Plains (Jones et al. 1983).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



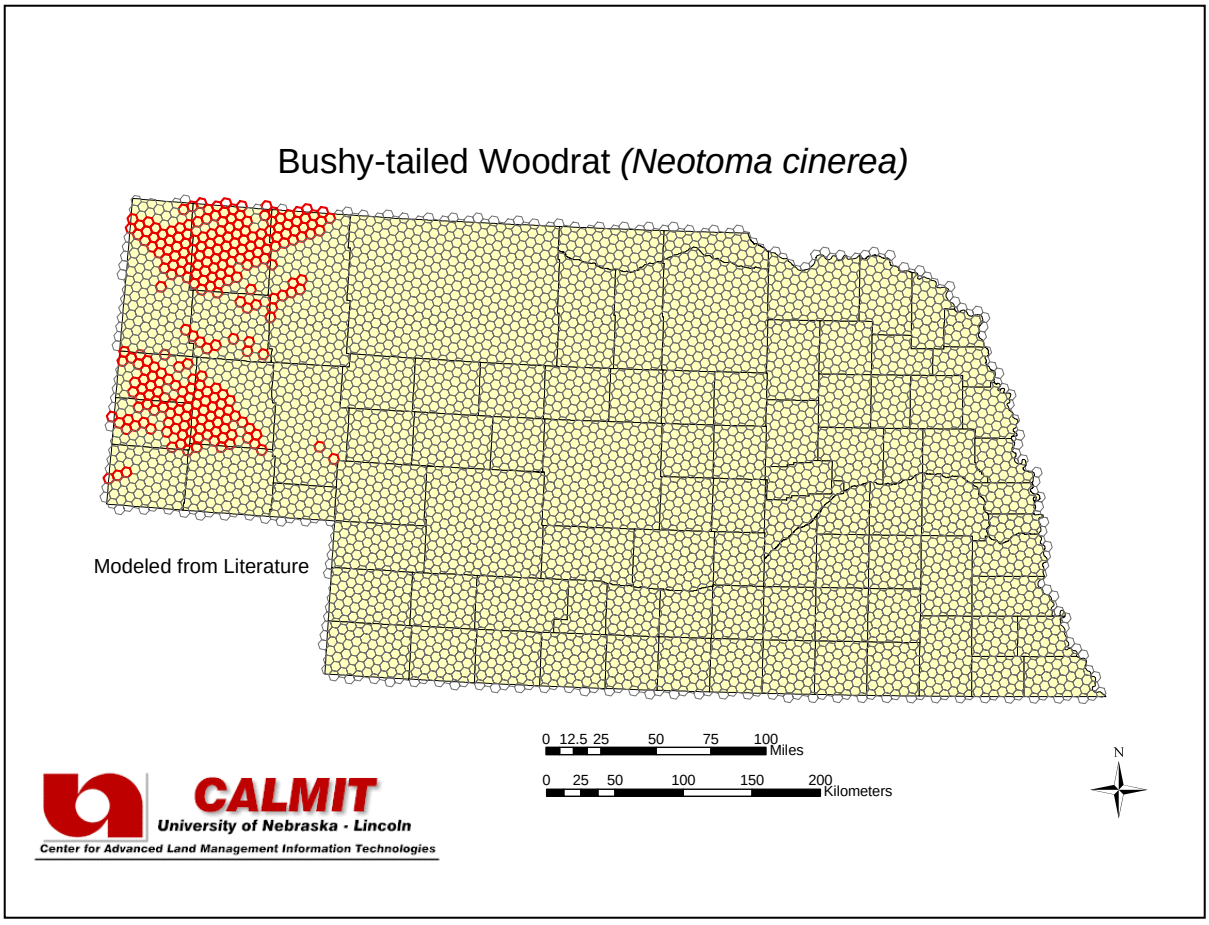
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Bushy-tailed woodrat**	TNC Global Status:	G5
Scientific Name:	***Neotoma cinerea***	Federal Status:	-
TNC Element Code:	AMAFF08090	State (NE) Status:	S3

Habitat Description:
Rocky situations, coniferous forests (Whitaker 1997). Inhabits rocky slopes and crevices (Jones et al. 1983, 1985). Found on cliffs, rockslides, caves, river canyons and rock outcrops in pine forests (Forsyth 1999). Found only in the extreme western counties of Nebraska (Benedict et al. 2000).

Total Area of Modeled Habitat (ha): 1,033,925

Model Description:
Modeled from literature using the set of variables 'Land Cover class Ponderosa Pine Forests and Woodlands is present' AND '30-year Average Precipitation for July < 73.5 mm'.



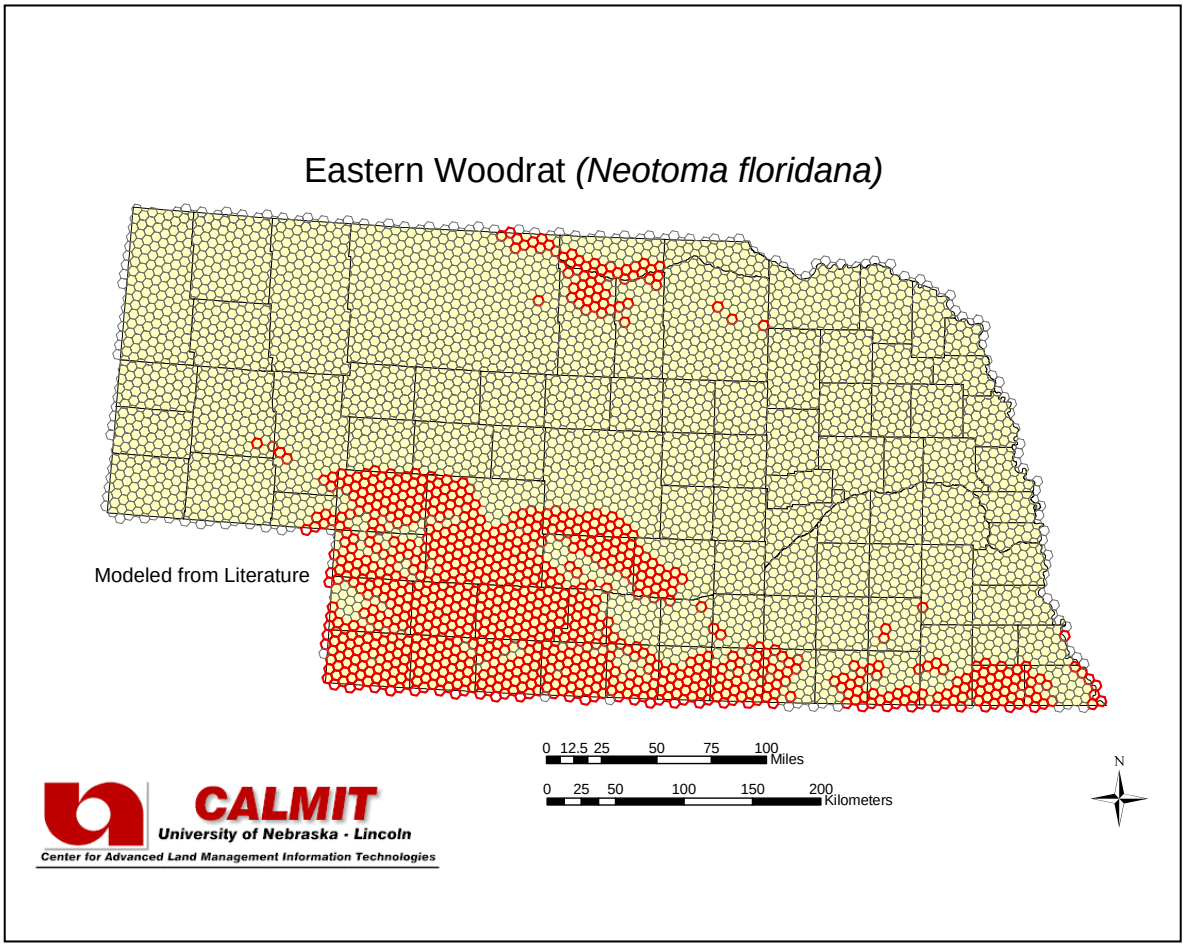
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Eastern woodrat**	TNC Global Status:	G5
Scientific Name:	***Neotoma floridana***	Federal Status:	-
TNC Element Code:	AMAFF08010	State (NE) Status:	-

Habitat Description:
Species is known to inhabit wooded areas, buildings or rocky outcrops. In Nebraska, an isolated population occurs along the Niobrara River in north-central Nebraska (Jones 1964; Freeman 1998), while a larger number may be found in southwestern Nebraska along the Platte and Republican Rivers and their tributaries (Jones 1964). Recently, it has also been found in southeastern Nebraska along the Big and Little Blue River drainages (Benedict 2000).

Total Area of Modeled Habitat (ha): 3,831,636

Model Description:
Modeled from literature using the set of variables ('30-Year Average Precipitation for March > 27 mm' AND 'Average Growing Degree Days Coefficient of Variation for June < 18.5%' AND Elevation < 1100 m' AND 'Land Cover Class Agricultural Fields < 60%') OR ('30-Year Average Precipitation for March > 27 mm' AND 'Land Cover Class Ponderosa Pine is present' AND 'Land Cover Class Little Bluestem-Gramma Mixedgrass Prairie > 25%').



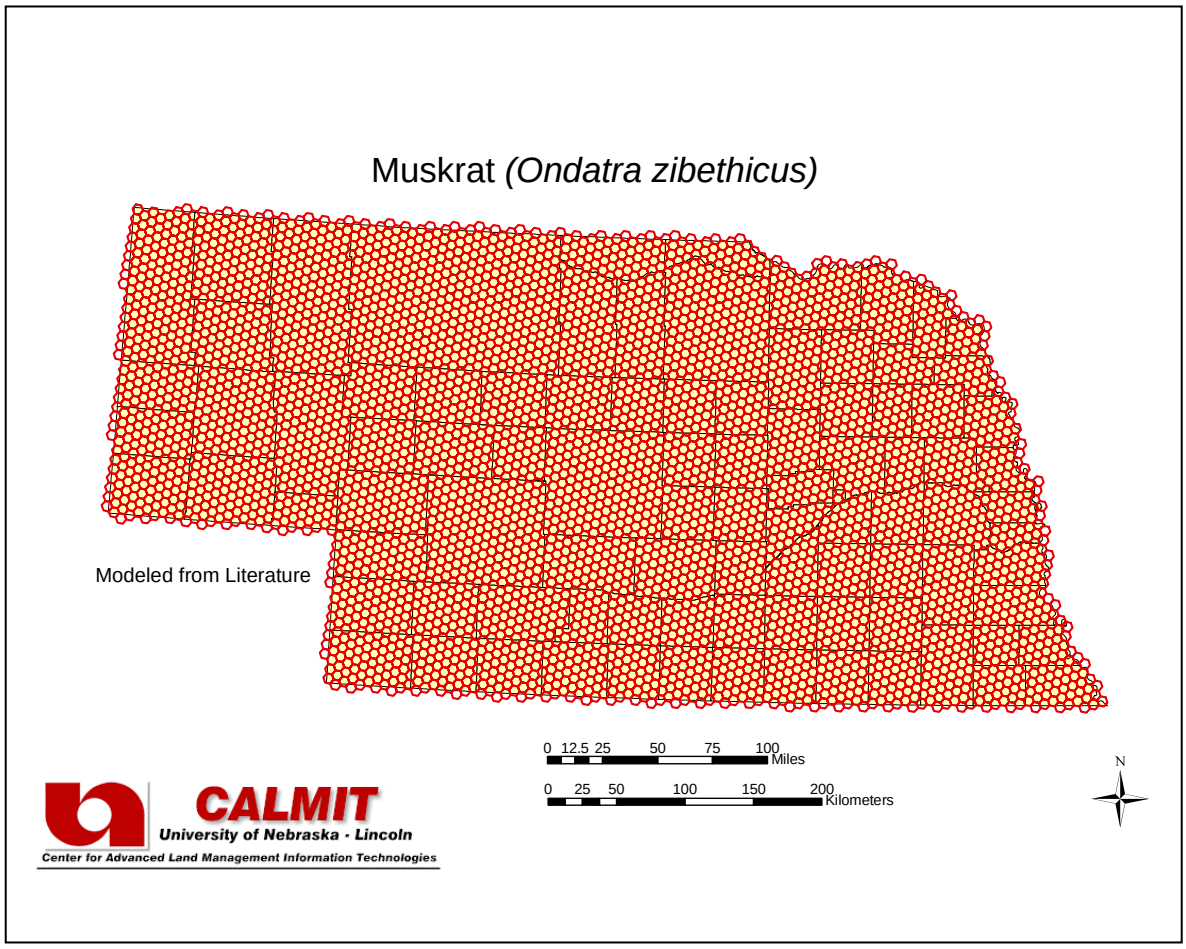
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Muskrat**	TNC Global Status:	G5
Scientific Name:	***Ondatra zibethicus***	Federal Status:	-
TNC Element Code:	AMAFF15010	State (NE) Status:	S5

Habitat Description:
Found in lakes, rivers, ponds, sloughs, and marshes; prefers slow moving or standing water about 1.5 to 2.0 m deep throughout the year and avoids water over 4 m in depth due to lack of aquatic vegetation (Allen and Hoffman 1984; Banfield 1974; Choate et al. 1994; Hamilton and Whitaker 1979; Feldhamer 1999; Kurta 1995). Inhabits the waterways and wet areas of the Sand Hills (Freeman 1998). Muskrats are found throughout Nebraska wherever suitable aquatic habitat exists (Jones 1964; NGPC 2002).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



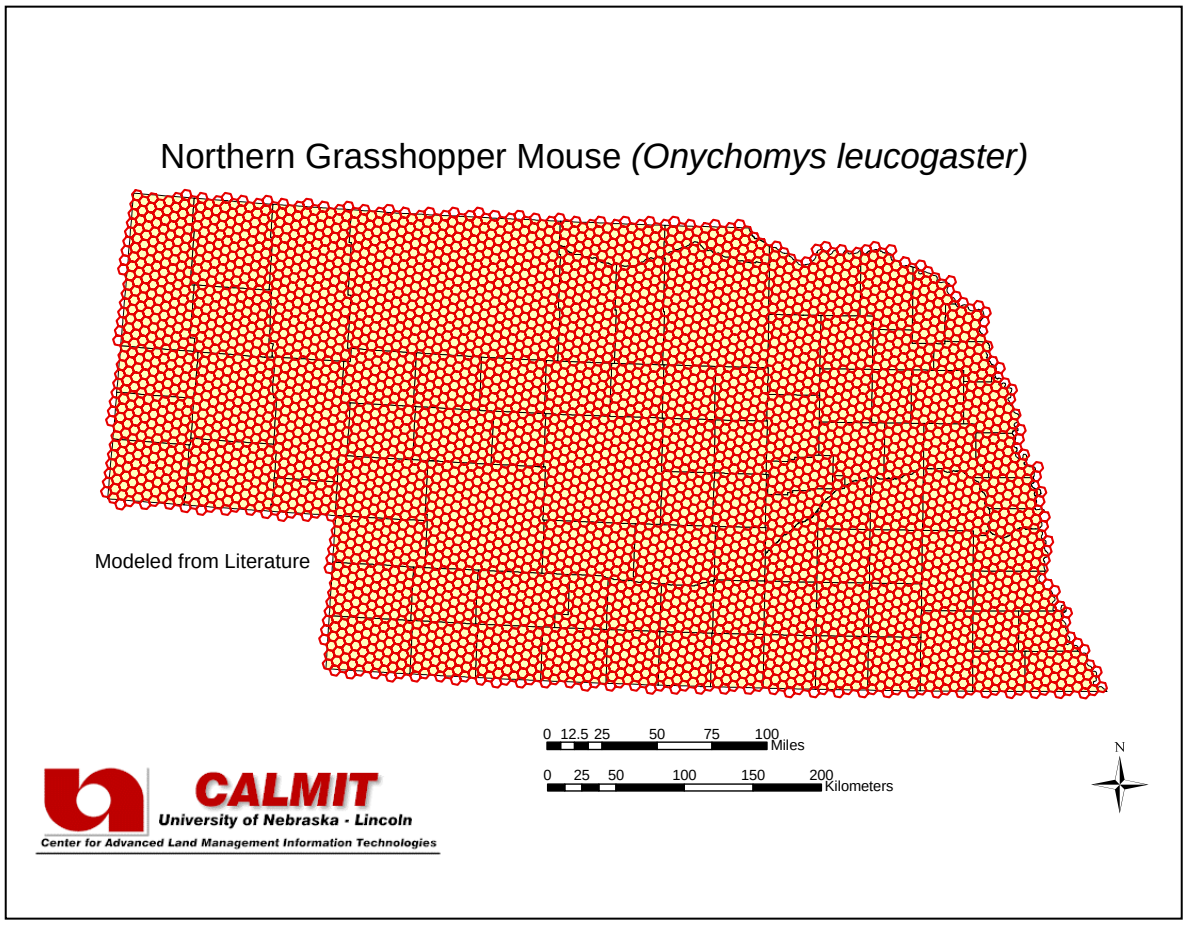
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Northern grasshopper mouse**	TNC Global Status:	G5
Scientific Name:	***Onychomys leucogaster***	Federal Status:	-
TNC Element Code:	AMAFF06010	State (NE) Status:	S5

Habitat Description:
Probably restricted by tall-grass prairie. Can be found in the upland Sand Hills community but its distribution extends beyond the Sand Hills. It is more common in the western part of the state than the eastern part (Freeman 1998). Historically occupied all but extreme eastern counties of Nebraska (Jones 1964 in Benedict et al. 2000), but recently have been found in Cass county and southward (Benedict 2000). Grasshopper mice live in semiarid grasslands and shrublands, generally on sandy to silty soils and are commonly found on overgrazed rangelands and in abandoned fields (Jones et al. 1985).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



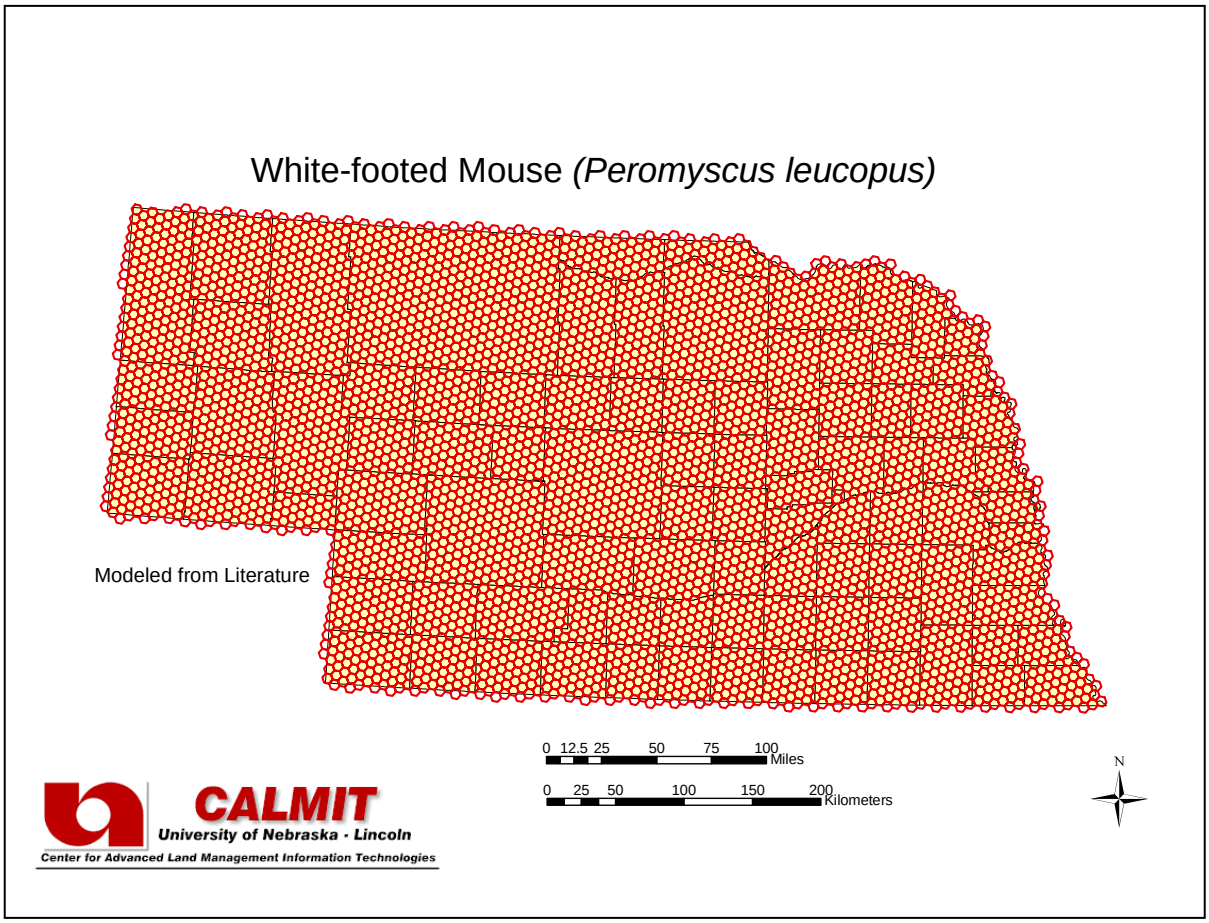
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**White-footed mouse**	TNC Global Status:	G5
Scientific Name:	***Peromyscus leucopus***	Federal Status:	-
TNC Element Code:	AMAFF03070	State (NE) Status:	S5

Habitat Description:
Typically inhabits warm, dry, eastern deciduous forests. Prefers to take cover in fallen logs, rocks and brush. Western parts of its distribution are limited to woody river bottoms, valleys and ravines. Also common in hedgerows bordering agricultural areas, foraging at night in brushy fields and croplands. Will also habituate man made structures. (Banfield 1974; Choate et al. 1994; Hamilton and Whitaker 1979; Lackey 1999). More restricted to wooded areas and in the Sand Hills is restricted to waterways, especially where there are trees and tall cover (Freeman 1998). Adults avoid open areas (Kurta 1995). Requires some type of cover ranging from shrubs and tree canopy to fallen logs or cropland (Lackey 1999). Subadults may disperse into grassy areas or cultivated areas. (Kurta 1995)

Total Area of Modeled Habitat (ha): 20,542,058

Model Description:
Modeled from literature using the variable 'Land Cover class Deciduous Forests and Woodlands > 0.5%' OR 'Land Cover class Ponderosa Pine Forests and Woodlands > 1%'.

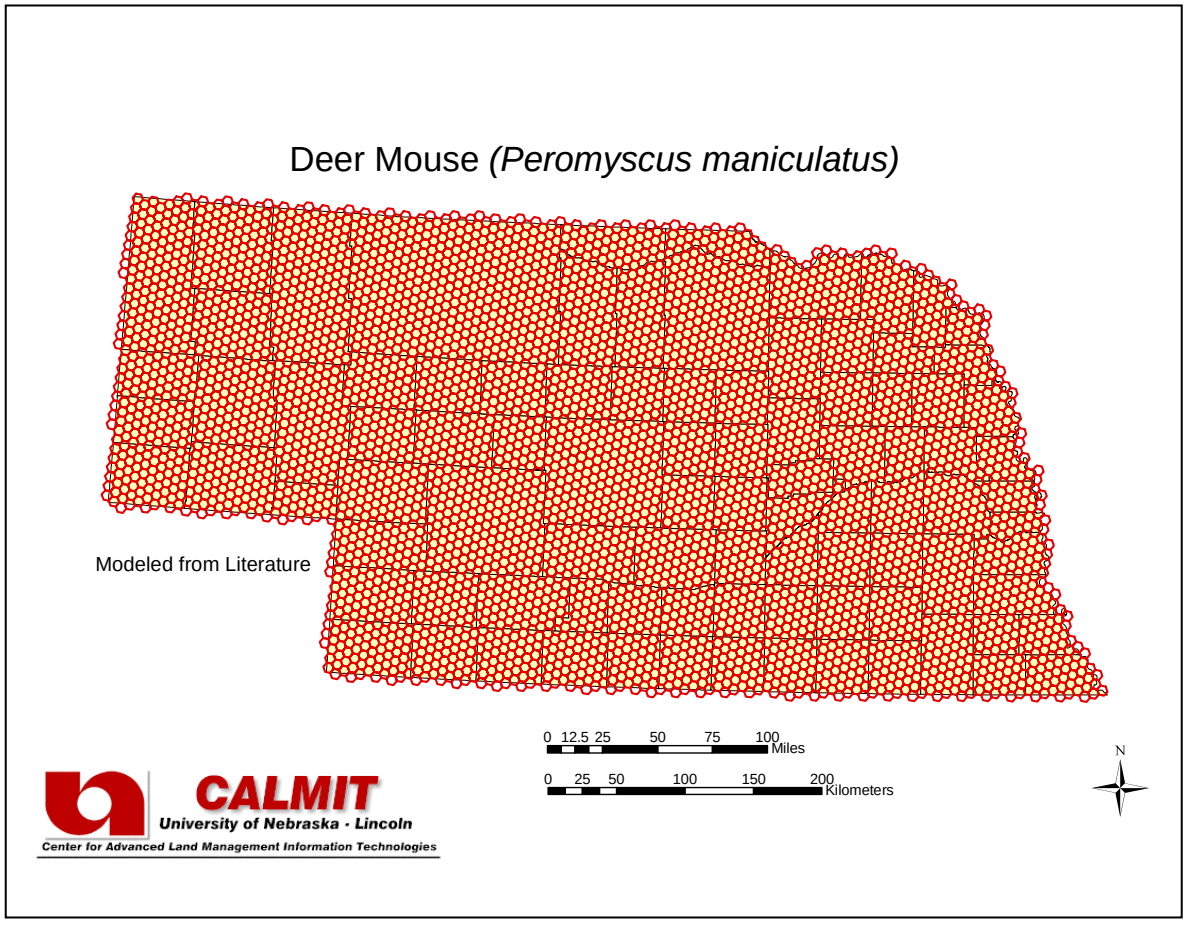


Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Deer mouse**	TNC Global Status:	G5
Scientific Name:	***Peromyscus maniculatus***	Federal Status:	-
TNC Element Code:	AMAFF03040	State (NE) Status:	S5

Habitat Description:
Occur from arid grasslands to floodplains, and in cultivated fields (Jones et al. 1985). Abundant in the drier upland Sand Hills and also the more moist grassy areas of the Sand Hills (Freeman 1998). Not found in deep woods or marshy areas (Freeman 1998). Deer mice are usually not seen in wetlands and may be absent from woodlands, and riparian situations (Jones 1964; Jones et al. 1985).

Total Area of Modeled Habitat (ha): 20,642,058
Model Description:
Statewide distribution.



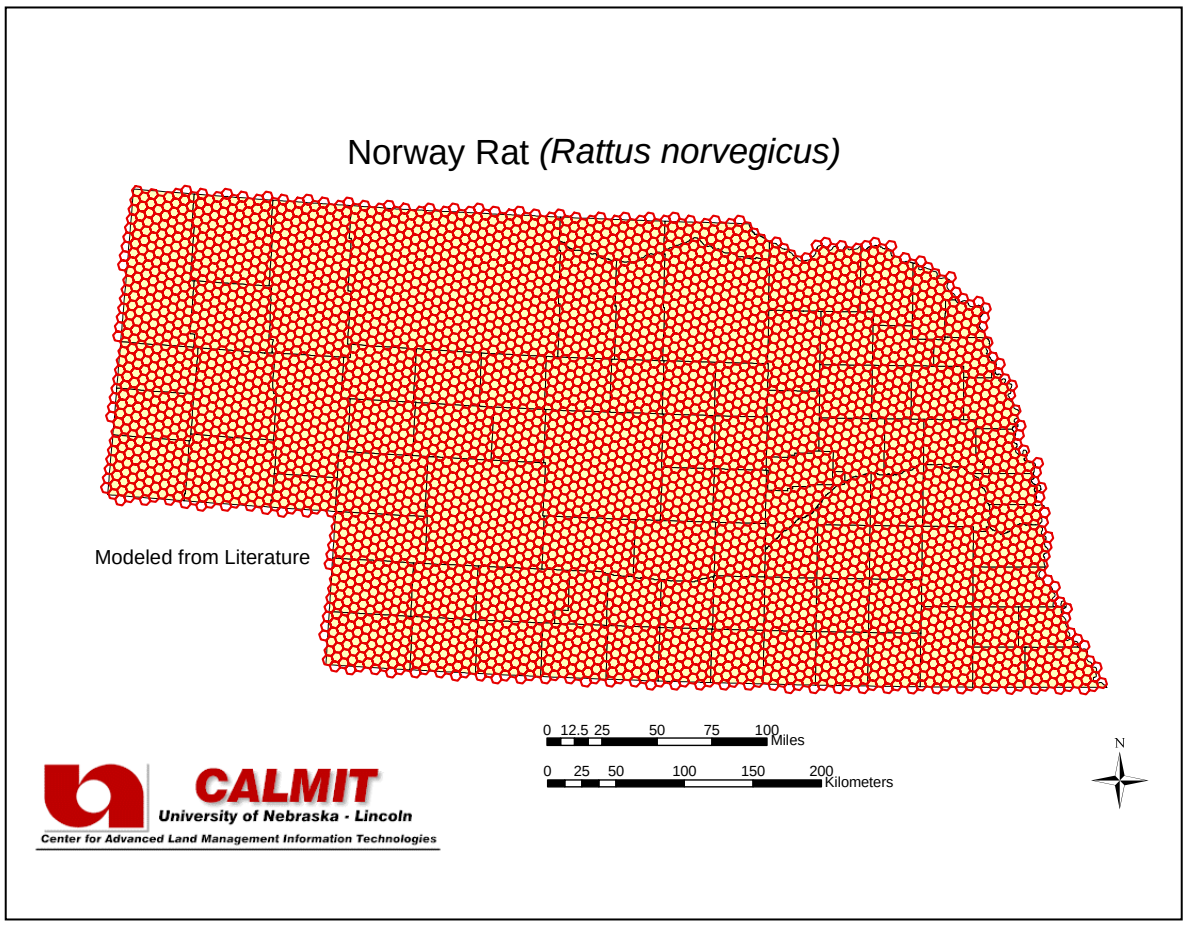
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Norway rat**	TNC Global Status:	G5
Scientific Name:	***Rattus norvegicus***	Federal Status:	--
TNC Element Code:	AMAFF21020	State (NE) Status:	SE

Habitat Description:
Introduced species. Occurs widely in the Plains states, but is mostly limited to urban areas or other human habitations such as farm buildings (Jones et al. 1983, 1985). Occurs on farms, in cities, and among many types of human dwellings; in summer, it often inhabits cultivated fields (Whitaker 1997).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



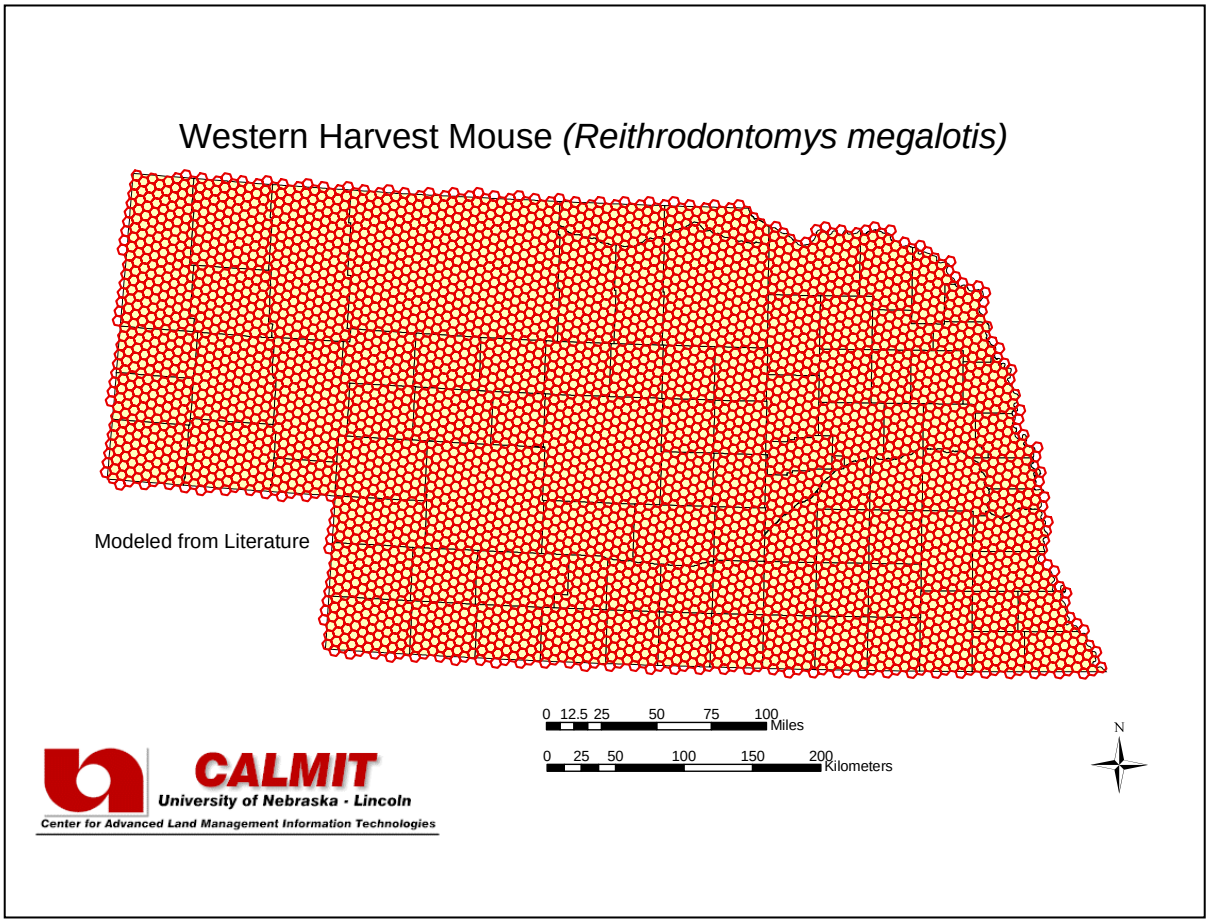
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Western harvest mouse**	TNC Global Status:	G5
Scientific Name:	***Reithrodontomys megalotis***	Federal Status:	-
TNC Element Code:	AMAFF02030	State (NE) Status:	S5

Habitat Description:
Statewide distribution. A common inhabitant of grassy areas throughout Nebraska, this species is widely distributed in the eastern part of the state, but frequently is restricted to riparian communities in the western part (Jones 1964). Lush, lowland swales seem to provide the optimum habitat for this mouse but it lives also in weedy fencerows, thickets, fallow fields, and on dry uplands where ground cover is abundant. Typical habitats include dense patches of tall grass, shrublands (including sagebrush), yucca-grass associations, brushy riparian habitats, cattails, alfalfa fields, and borrow pits with weedy vegetation (Jones et al. 1983). Avoids only dense forest and xeric uplands. Occupies abandoned fields to well-developed mid- and tall-grass prairie, weedy field margins, and highway rights-of-way (Jones et al. 1985). Old fields, meadows, weedy roadsides, agricultural areas, grassy situations within pine-oak forest, and riparian borders (NatureServe 2002). Prefers dense vegetative cover. Also may be found in shrubby arid regions.

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



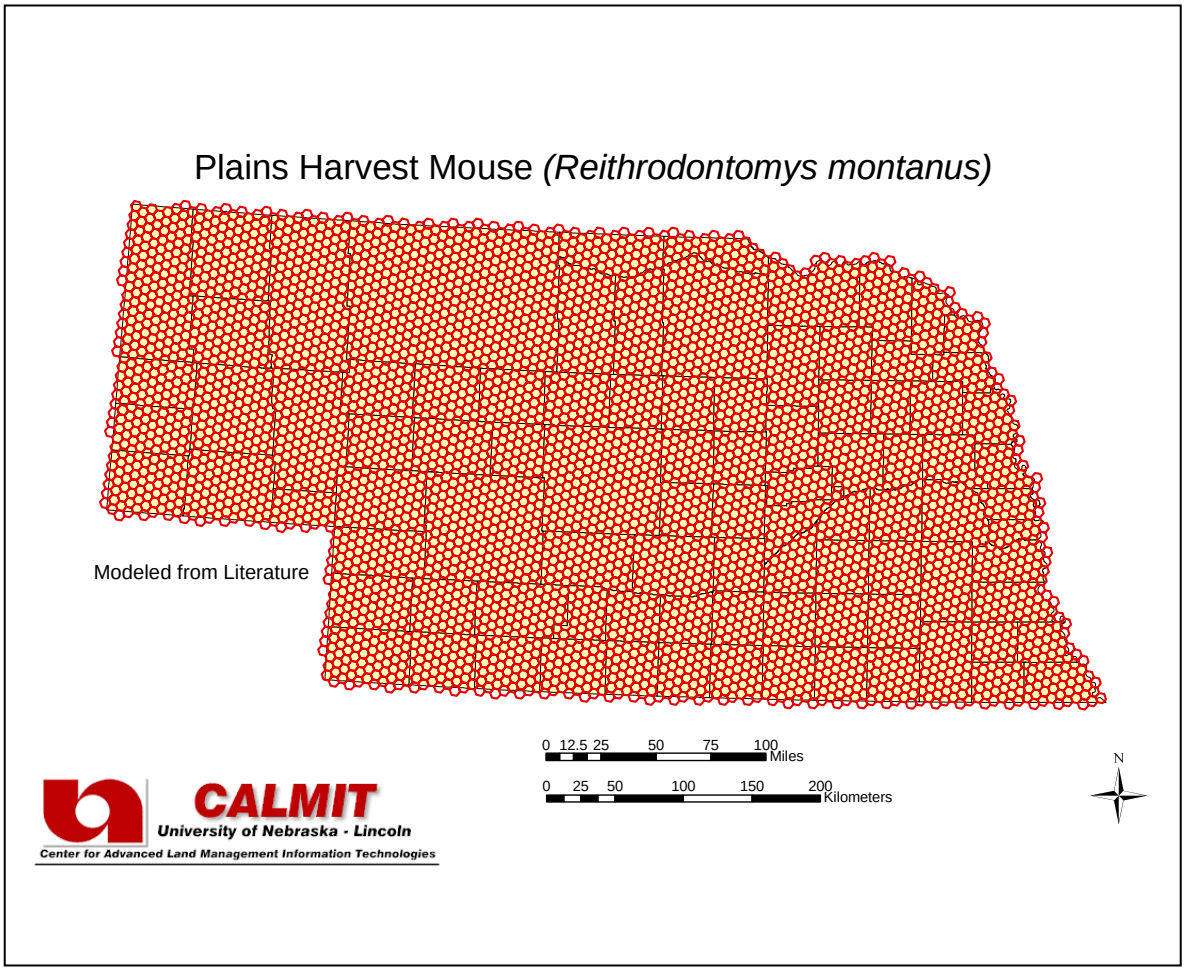
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Plains harvest mouse**	TNC Global Status:	G5
Scientific Name:	***Reithrodontomys montanus***	Federal Status:	-
TNC Element Code:	AMAFF02010	State (NE) Status:	S4

Habitat Description:
Found in drier, upland habitat of the Sand Hills and throughout the state (Jones 1964; Freeman 1998). Found in open grassy areas, including prairies and other types of grasslands (Whitaker 1997). This is a species of well-developed upland grasslands. It responds well to grazed rangelands, with exposed rocks and prickly pear, but the cover of grasses must be greater than about 50 percent (Jones et al. 1985). Two subspecies found in Nebraska (Jones et al. 1983).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



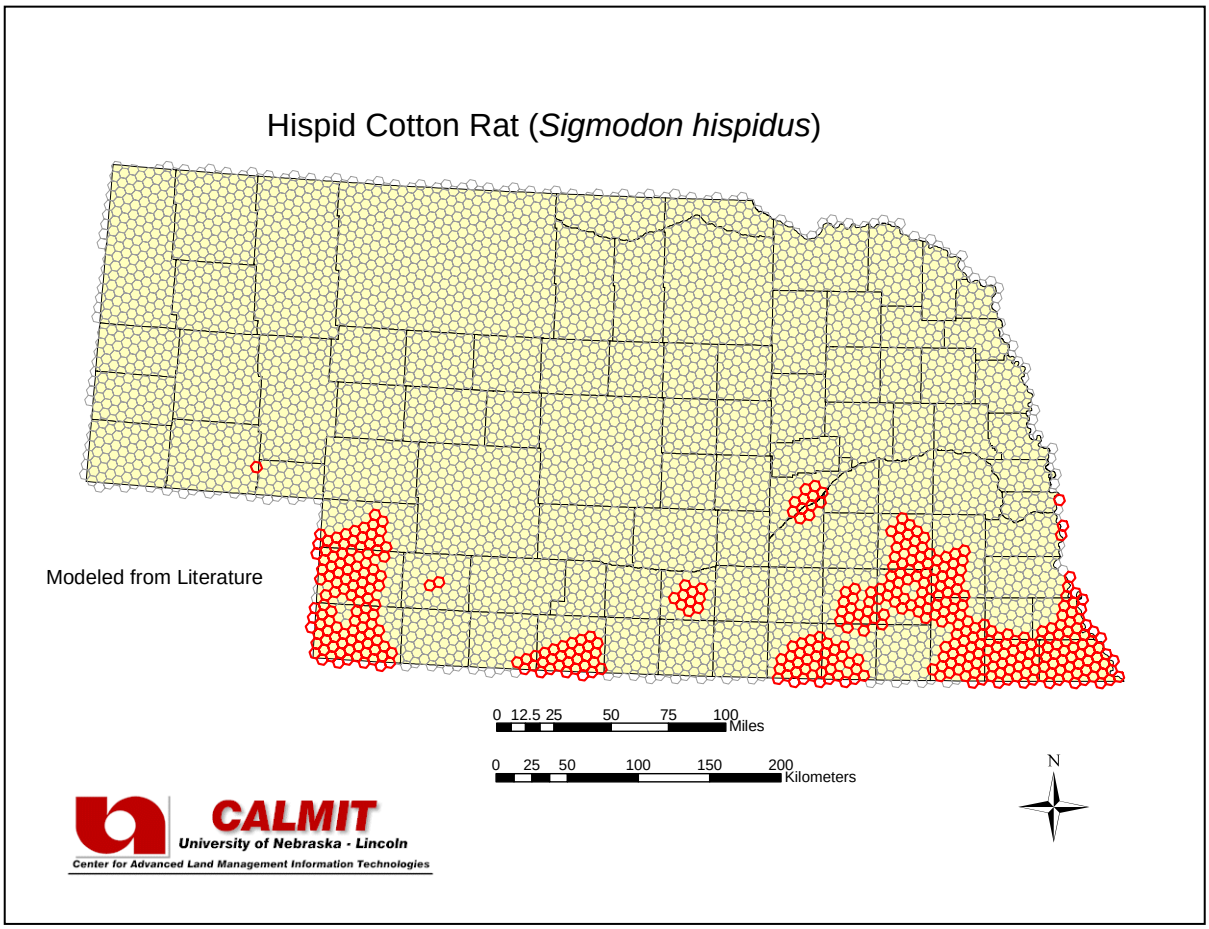
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Hispid cotton rat**	TNC Global Status:	G5
Scientific Name:	***Sigmodon hispidus***	Federal Status:	-
TNC Element Code:	AMAFF07010	State (NE) Status:	S3

Habitat Description:
Grassy and weedy fields (Whitaker 1997). Occupies a wide variety of relatively mesic habitats: thickets, woodland borders, riparian ecosystems such as slough grass and cattails, as well as weedy margins of fields and moist pastures – especially stands of sunflowers and summer cypress – and tall-grass stands in roadside ditches. A common denominator of suitable habitat is nearly complete ground cover (Jones et al. 1983). Grassland sites (McMillan and Kaufman 1994). In Nebraska, its distribution is limited by winter temperatures to the southern portion of the state (Jones et al. 1983).

Total Area of Modeled Habitat (ha): 1,743,504

Model Description:
Modeled from literature using the variable '30-year Average Minimum Temperature for February > -8.4ºC' AND 'Land Cover class Upland Tallgrass Prairie is present' OR 'Land Cover class Emergent Wetland is present'.



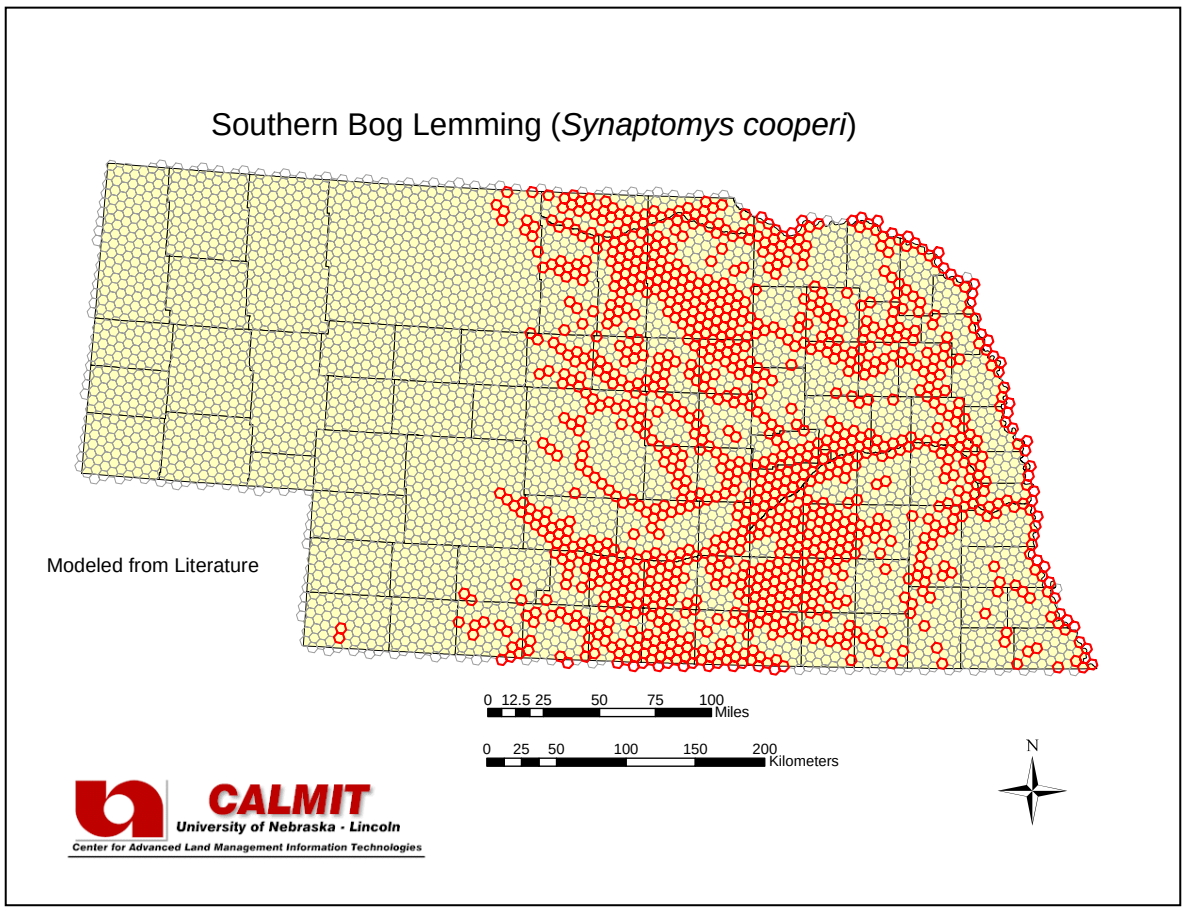
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Southern bog lemming**	TNC Global Status:	G5
Scientific Name:	***Synaptomys cooperi***	Federal Status:	-
TNC Element Code:	AMAFF17010	State (NE) Status:	S1

Habitat Description:
Favored habitat includes vegetation surrounding streams and creeks, damp to wet grasslands and marshes (Sheffield 1998). Much of their natural habitat has been converted to farmland and they are now restricted to fencerows, damp corners of cultivated fields, swales, grassy riparian communities and bogs (Jones et al. 1983). An isolated population is known only from the vicinity of cold-water springs draining into Rock Creek, Dundy County, in southwestern Nebraska.

Total Area of Modeled Habitat (ha): 4,764,185

Model Description:
Modeled from literature using the set of variables 'Land Cover class Riparian Shrubland is present' OR 'Land Cover class Emergent Wetland > 0.5%' AND 'Land Cover class Agricultural Fields is present' AND 'Elevation < 825 m'. The location of the isolated population in the southwestern corner of the state could not be modeled using the available variables and was identified using only location information from literature.



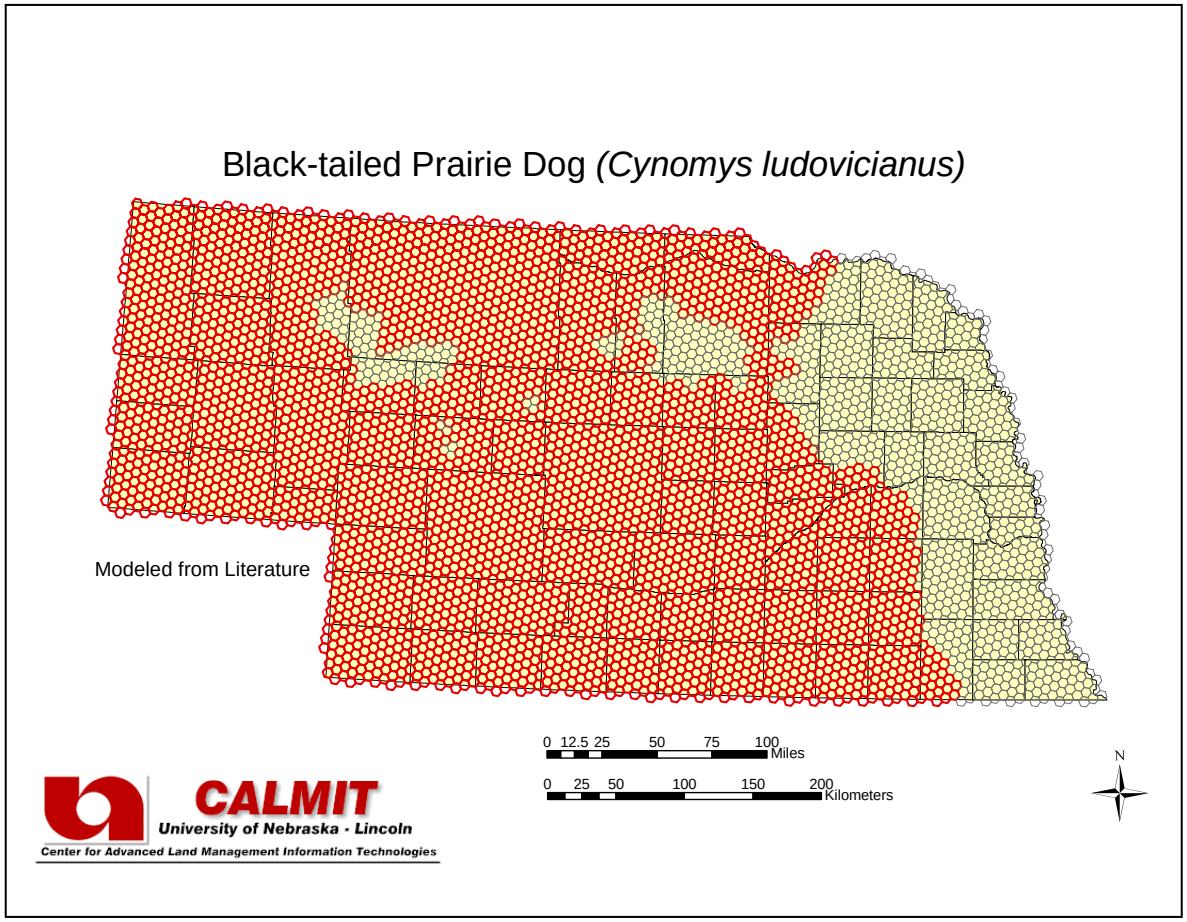
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Black-tailed prairie dog**	TNC Global Status:	G4
Scientific Name:	***Cynomys ludovicianus***	Federal Status:	-
TNC Element Code:	AMAFB06010	State (NE) Status:	S4

Habitat Description:
Typically an inhabitant of the short-grass prairie (Whitaker 1997) and considered a grassland or steppe species by Hoffman and Jones (1970) (Freeman 1998). It thrives on overgrazed rangeland and avoids stands of tall grass (Jones et al. 1985). Likes river flats and coulee bottomlands (Forsyth 1999). Inhabits dry upland pastures (Jones et al. 1983). Diet consists of forbs and grasses; some animal matter; opportunistic but does select for certain plants according to nutritional requirements (Forsyth 1999). Most abundant and an important community member in the Mixed Grass Prairie and Short Grass Plains associations (Carpenter 1940 in Osborn 1942).

Total Area of Modeled Habitat (ha): 1.60×10^7

Model Description:
Modeled from literature using the set of variables 'Land Cover class Little Bluestem-Gramma Mixedgrass Prairie is present' OR 'Land Cover class Western Wheatgrass Mixedgrass Prairie is present' OR 'Land Cover class Western Shortgrass Prairie is present'.



Nebraska GAP Analysis 2004
Mammal Species Atlas

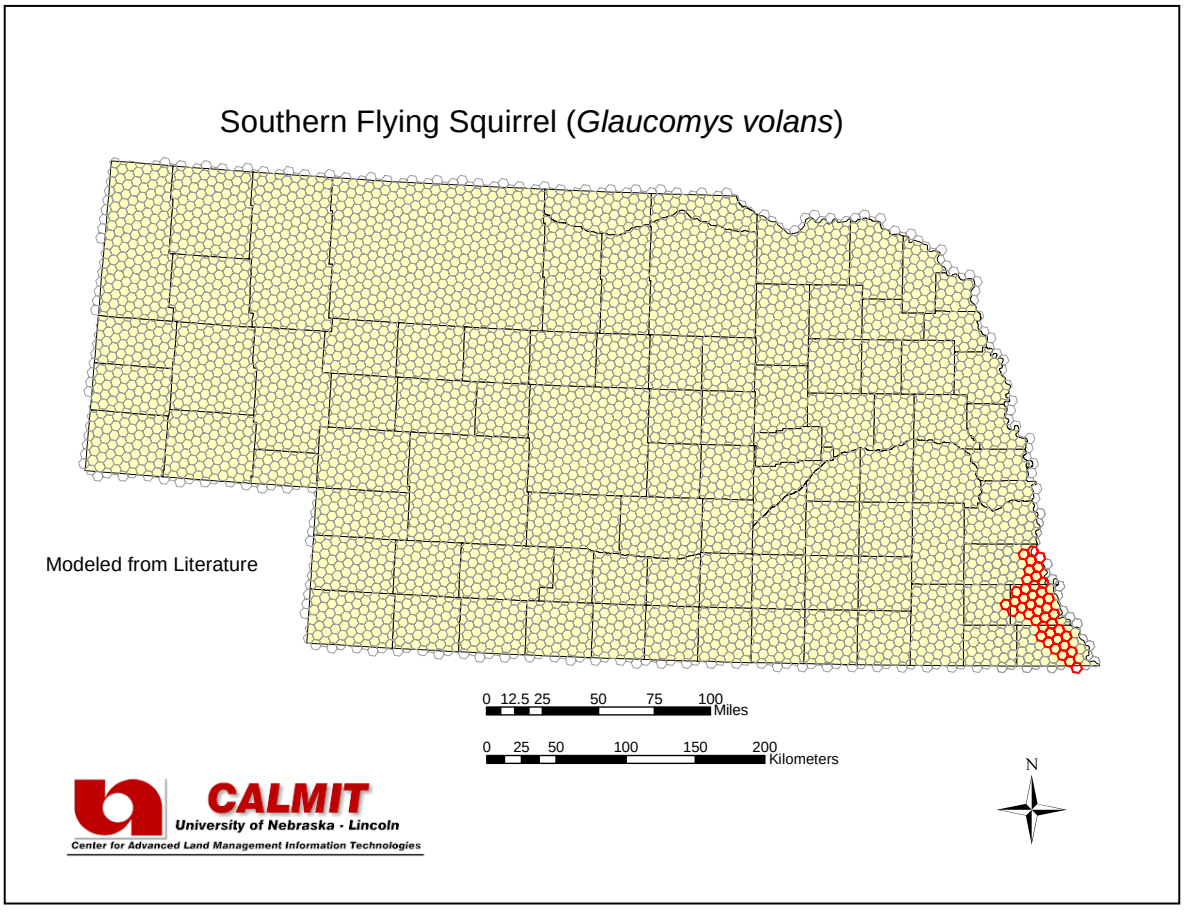
Common Name:	**Southern flying squirrel**	TNC Global Status:	G5
Scientific Name:	***Glaucomys volans***	Federal Status:	-
TNC Element Code:	AMAFB09010	State (NE) Status:	S1

Habitat Description:

Only the southern flying squirrel is found in Nebraska, and it is found only in remnant tracts of eastern deciduous forest in the southeastern corner of the state alone the Missouri River (Jones 1964); it is known to occur in the forested bluffs along the Missouri River from the far southeastern corner of the state north to about Nebraska City (NGPC 2002). Considered a threatened species in Nebraska. Habitat is best characterized by mature, oak-hickory deciduous forest, usually not far from water. Also occupies timbered areas within or around human habitations, particularly if oak-hickory trees predominate (Dolan and Carter 1977; Jones and Birney 1988; Layne 1999; Schwartz 1981; Whittaker and Hamilton 1979). Prefers deciduous and mixed forests, particularly beech- maple, oak-hickory and poplar. Also occurs in old orchards (NatureServe 2002).

Total Area of Modeled Habitat (ha): 170,296

Model Description:
Modeled from literature using the set of variables 'Land Cover class Deciduous Forests and Woodlands is present' AND '30-year Average Precipitation Coefficient of Variation for August > 70.5%', clipped to include only the area of extreme southeastern Nebraska described in the literature (NGPC 2002).



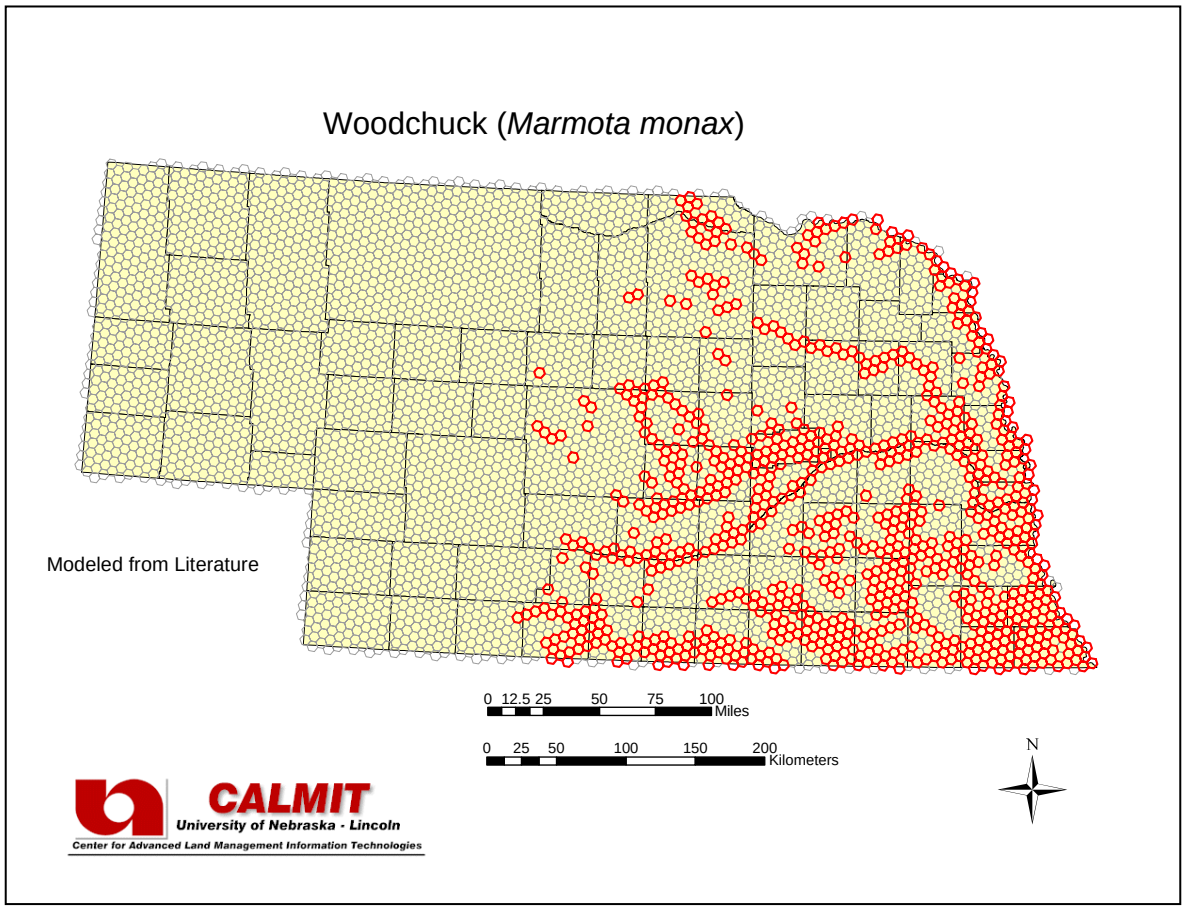
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Woodchuck**	TNC Global Status:	G5
Scientific Name:	***Marmota monax***	Federal Status:	-
TNC Element Code:	AMAFB03010	State (NE) Status:	S4

Habitat Description:
Typically inhabits forest edges and strips of trees extending along creeks and fence-lines where there are refuges for dens and areas of grass, alfalfa or similar vegetation for grazing (Jones 1964; Jones et al. 1983 in Benedict et al. 2000). Found primarily in the eastern half of the state. Burrows are constructed beneath rocks, stumps, building foundations or other supportive structures (Banfield 1974; Jones and Birney 1988; Schultz 1981; Svendsen 1999).

Total Area of Modeled Habitat (ha): 3,491,034

Model Description:
Modeled from literature using the set of variables 'Land Cover class Deciduous Forests and Woodlands < 5%' OR 'Land Cover class Riparian Woodland is present' AND '30-year Average Precipitation for August > 65 mm'.



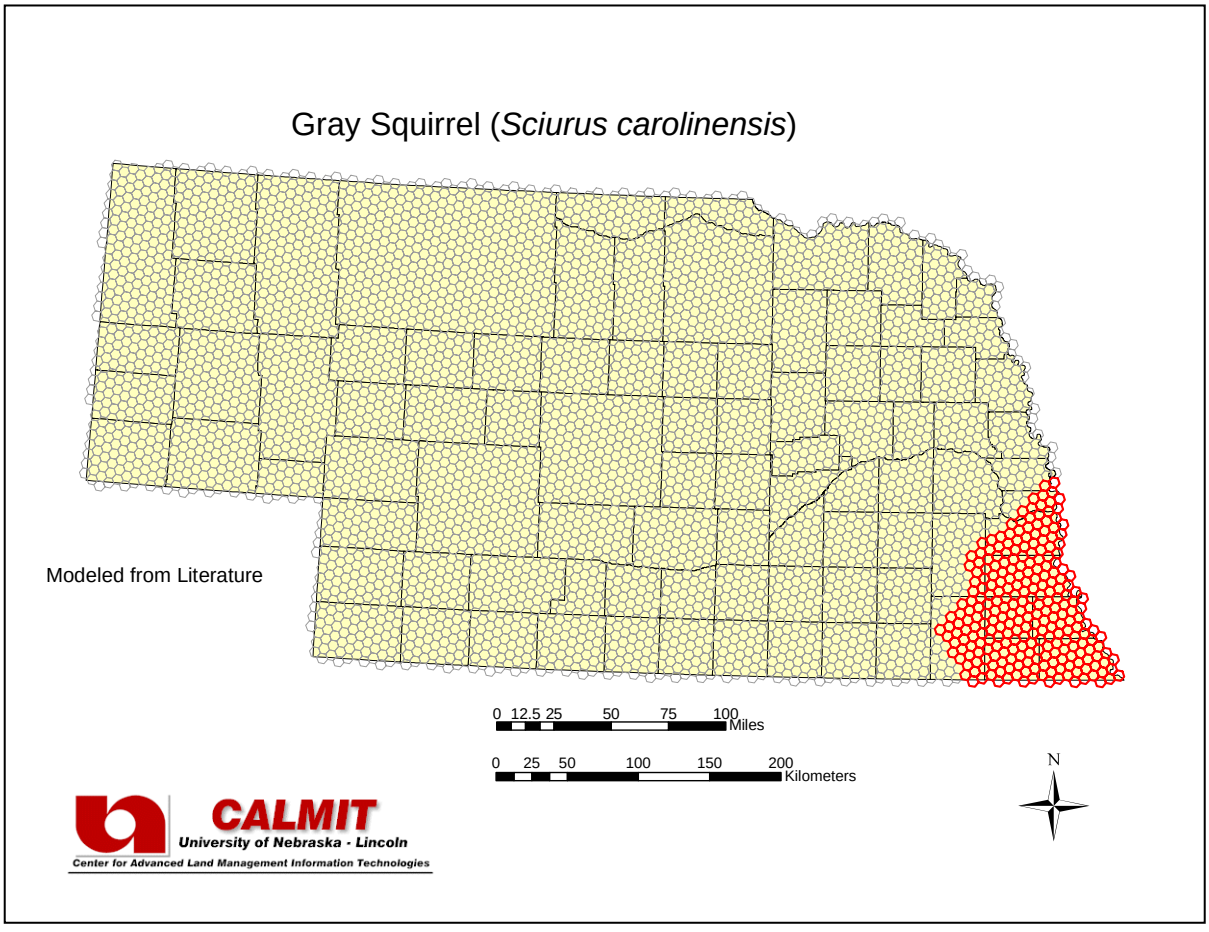
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Gray squirrel**	TNC Global Status:	G5
Scientific Name:	***Sciurus carolinensis***	Federal Status:	-
TNC Element Code:	AMAFB07010	State (NE) Status:	S4

Habitat Description:
Hardwood or mixed forests with nut trees, especially oak-hickory forests (Whitaker 1997). Natural habitat is forests of hardwoods or mixed hardwoods and evergreens. The larger the trees, the better the habitat. (Wilson and Ruff 1999). Forest stands of eastern hardwoods or mixed forests; beech/maple, hemlock hardwoods, red and white pine; along streams (especially where there is a wide river-bottom habitat) and in suburban areas. (Forsyth 1999). In Nebraska, limited to the southeastern corner of the state (Jones et al. 1983).

Total Area of Modeled Habitat (ha): 1,050,150

Model Description:
Modeled from literature using the set of variables 'Land Cover class Deciduous Forests and Woodlands is present' AND 'Land Cover class Upland Tallgrass Prairie is present' AND '30-year Average Precipitation for July > 89.5 mm'.



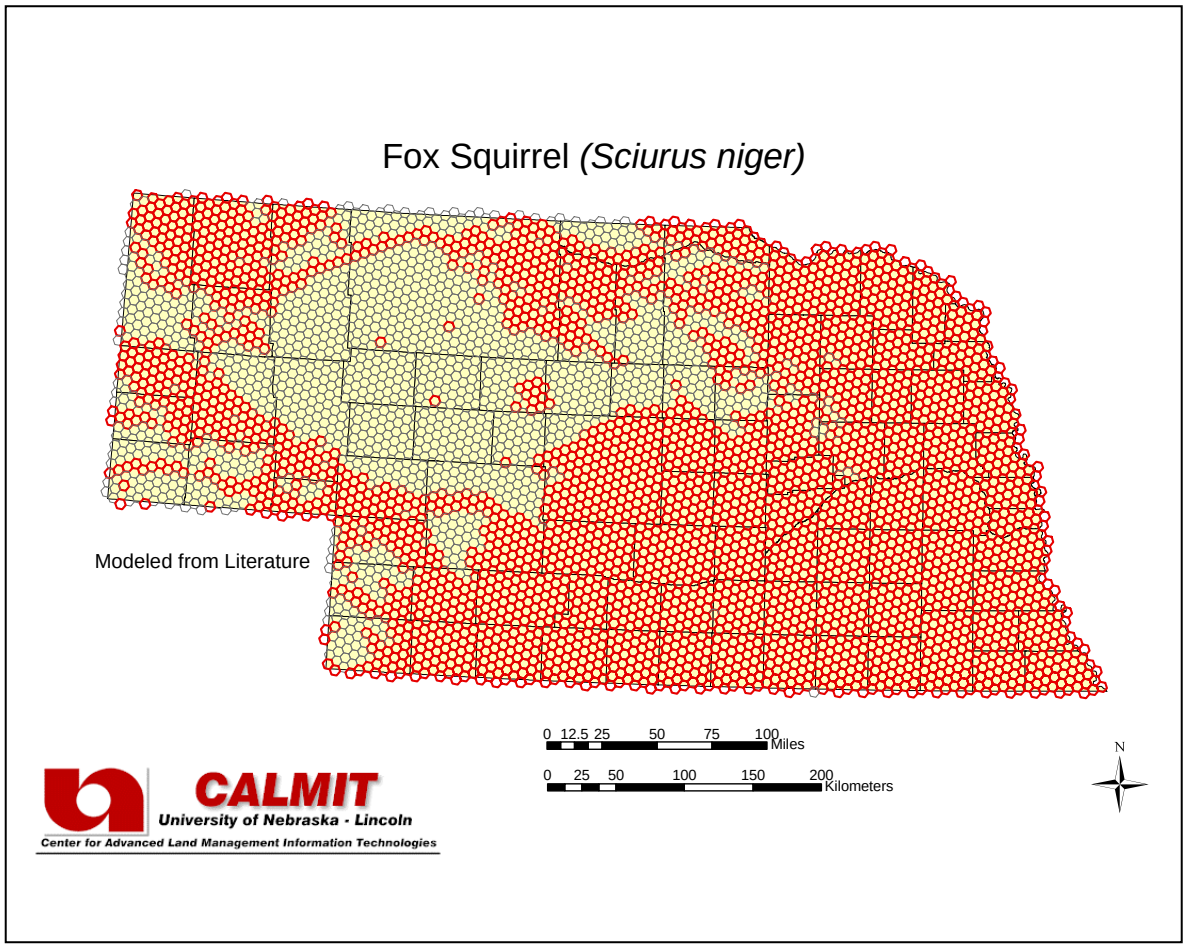
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Fox squirrel**	TNC Global Status:	G5
Scientific Name:	***Sciurus niger***	Federal Status:	-
TNC Element Code:	AMAFB07040	State (NE) Status:	S5

Habitat Description:
Restricted to deciduous forest and riparian and urban woodland (Jones 1964; Jones et al. 1985). They are savannah animals, preferring open, park-like habitats where trees are scattered and the understory is open, rather than dense forests (Wilson and Ruff 1999). Live in suburbs, open hardwood woodlots with clearings interspersed, and along shrubby fencerows (Forsyth 1999). A common inhabitant of the eastern forest and non-grassland areas. It extends into the Sand Hills along major river systems (Freeman 1998).

Total Area of Modeled Habitat (ha): 14,179,004

Model Description:
Modeled from literature using the set of variables 'Land Cover class Deciduous Forests Woodlands is present' AND 'Land Cover class Sandhills Upland Prairie < 20%' OR 'Land Cover class Ponderosa Pine Forests and Woodlands is present'.



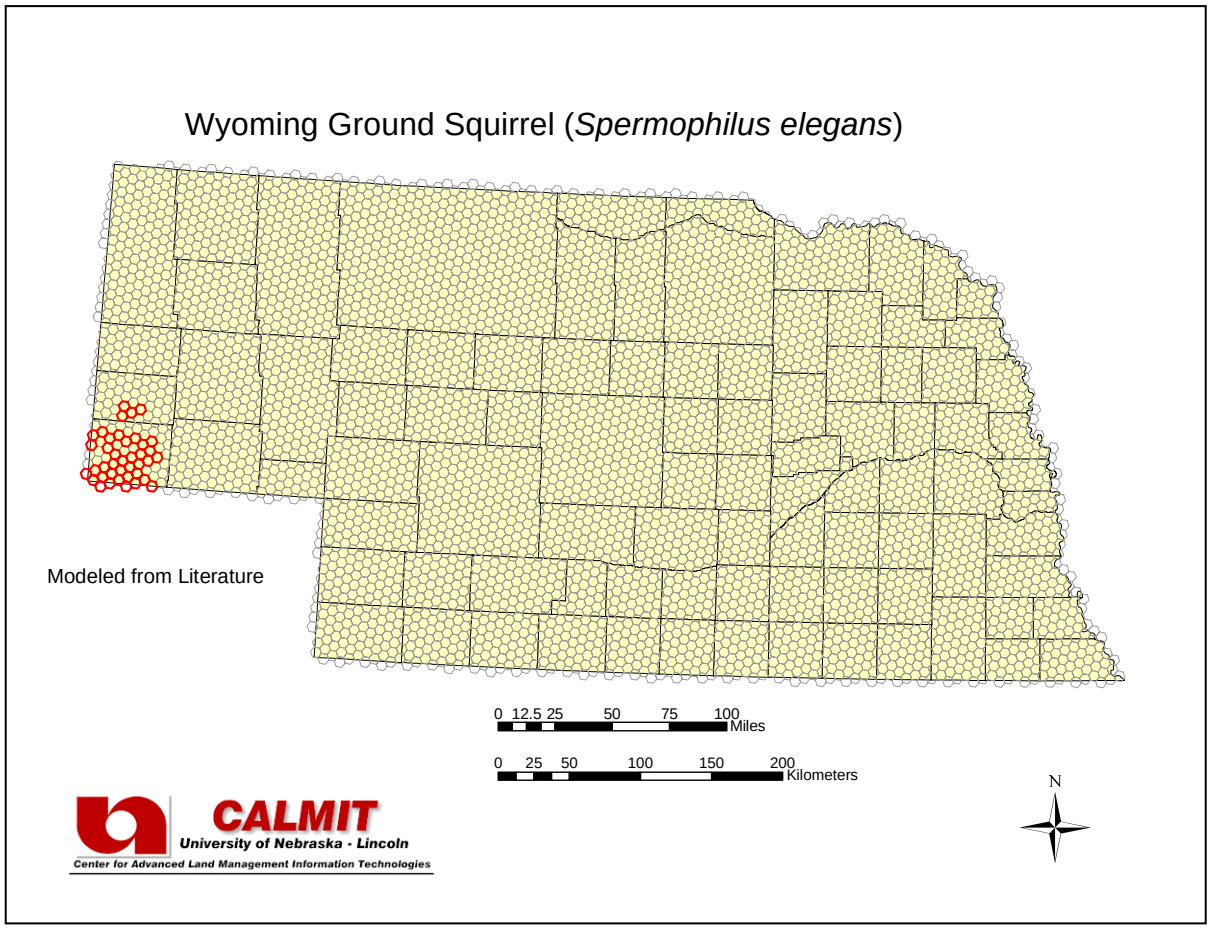
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Wyoming ground squirrel**	TNC Global Status:	G5
Scientific Name:	***Spermophilus elegans***	Federal Status:	-
TNC Element Code:	AMAFB05190	State (NE) Status:	SH

Habitat Description:
May be extirpated in Nebraska, but had been reported from the southern Panhandle (Jones et al. 1983). Favored habitat is well-drained upland slopes covered by dry grassland or shrub-steppe, especially sagebrush. Heavy clay or shale-derived "gumbo" soils are avoided. Waterlogged soils or loose sand are also unsuitable. Well-drained upland slopes covered by dry grassland or shrub steppe, especially sagebrush; mainly on slopes with loose sandy soils, suitable for digging burrows; mountain meadows, talus slopes (Smith, in Wilson and Ruff 1999).

Total Area of Modeled Habitat (ha): 162,183

Model Description:
Modeled from literature using the set of variables 'Land Cover class Western Shortgrass Prairie > 25%' AND 'Percentage of Medium-textured Soils > 75%' AND 'Elevation > 1420 m'.



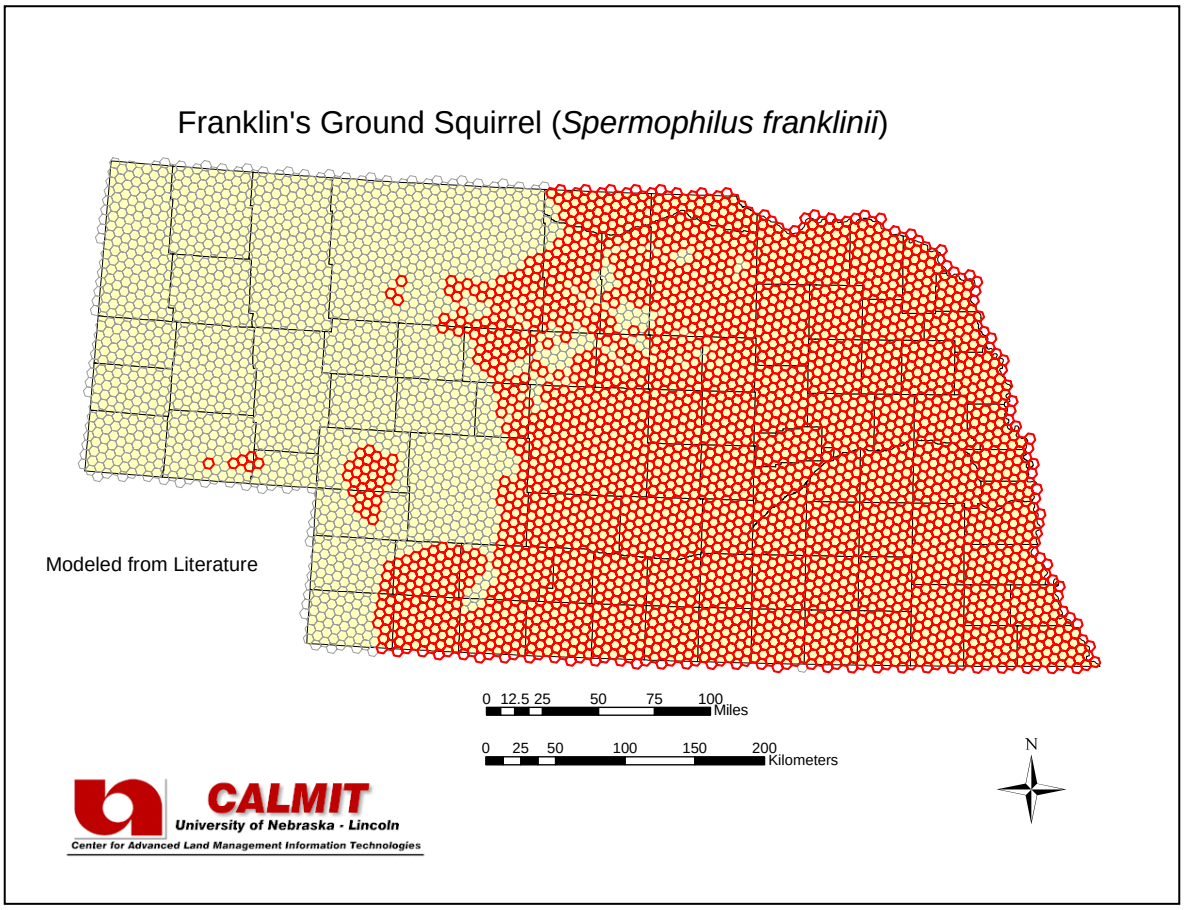
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Franklin's ground squirrel**	TNC Global Status:	G5
Scientific Name:	***Spermophilus franklinii***	Federal Status:	-
TNC Element Code:	AMAFB05120	State (NE) Status:	S5

Habitat Description:
Dense grassy areas, hedges, and brush borders (Whitaker 1997). Inhabit a variety of closed habitats, including tall grass in disturbed areas, shrub land, and woodland edges (Wilson and Ruff 1999). The transition zone between high coniferous forests and grassy areas; areas with low trees but dense ground cover (Forsyth 1999). Burrow in well-drained soils (Jones et al. 1985). Typical inhabitant of the tall-grass prairie in the eastern part of the state (Jones 1964) but extends into the Sand Hills along natural and constructed waterways (Freeman 1998). Franklin's ground squirrel can be found in the tallgrass prairie of the northcentral U.S. and adjacent parts of Canada. They live at the border between grassy areas and woody vegetation because of the diverse food sources available (Baker, 1983). This squirrel is not often seen because of its preference for densely vegetated areas.

Total Area of Modeled Habitat (ha): 1.25×10^7

Model Description:
Modeled from literature using the set of variables 'Land Cover class Upland Tallgrass Prairie is present' OR 'Land Cover class Deciduous Forests and Woodlands is present' AND NOT '30-year Average Precipitation for March < 32.5 mm'.



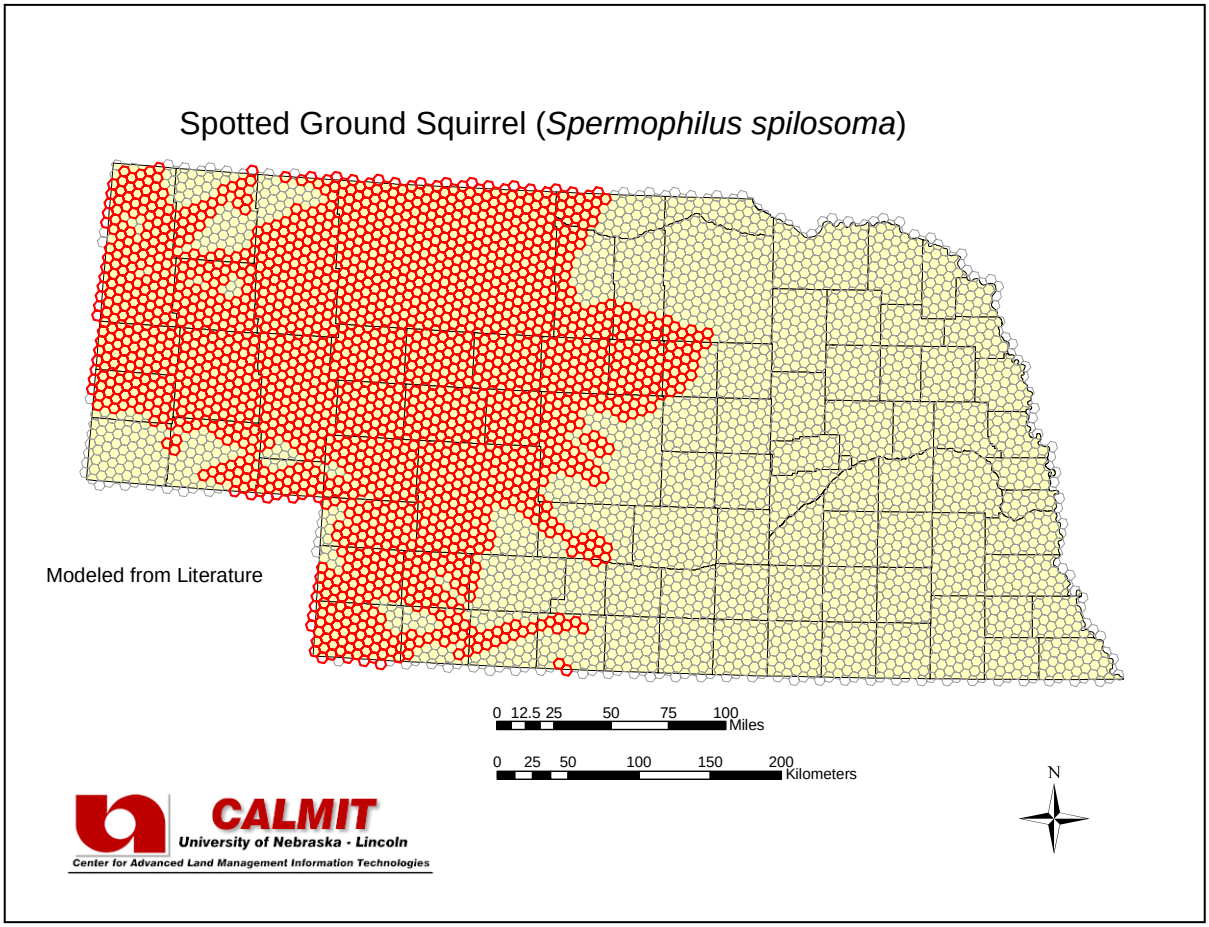
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Spotted ground squirrel**	TNC Global Status:	G5
Scientific Name:	**Spermophilus spilosoma**	Federal Status:	-
TNC Element Code:	AMAFB05110	State (NE) Status:	S4

Habitat Description:
Prefers dry, deep, and sandy soils with sparse vegetation (Wilson and Ruff 1999). Predominately dry, sandy areas, grassy areas and pinewoods (Whitaker 1997). Sandy soils in semiarid grasslands or grassland-shrub ecotones, often where there are sagebrush, prickly pear, and yucca. Limited to approximately the western two-thirds of Nebraska; its preferred habitat is dry, sandy soils, such as the Sand Hills of Nebraska (Jones et al. 1983).

Total Area of Modeled Habitat (ha): 8,466,028

Model Description:
Modeled from literature using the set of variables 'Coarse-textured Soil is present' AND '30-year Average Precipitation for September < 55 mm'.



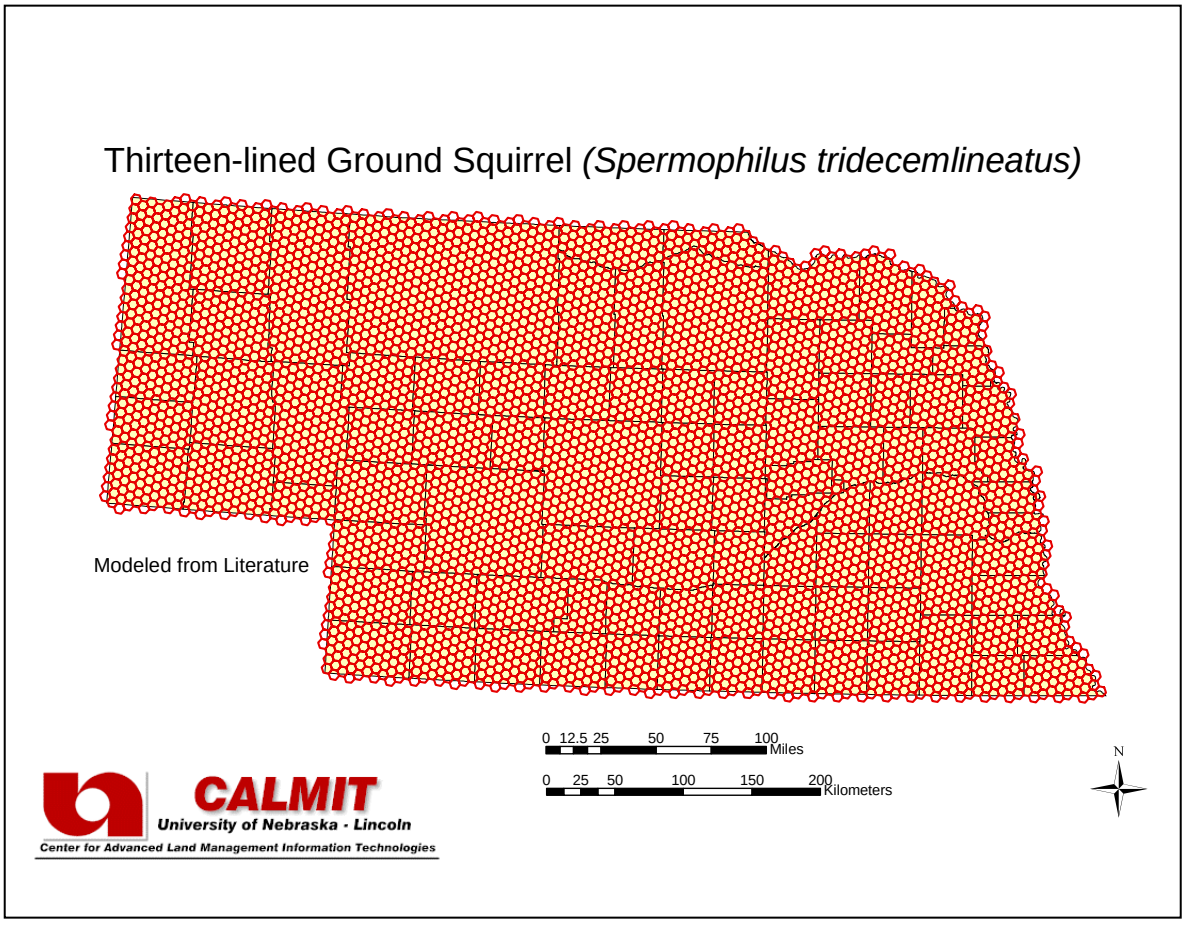
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Thirteen-lined ground squirrel**	TNC Global Status:	G5
Scientific Name:	**Spermophilus tridecemlineatus**	Federal Status:	-
TNC Element Code:	AMAFB05090	State (NE) Status:	S5

Habitat Description:
Statewide distribution. Inhabits transitional zone between grassland and forest with low grass, weeds or shrubby vegetation; also golf courses, abandoned overgrown fields, meadows and along fence lines between cultivated fields (Forsyth 1999) and where the soil is well-drained (Jones et al. 1983). Tall grass areas inhibit their view of the surroundings, and they are not found in such areas (Jones et al. 1983). Restricted to dry and sandy (and "tighter") soils of open areas, such as grasslands, cultivated fields, meadows, roadsides, airfields, shrublands, and suburb lawns (NatureServe 2002). *Spermophilus tridecemlineatus* prefers open areas with short grass and well-drained sandy or loamy soils for burrows. It avoids wooded areas. Mowed lawns, golf courses, cemeteries, well-grazed pastures, parks and roadsides are common habitats for it now that it is no longer limited to prairie regions. (Jones 1988; Kurta 1995).

Total Area of Modeled Habitat (ha): 20,642,058

Model Description:
Statewide distribution.



Nebraska GAP Analysis 2004
Mammal Species Atlas

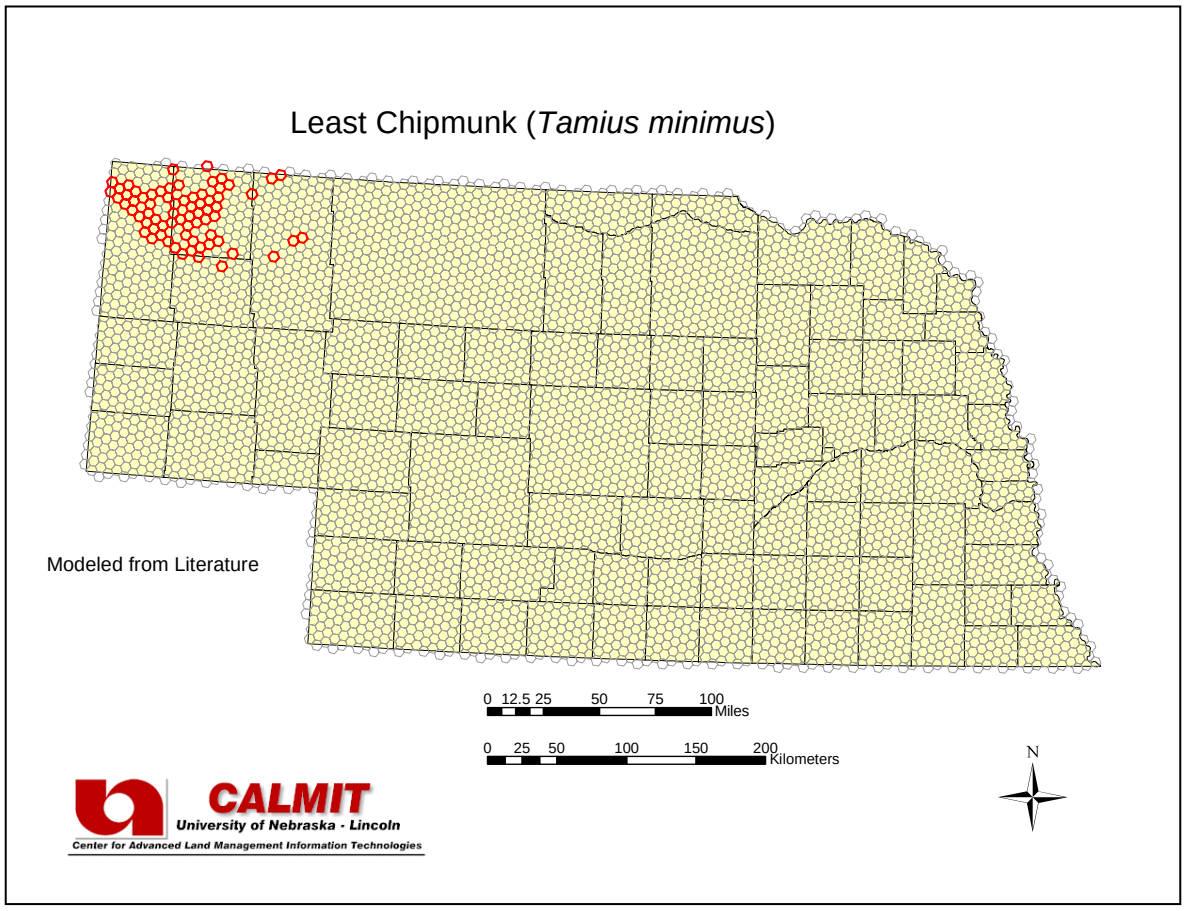
Common Name:	**Least chipmunk**	TNC Global Status:	G5
Scientific Name:	**Tamias minimus**	Federal Status:	-
TNC Element Code:	AMAFB02020	State (NE) Status:	S3

Habitat Description:

Habitat includes mixed hardwood and coniferous forests, shrubby growth around watercourses, rocky ravines, brushlands and arid badlands (Jones et al. 1983; Forsyth 1999). Found in most ecosystems except unbroken forest and open grassland (Jones et al. 1985). In Nebraska, its distribution appears to be limited to the northwestern corner of the state (Jones et al. 1983).

Total Area of Modeled Habitat (ha): 283,827

Model Description:
Modeled from literature using the set of variables 'Land Cover class Ponderosa Pine Forests and Woodlands is present' AND 'Land Cover class Western Wheatgrass Mixedgrass Prairie is present' AND 'Land Cover class Barren/Sand/Outcrop is present'.



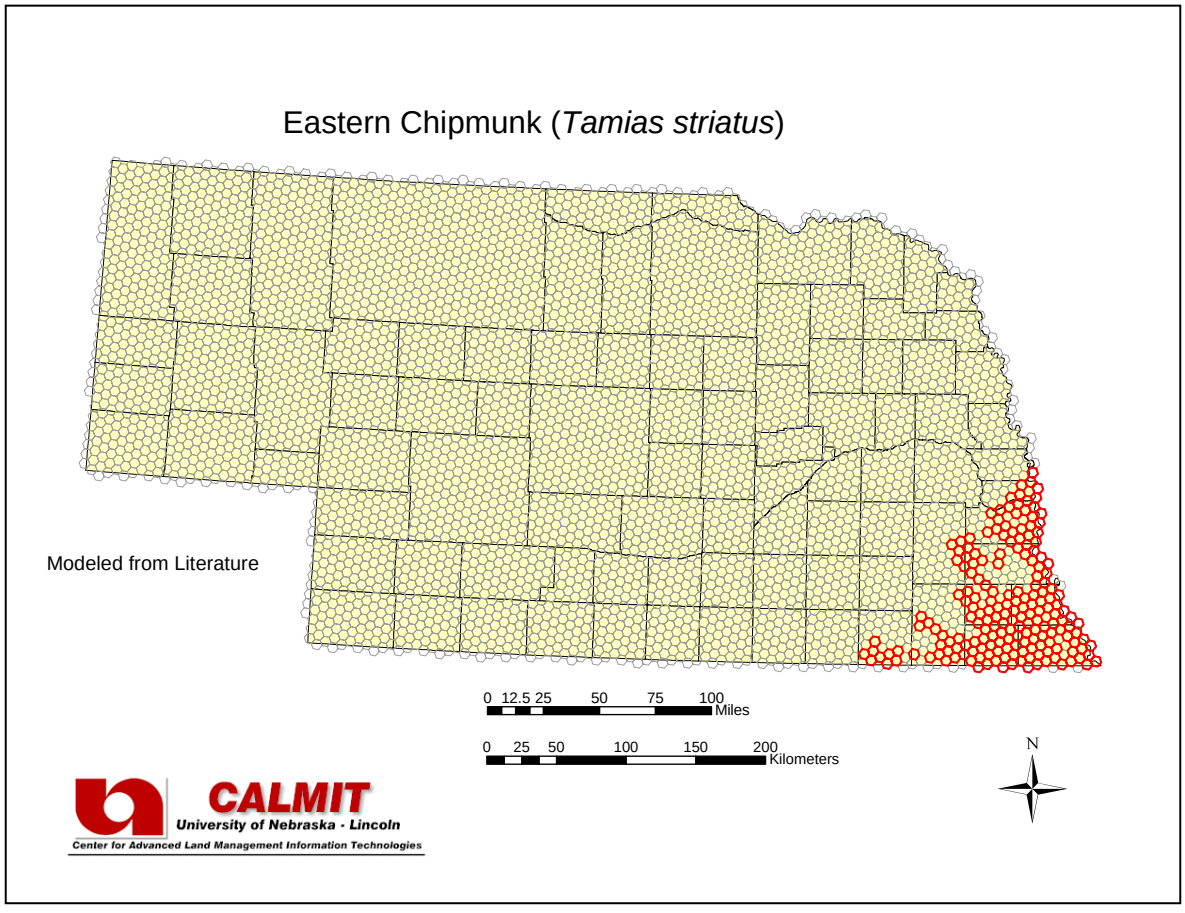
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Eastern chipmunk**	TNC Global Status:	G5
Scientific Name:	**Tamias striatus**	Federal Status:	-
TNC Element Code:	AMAFB02230	State (NE) Status:	G1

Habitat Description:
Favored habitats are wooded hillsides, rocky ravines, and dry, upland timber (Jones et al. 1979). Most commonly found in mature deciduous forests such as those along the wooded bluffs of the Missouri River (Jones 1964; Forsyth 1999; Svendsen and Yahner 1979, King et al. 1998); however, due to its varied diet, it can be found in all stages of forest growth including mixed coniferous-deciduous stands (Forsyth 1999). Rarely seen any distance from wooded or brushy areas (Jones et al. 1979). Sectors uninhabited by chipmunks are typified by dense growth of young trees and shrubs or sandy soil (Svendsen and Yahner 1979). Rare in the western portion of its range, probably due to forest thinning and the clearing of brush for pastureage or agriculture (Jones et al. 1983).

Total Area of Modeled Habitat (ha): 774,435

Model Description:
Modeled from literature using the set of variables ‘Land Cover class Deciduous Forests and Woodlands > 5%’ AND ‘30-year Average Precipitation for July > 90 mm’.



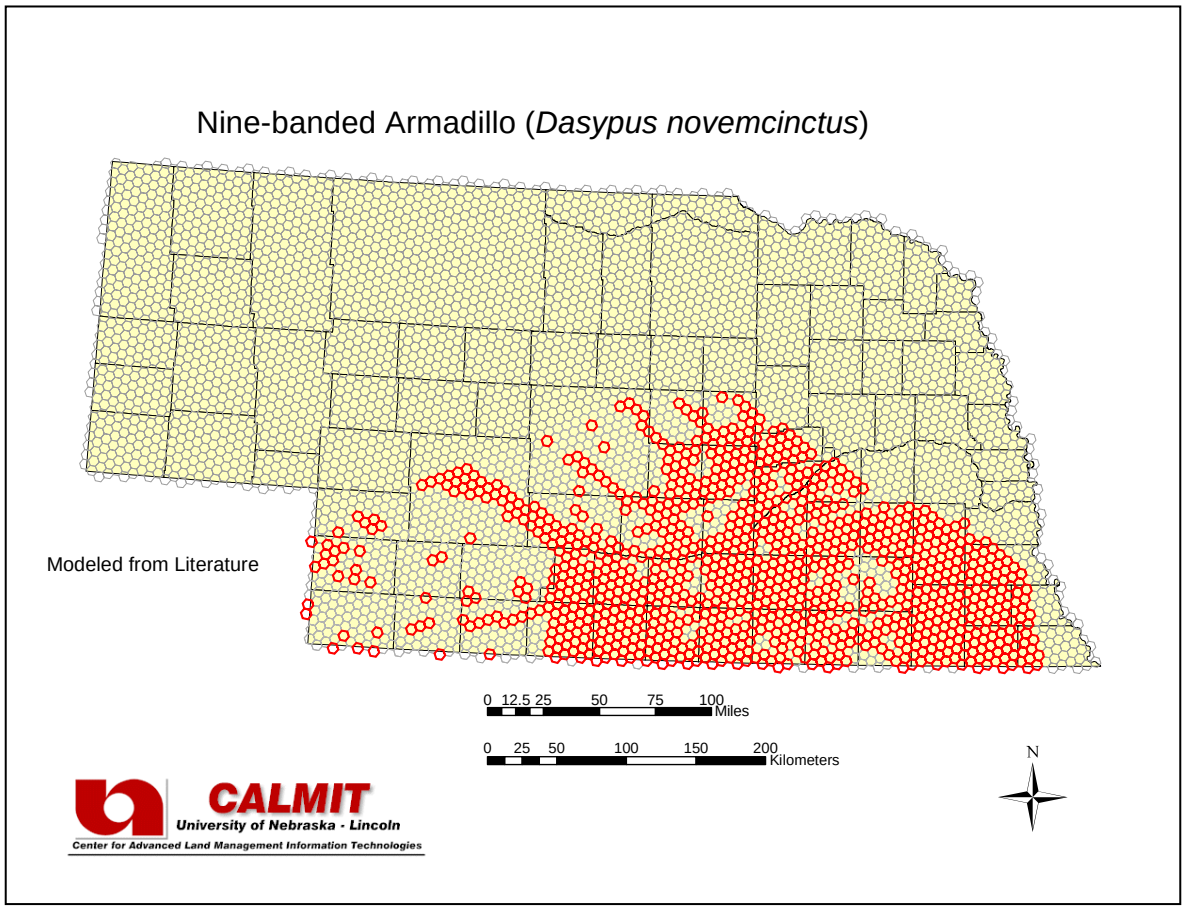
Nebraska GAP Analysis 2004
Mammal Species Atlas

Common Name:	**Nine-banded armadillo**	TNC Global Status:	G5
Scientific Name:	**Dasypus novemcinctus**	Federal Status:	-
TNC Element Code:	AMADA01010	State (NE) Status:	-

Habitat Description:
Habitat often determined by quality of soil for burrowing: favors areas with soft soil and rotting wood, and abundant in sandy soils; less common in clay (Whitaker 1997). Occurs principally from woodlands to open savanna and scrub; those few records from Nebraska and northern Kansas generally are associated with river valleys (Jones et al. 1983, 1985). The armadillo has been documented as expanding its range into Nebraska (Benedict et al. 2000). Examination of recent records indicates that the species may be entering the state along the Republican River and its tributaries in the southwest and from Kansas in the central and eastern part of Nebraska (Freeman and Genoways 1998).

Total Area of Modeled Habitat (ha): 4,107,363

Model Description:
Modeled from literature using the set of variables 'Land Cover class Open Water is present' AND 'Land Cover class Little Bluestem-Gramma Mixedgrass Prairie is present' OR 'Land Cover Class Upland Tallgrass Prairie is present', clipped to the area of verified observations (Freeman and Genoways 1998).



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Appendix H:

Status 1 & 2 Areas Documentation

Management areas categorized as Status 1 or Status 2 by NE-GAP

Managing Entity	Status 1 & 2 Area/size (km^2)	Established	Management Plan Source/Status Reviewer
Lower Big Blue NRD	Leisure Lake Wildlife Management Area (0.30)	1983	L. Ron Fleecs, Manager, Lower Big Blue NRD
Lower Platte South NRD	Bagley Conservation Easement (0.60)		Lower Platte South NRD Personnel
	Batie Prairie (0.52)		
	Craft Prairie (0.20)		
	Sabatka Conservation Easement (0.16)		
	Schmutte Prairie (0.19)		
	Whitehead Saline Wetlands (0.40)		
National Audubon Society	Leona Walters Prairie (0.16)		NE-GAP personnel
	Lillian Annette Rowe Bird Sanctuary (4.99)	1974	Bill Teddicken, Habitat Specialist, Rowe Sanctuary
	Spring Creek Prairie (2.64)	1998	Marian Langan, NE Audubon Society pers. comm. Jan 2002
National Park Service	Agate Fossil Beds NM (12.44)	1997	Ruthann Knudson, Supt, Agate Fossil Beds NM pers. comm. Jan 2002
	Homestead NM of America (0.68)	1936	Homestead National Monument of America, General Management Plan, Dec. 1999
	Scotts Bluff NM (13.07)	1919	Scotts Bluff National Monument Resources Management Plan, Feb. 1996
Platte River Whooping	Binefield Easement (5.75)		Kent Pfeifer, Platte River Whooping Crane

Managing Entity	Status 1 & 2 Area/size (km^2)	Established	Management Plan Source/Status Reviewer
Crane Maintenance Trust, Inc	Bombeck Tract (0.41)	1996	Maintenance Trust, Inc
	Caraway (0.32)	1993	
	Ruge Tract (1.67)	1986	
	Thomazin Easement (1.71)		
	West Ruge (0.26)	1986	
	Wildrose Ranch & Crane Meadows (16.13)	1979/87	
	Wolbach Easement (2.84)		
	Woodman Tract (0.59)	1999	
Prairie Plains Resource Institute	Lincoln Creek (0.07)	1983	Mike Bullerman, Restoration Ecologist, Prairie Plains Resource Institute
	Marie Ratzlaff Prairie Preserve (0.16)	1988	
	Olson Nature Preserve (0.43)	1995	
	Pearl Harbor Survivors Memorial Prairie (0.52)	1983	
The Nature Conservancy	Anderson Tract I (6.20)		NE-GAP personnel
	Anderson Tract II (0.94)	1992	NE-GAP personnel
	Arapahoe Prairie (5.27)	1976	Jayne Jonas, Land Steward, TNC
	Birdwood Creek Easement (71.04)	1999	
	Brooks North Tract (0.12)		NE-GAP personnel
	Brooks South Tract (0.26)	1994	NE-GAP personnel
	Brown Tract (1.37)		NE-GAP personnel
	Carter Tract (2.48)	2000	Jayne Jonas, Land Steward, TNC
	Dahms Tract (3.21)		NE-GAP personnel

Managing Entity	Status 1 & 2 Area/size (km^2)	Established	Management Plan Source/Status Reviewer
	Dahms Tract East (1.52)		NE-GAP personnel
	Derr Tract (0.80)	2000	NE-GAP personnel
	Egelhoff Conservation Easement (1.30)	1999	NE-GAP personnel
	Graves Conservation Easement (4.44)		NE-GAP personnel
	Graves Ranch (3.39)	1985	Jayne Jonas, Land Steward, TNC
	Horse Creek Fen (12.95)	1997	
	Jumbo Valley Fen (10.69)	1996	
	Kelly Tract (9.97)	1999	
	Little Salt Fork Marsh (0.72)	1994/96	NE-GAP personnel
	Little Salt Fork Marsh - Noble Tract (0.41)	1998	NE-GAP personnel
	McCormick Tract (0.83)	1994	NE-GAP personnel
	Murphy Ranch (6.53)		Jayne Jonas, Land Steward, TNC
	Niobrara Valley Preserve (221.63)	1980	NE-GAP personnel
	Rice Tract (16.62)		NE-GAP personnel
	Rice Tract/Cherry Ranch (13.43)	2001	NE-GAP personnel
	Rock Barn Tract (1.44)	2000	NE-GAP personnel
	Rulo Bluffs Preserve (1.76)	1989/94	NE-GAP personnel
	School Section (2.40)		NE-GAP personnel
	Speidell Tract (2.99)	1997	NE-GAP personnel
	Studnicka Tract (0.92)	1994	NE-GAP personnel
	Turkey Creek Conservation Easement (14.03)	1998	NE-GAP personnel

Managing Entity	Status 1 & 2 Area/size (km^2)	Established	Management Plan Source/Status Reviewer
	Vineyard Tract Easement (1.32)	2001	NE-GAP personnel
	Willa Cather Memorial Prairie (2.47)	1974	NE-GAP personnel
	Wolbach Easement (1.54)		NE-GAP personnel
U.S. Fish & Wildlife Service	Atlanta WPA* (4.64)	1964/1968-72/1986	WPAs - Tom Koerner, U.S. Fish & Wildlife Service, Assistant Refuge Manager, Rainwater Basin Wildlife Mgmt District
	Bluestem WPA (0.33)		
	Boyer Chute National Wildlife Refuge (8.97)		NE-GAP personnel
	Brauning WPA (0.97)	1996	WPAs - Tom Koerner, U.S. Fish & Wildlife Service, Assistant Refuge Manager, Rainwater Basin Wildlife Mgmt District
	Clark WPA (1.93)		
	Cottonwood WPA (0.94)	1970-72/2000	
	County Line Marsh WPA (1.67)		
	Crescent Lake National Wildlife Refuge (184.26)		NE-GAP personnel
	Desoto National Wildlife Refuge (16.29)		NE-GAP personnel
	Eckhardt WPA (0.73)		WPAs - Tom Koerner, U.S. Fish & Wildlife Service, Assistant Refuge Manager, Rainwater Basin Wildlife Mgmt District
	Elley WPA (0.22)		
	FCC WPA (0.97)		
	Fort Niobrara National Wildlife Refuge (78.43)	1912	Fort Niobrara NWR Comprehensive Conservation Plan Sept 1999
	Freeman Lakes WPA (0.76)	1993	WPAs - Tom Koerner, U.S. Fish & Wildlife

Managing Entity	Status 1 & 2 Area/size (km^2)	Established	Management Plan Source/Status Reviewer
	Frerichs WPA (0.21)		Service, Assistant Refuge Manager, Rainwater Basin Wildlife Mgmt District
	Funk WPA (8.27)	1986	
	Gleason WPA (2.39)		
	Glenvil Basin WPA (0.50)		
	Green Acres WPA (0.24)		
	Griess WPA (0.09)		
	Hannon WPA (1.33)	1993	
	Hansen WPA (1.26)	1993	
	Harms WPA (0.23)		
	Harvard WPA (6.25)		
	Heron WPA (1.26)	1996/97	
	Hultine 1 WPA (1.84)	1990/91	
	Hultine 2 WPA (2.11)	1993/96	
	Jensen WPA (1.94)		
	Johnson WPA (2.42)	1987/89	
	Jones WPA (0.70)	1970	
	Kenesaw WPA (0.66)	1997	
	Killdeer WPA (0.16)		
	Krause WPA (2.17)	1991	
	Lange WPA (0.64)		
	Lindau WPA (0.66)		WPAs - Tom Koerner, U.S. Fish & Wildlife

Managing Entity	Status 1 & 2 Area/size (km^2)	Established	Management Plan Source/Status Reviewer
	Linder WPA (0.63)	1991	Service, Assistant Refuge Manager, Rainwater Basin Wildlife Mgmt District
	Macon Lakes WPA (3.80)	1995/97	
	Mallard Haven WPA (4.87)	1993	
	Massie WPA (3.49)	1990	
	McMurtrey WPA (4.33)		
	Meadowlark 1 WPA (0.18)	1996	
	Meadowlark 2 WPA (0.15)		
	Miller's Pond WPA (0.57)	1995	
	Moger WPA (0.80)	1992	
	Morphy WPA (0.41)		
	Nelson WPA (0.64)	1991	
	North Platte National Wildlife Refuge (10.91)	1916	North Platte NWR, Comprehensive Conservation Plan, Aug 2001
	Peterson WPA (4.78)		WPAs - Tom Koerner, U.S. Fish & Wildlife Service, Assistant Refuge Manager, Rainwater Basin Wildlife Mgmt District
	Platte River NWMA (2.19)		NE-GAP personnel
	Prairie Dog WPA (3.70)		WPAs - Tom Koerner, U.S. Fish & Wildlife Service, Assistant Refuge Manager, Rainwater Basin Wildlife Mgmt District
	Quadhamer WPA (2.45)		WPAs - Tom Koerner, U.S. Fish & Wildlife

Managing Entity	Status 1 & 2 Area/size (km^2)	Established	Management Plan Source/Status Reviewer
	Rauscher WPA (1.05)		Service, Assistant Refuge Manager, Rainwater Basin Wildlife Mgmt District
	Real WPA (0.64)	1991	
	Ritterbush WPA (0.33)		
	Rolland WPA (0.55)		
	Schuck 1 WPA (0.19)	1992	
	Schuck 2 WPA (0.17)	1992	
	Sinninger WPA (0.63)	1964	
	Smith WPA (1.93)	1989	
	Springer WPA (2.57)	1991-95	
	Tamora Basin WPA (1.12)	1997	
	Theesen WPA (0.33)		
	Troester Basin WPA (1.30)	1994-96	
	Valentine National Wildlife Refuge (294.38)	1935	Valentine NWR Comprehensive Conservation Plan Sept 1999
	Verona WPA (0.64)	1996	WPAs - Tom Koerner, U.S. Fish & Wildlife Service, Assistant Refuge Manager, Rainwater Basin Wildlife Mgmt District
	Victor Lakes WPA (0.93)		
	Waco Basin WPA (0.64)		
	Weseman WPA (0.66)	1996	
	Wilkins WPA (1.98)		
	Wilkins 2 WPA (0.22)		

Managing Entity	Status 1 & 2 Area/size (km^2)	Established	Management Plan Source/Status Reviewer
	Youngson WPA (0.73)		WPAs - Tom Koerner, U.S. Fish & Wildlife Service, Assistant Refuge Manager, Rainwater Basin Wildlife Mgmt District
U.S. Forest Service	Soldier Creek Wilderness (39.06)	1986	http://www.fs.fed.us/r2/nebraska/units/prrd/soldier.html
University of NE	Allwine Prairie (0.66)	1970	http://snrs.unl.edu/wedin/nefieldsites/
	Madigan Prairie (0.09)	1978	
	Nine Mile Prairie (0.93)	1983	
	Reller Prairie (0.32)		

* Waterfowl Production Area

Appendix I:
Bird Species Habitats by Status Matrix

[1] Federal - Army Corps of Engineers, Bureau of Land Management, U.S. Forest Service, U.S Fish and Wildlife Service, National Park Service and Department of Defense.
[2] Native American lands
[3] State - Nebraska Natural Resource Disitricts, Nebraska Game and Parks Commission, Univeristy of Nebraska , Nebraska Historical Society, individual cities and counties
[4] Private – Non-governmental organizations, privately-owned and unidentified

Modeled Nebraska Birds (ha)

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Wood Duck *Aix sponsa*	**1**	11998.4	118370.8	12841.6	758.2	143969.0
	2	25026.8	0.0	47889.6	2072.7	74989.1
	3	54423.6	0.0	224.7	3127.2	57775.5
	4	2530.3	0.0	147.4	18358.8	21036.5
	Total	93979.1	118370.8	61103.3	24316.9	297770.1
Northern Pintail *Anas acuta*	**1**	13204.2	101392.4	12846.0	1704.4	129147.0
	2	21631.4	0.0	77200.5	1794.9	100626.8
	3	63960.0	0.0	155.4	3339.4	67454.8
	4	2559.2	0.0	147.5	25769.1	28475.8
	Total	101354.8	101392.4	90349.4	32607.8	325704.4
American Wigeon *Anas americana*	**1**	11269.1	28460.4	4369.3	3374.4	47473.2
	2	135031.3	0.0	71572.7	2134.6	208738.6
	3	40973.9	0.0	60.6	4026.0	45060.5
	4	6459.0	0.0	40.2	16470.9	22970.1
	Total	193733.3	28460.4	76042.8	26005.9	324242.4
Northern Shoveler *Anas clypeata*	**1**	13204.3	101392.4	12846.0	1704.2	129146.9
	2	21631.4	0.0	77200.3	1794.1	100625.8
	3	63960.5	0.0	155.7	3339.9	67456.1
	4	2559.7	0.0	147.5	25769.9	28477.1
	Total	101355.9	101392.4	90349.5	32608.1	325705.9
Green-winged Teal *Anas crecca*	**1**	3897.0	184.0	4743.6	440.0	9264.6
	2	19617.1	0.0	42606.3	1551.1	63774.5
	3	39362.6	0.0	0.0	2346.2	41708.8
	4	5215.2	0.0	0.0	16742.7	21957.9
	Total	68091.9	184.0	47349.9	21080.0	136705.8
Cinnamon Teal *Anas cyanoptera*	**1**	81.1	0.0	41.4	215.1	337.6
	2	14129.0	0.0	5392.3	0.0	19521.3

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	3	13972.5	0.0	0.0	285.2	14257.7
	4	0.0	0.0	0.0	1899.8	1899.8
	Total	28182.6	0.0	5433.7	2400.1	36016.4
Blue-winged Teal *Anas discors*	**1**	13489.3	121875.1	13483.0	2429.9	151277.3
	2	38758.2	0.0	84396.0	1794.3	124948.5
	3	65208.9	0.0	221.8	3339.8	68770.5
	4	2559.7	0.0	147.9	27376.6	30084.2
	Total	120016.1	121875.1	98248.7	34940.6	375080.5
Mallard *Anas platyrhynchos*	**1**	17133.3	159419.3	17426.6	3374.3	197353.5
	2	137625.8	0.0	110350.9	2134.2	250110.9
	3	69028.6	0.0	290.8	4026.1	73345.5
	4	6527.1	0.0	147.2	42355.5	49029.8
	Total	230314.8	159419.3	128215.5	51890.1	569839.7
Gadwall *Anas strepera*	**1**	1616.2	0.0	6815.1	213.2	8644.5
	2	83080.7	0.0	20167.2	0.0	103247.9
	3	55595.8	0.0	0.0	548.1	56143.9
	4	733.3	0.0	0.0	35733.0	36466.3
	Total	141026.0	0.0	26982.3	36494.3	204502.6
Lesser Scaup *Aythya affinis*	**1**	61.1	0.0	785.4	0.0	846.5
	2	0.0	0.0	1590.1	0.0	1590.1
	3	4901.1	0.0	0.0	0.0	4901.1
	4	0.0	0.0	0.0	1069.9	1069.9
	Total	4962.2	0.0	2375.5	1069.9	8407.6
Redhead *Aythya americana*	**1**	1181.1	0.0	6814.5	193.8	8189.4
	2	80402.8	0.0	9277.2	0.0	89680.0
	3	36328.3	0.0	0.0	336.0	36664.3
	4	0.0	0.0	0.0	27208.5	27208.5
	Total	117912.2	0.0	16091.7	27738.3	161742.2
Canvasback	**1**	61.1	91.4	0.0	0.0	152.5

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Aythya valisineria						
	2	628.3	0.0	5508.5	0.0	6136.8
	3	36670.2	0.0	0.0	0.0	36670.2
	4	0.0	0.0	0.0	339.7	339.7
	Total	37359.6	91.4	5508.5	339.7	43299.2
Canada Goose *Branta canadensis*	**1**	13354.1	118627.9	10271.5	1723.9	143977.4
	2	75798.4	0.0	97851.3	2074.6	175724.3
	3	58002.3	0.0	289.8	2028.6	60320.7
	4	2187.5	0.0	146.7	21701.4	24035.6
	Total	149342.3	118627.9	108559.3	27528.5	404058.0
Trumpeter Swan *Cygnus buccinator*	**1**	748.1	0.0	5564.9	213.3	6526.3
	2	72314.3	0.0	7081.2	0.0	79395.5
	3	25867.9	0.0	0.0	336.0	26203.9
	4	0.0	0.0	0.0	19318.1	19318.1
	Total	98930.3	0.0	12646.1	19867.4	131443.8
Ruddy Duck *Oxyura jamaicensis*	**1**	751.4	0.0	6812.2	0.0	7563.6
	2	78855.2	0.0	9194.5	0.0	88049.7
	3	40930.5	0.0	0.0	0.0	40930.5
	4	0.0	0.0	0.0	18543.0	18543.0
	Total	120537.1	0.0	16006.7	18543.0	155086.8
White-throated Swift *Aeronautes saxatalis*	**1**	686.0	0.0	1457.5	1859.2	4002.7
	2	16469.0	0.0	16108.9	0.0	32577.9
	3	1091.5	0.0	0.0	1997.4	3088.9
	4	6444.3	0.0	0.0	1911.2	8355.5
	Total	24690.8	0.0	17566.4	5767.8	48025.0
Chimney Swift *Chaetura pelagica*	**1**	14799.9	134633.2	9531.7	774.2	159739.0
	2	52571.1	0.0	83263.2	2133.7	137968.0
	3	26216.3	0.0	289.8	1367.0	27873.1
	4	3151.6	0.0	146.7	28721.9	32020.2
	Total	96738.9	134633.2	93231.4	32996.8	357600.3

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Ruby-throated Hummingbird *Archilochus colubris*	**1**	5055.2	29468.0	2126.5	0.0	36649.7
	2	0.0	0.0	11262.7	582.6	11845.3
	3	2096.9	0.0	121.3	0.0	2218.2
	4	68.0	0.0	90.9	429.6	588.5
	Total	7220.1	29468.0	13601.4	1012.2	51301.7
Chuck-will's-widow *Caprimulgus carolinensis*	**1**	5016.2	17560.4	314.2	0.0	22890.8
	2	0.0	0.0	8954.1	521.0	9475.1
	3	1395.6	0.0	29.6	0.0	1425.2
	4	68.0	0.0	0.0	176.0	244.0
	Total	6479.8	17560.4	9297.9	697.0	34035.1
Whip-poor-will *Caprimulgus vociferus*	**1**	3724.4	21614.9	314.2	0.0	25653.5
	2	63.1	0.0	7030.6	521.0	7614.7
	3	1867.9	0.0	0.0	0.0	1867.9
	4	0.0	0.0	0.0	176.0	176.0
	Total	5655.4	21614.9	7344.8	697.0	35312.1
Common Nighthawk *Chordeiles minor*	**1**	17133.0	159418.8	17425.4	33374.4	227351.6
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.7	0.0	289.8	4026.0	73343.5
	4	6527.4	0.0	146.7	42354.7	49028.8
	Total	230312.6	159418.8	128211.9	81888.8	599832.1
Common Poorwill *Phalaenoptilus nuttallii*	**1**	607.7	0.0	0.0	9784.6	10392.3
	2	0.0	0.0	0.0	653.5	653.5
	3	29047.9	0.0	8931.6	0.0	37979.5
	4	397.4	0.0	0.0	214.1	611.5
	Total	30053.0	0.0	8931.6	10652.2	49636.8
Piping Plover *Charadrius melodus*	**1**	4764.9	17158.2	1479.2	372.7	23775.0
	2	7289.0	0.0	57170.5	1776.5	66236.0

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	3	5795.8	0.0	0.0	1692.6	7488.4
	4	0.0	0.0	0.0	8072.6	8072.6
	Total	17849.7	17158.2	58649.7	11914.4	105572.0
Mountain Plover *Charadrius montanus*	**1**	0.0	0.0	0.0	0.0	0.0
	2	0.0	0.0	0.0	0.0	0.0
	3	0.0	0.0	0.0	0.0	0.0
	4	0.0	0.0	0.0	0.0	0.0
	Total	0.0	0.0	0.0	0.0	0.0
Killdeer *Charadrius vociferus*	**1**	17133.0	159418.8	17425.4	3374.4	197351.6
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.7	0.0	289.8	4026.0	73343.5
	4	6527.4	0.0	146.7	42354.7	49028.8
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Black Tern *Chlidonias niger*	**1**	954.4	0.0	6814.5	193.8	7962.7
	2	80402.8	0.0	8707.8	0.0	89110.6
	3	24971.6	0.0	0.0	336.0	25307.6
	4	0.0	0.0	0.0	27208.5	27208.5
	Total	106328.8	0.0	15522.3	27738.3	149589.4
Least Tern *Sterna antillarum*	**1**	0.0	0.0	0.0	8072.6	8072.6
	2	5795.8	0.0	0.0	1692.6	7488.4
	3	7289.0	0.0	57170.5	1776.5	66236.0
	4	4764.9	17158.2	1479.2	372.7	23775.0
	Total	17849.7	17158.2	58649.7	11914.4	105572.0
Forster's Tern *Sterna forsteri*	**1**	0.0	0.0	0.0	339.7	339.7
	2	36670.2	0.0	0.0	0.0	36670.2
	3	629.3	0.0	6317.9	0.0	6947.2
	4	230.7	91.4	0.0	0.0	322.1
	Total	37530.2	91.4	6317.9	339.7	44279.2
Black-necked Stilt	**1**	61.1	0.0	0.0	0.0	61.1

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Himantopus mexicanus						
	2	0.0	0.0	268.5	0.0	268.5
	3	11718.9	0.0	0.0	0.0	11718.9
	4	0.0	0.0	0.0	339.7	339.7
	Total	11780.0	0.0	268.5	339.7	12388.2
American Avocet *Recurvirostra americana*	**1**	576.0	0.0	0.0	1881.7	2457.7
	2	19530.0	0.0	0.0	1343.9	20873.9
	3	16810.9	0.0	6237.6	0.0	23048.5
	4	114.8	227.1	524.9	591.0	1457.8
	Total	37031.7	227.1	6762.5	3816.6	47837.9
Spotted Sandpiper *Actitis macularia*	**1**	4161.4	33263.6	1232.9	159.4	38817.3
	2	15661.5	0.0	37686.1	1735.3	55082.9
	3	14926.8	0.0	0.0	1692.6	16619.4
	4	504.7	0.0	0.0	6978.8	7483.5
	Total	35254.4	33263.6	38919.0	10566.1	118003.1
Upland Sandpiper *Bartramia longicauda*	**1**	16920.4	159418.8	17165.7	3122.9	196627.8
	2	124293.5	0.0	94472.7	2133.7	220899.9
	3	66785.9	0.0	260.2	4026.0	71072.1
	4	6493.7	0.0	146.7	40667.8	47308.2
	Total	214493.5	159418.8	112045.3	49950.4	535908.0
Willet *Catoptrophorus semipalmatus*	**1**	971.1	0.0	6387.1	213.3	7571.5
	2	78988.8	0.0	10339.1	0.0	89327.9
	3	45823.5	0.0	0.0	336.0	46159.5
	4	0.0	0.0	0.0	27193.0	27193.0
	Total	125783.4	0.0	16726.2	27742.3	170251.9
Common Snipe *Gallinago gallinago*	**1**	1866.8	1458.5	7287.2	1982.5	12595.0
	2	84317.8	0.0	42464.0	95.4	126877.2
	3	56715.7	0.0	0.0	3023.4	59739.1
	4	5939.6	0.0	0.0	38172.1	44111.7

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	Total	148839.9	1458.5	49751.2	43273.4	243323.0
Long-billed Curlew *Numenius americanus*	**1**	1748.3	227.1	8200.4	2944.6	13120.4
	2	137624.5	0.0	33661.6	0.0	171286.1
	3	56485.4	0.0	0.0	1997.4	58482.8
	4	5178.6	0.0	0.0	37267.9	42446.5
	Total	201036.8	227.1	41862.0	42209.9	285335.8
Wilson's Phalarope *Phalaropus tricolor*	**1**	733.4	0.0	0.0	33586.8	34320.2
	2	55595.3	0.0	0.0	336.0	55931.3
	3	83043.5	0.0	17226.1	0.0	100269.6
	4	1167.3	0.0	6814.5	213.3	8195.1
	Total	140539.5	0.0	24040.6	34136.1	198716.2
Great Blue Heron *Ardea herodias*	**1**	13241.2	121874.7	6491.4	2231.7	143839.0
	2	22480.2	0.0	77181.6	1794.3	101456.1
	3	51130.2	0.0	221.2	3338.6	54690.0
	4	2559.4	0.0	146.7	24803.4	27509.5
	Total	89411.0	121874.7	84040.9	32168.0	327494.6
American Bittern *Botaurus lentiginosus*	**1**	954.4	0.0	6814.5	193.8	7962.7
	2	80402.8	0.0	8707.8	0.0	89110.6
	3	24971.6	0.0	0.0	336.0	25307.6
	4	0.0	0.0	0.0	27208.5	27208.5
	Total	106328.8	0.0	15522.3	27738.3	149589.4
Cattle Egret *Bubulcus ibis*	**1**	7294.9	1846.8	2342.8	427.4	11911.9
	2	0.0	0.0	28781.9	1611.8	30393.7
	3	11002.0	0.0	29.6	2028.6	13060.2
	4	68.0	0.0	0.0	6294.3	6362.3
	Total	18364.9	1846.8	31154.3	10362.1	61728.1
Green Heron *Butorides virescens*	**1**	5658.5	21614.9	843.7	161.8	28278.9
	2	63.1	0.0	27386.6	1794.3	29244.0

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	3	3918.3	0.0	29.6	1692.6	5640.5
	4	68.0	0.0	0.0	3974.3	4042.3
	Total	9707.9	21614.9	28259.9	7623.0	67205.7
Least Bittern *Ixobrychus exilis*	**1**	6357.5	45940.8	3619.9	16.6	55934.8
	2	0.0	0.0	14273.2	460.3	14733.5
	3	5611.0	0.0	32.2	85.7	5728.9
	4	0.0	0.0	55.8	636.6	692.4
	Total	11968.5	45940.8	17981.1	1199.2	77089.6
Black-crowned Night-Heron *Nycticorax nycticorax*	**1**	845.6	12827.9	4421.8	1175.6	19270.9
	2	5173.3	0.0	25951.4	983.7	32108.4
	3	48373.4	0.0	0.0	3126.9	51500.3
	4	2462.3	0.0	0.0	7268.3	9730.6
	Total	56854.6	12827.9	30373.2	12554.5	112610.2
White-faced Ibis *Plegadis chihi*	**1**	0.0	0.0	16.3	2706.9	2723.2
	2	27456.4	0.0	0.0	284.6	27741.0
	3	0.0	0.0	10884.6	0.0	10884.6
	4	840.4	5138.2	1213.6	17.9	7210.1
	Total	28296.8	5138.2	12114.5	3009.4	48558.9
Rock Dove *Columba livia*	**1**	17133.0	159418.8	17425.4	3374.4	197351.6
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.7	0.0	289.8	4026.0	73343.5
	4	6527.4	0.0	146.7	42354.7	49028.8
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Mourning Dove *Zenaida macroura*	**1**	6527.4	0.0	146.7	42354.7	49028.8
	2	69027.7	0.0	289.8	4026.0	73343.5
	3	137624.5	0.0	110350.0	2133.7	250108.2
	4	17133.0	159418.8	17425.4	3374.4	197351.6
	Total	230312.6	159418.8	128211.9	51888.8	569832.1

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Belted Kingfisher *Ceryle alcyon*	**1**	13269.9	84752.4	9844.1	1530.2	109396.6
	2	58035.9	0.0	90962.1	2074.6	151072.6
	3	55680.5	0.0	289.8	2028.6	57998.9
	4	2187.5	0.0	146.7	20566.6	22900.8
	Total	129173.8	84752.4	101242.7	26200.0	341368.9
Yellow-billed Cuckoo *Coccyzus americanus*	**1**	14164.3	148041.6	10414.0	635.6	173255.5
	2	49876.1	0.0	84532.4	2133.7	136542.2
	3	40665.5	0.0	289.8	2028.6	42983.9
	4	3382.6	0.0	146.7	22101.7	25631.0
	Total	108088.5	148041.6	95382.9	26899.6	378412.6
Black-billed Cuckoo *Coccyzus erythropthalmus*	**1**	16057.0	159191.7	11467.2	643.0	187358.9
	2	83145.1	0.0	55442.2	2133.7	140721.0
	3	42027.2	0.0	289.8	1367.0	43684.0
	4	68.0	0.0	146.7	39444.5	39659.2
	Total	141297.3	159191.7	67345.9	43588.2	411423.1
Cooper's Hawk *Accipiter cooperii*	**1**	15807.2	151354.5	9387.6	719.2	177268.5
	2	6833.3	0.0	824269.2	2133.7	833236.2
	3	30830.6	0.0	289.8	2790.9	33911.3
	4	2512.9	0.0	130.5	29253.0	31896.4
	Total	55984.0	151354.5	834077.1	34896.8	1076312.4
Sharp-shinned Hawk *Accipiter striatus*	**1**	628.8	0.0	0.0	275.4	904.2
	2	242009.0	0.0	16164.7	0.0	258173.7
	3	1328.4	0.0	0.0	0.0	1328.4
	4	3907.2	0.0	0.0	18085.0	21992.2
	Total	247873.4	0.0	16164.7	18360.4	282398.5
Golden Eagle *Aquila chrysaetos*	**1**	860.0	0.0	1515.2	2731.0	5106.2
	2	54479.2	0.0	18627.3	0.0	73106.5
	3	17168.9	0.0	0.0	1997.2	19166.1

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	4	6459.4	0.0	0.0	2251.1	8710.5
	Total	78967.5	0.0	20142.5	6979.3	106089.3
Red-tailed Hawk *Buteo jamaicensis*	**1**	16243.4	159159.9	9776.3	2423.2	187602.8
	2	28217.8	0.0	98300.4	2133.7	128651.9
	3	47689.1	0.0	289.8	3002.6	50981.5
	4	6493.7	0.0	1467.2	31439.8	39400.7
	Total	98644.0	159159.9	109833.7	38999.3	406636.9
Red-shouldered Hawk *Buteo lineatus*	**1**	2897.1	1446.2	314.2	0.0	4657.5
	2	0.0	0.0	2326.2	521.0	2847.2
	3	1395.6	0.0	0.0	0.0	1395.6
	4	0.0	0.0	0.0	176.0	176.0
	Total	4292.7	1446.2	2640.4	697.0	9076.3
Ferruginous Hawk *Buteo regalis*	**1**	1487.7	227.1	7839.7	2944.6	12499.1
	2	137624.5	0.0	56698.1	0.0	194322.6
	3	51591.6	0.0	0.0	2995.0	54586.6
	4	6459.4	0.0	0.0	13233.5	19692.9
	Total	197163.2	227.1	64537.8	19173.1	281101.2
Swainson's Hawk *Buteo swainsoni*	**1**	9157.0	45485.7	9595.7	3061.5	67299.9
	2	135066.2	0.0	83133.8	1551.1	219751.1
	3	62568.9	0.0	0.0	3940.3	66509.2
	4	6459.4	0.0	0.0	41266.1	47725.5
	Total	213251.5	45485.7	92729.5	49819.0	401285.7
Turkey Vulture *Cathartes aura*	**1**	15861.8	115934.1	10944.8	1557.5	144298.2
	2	22073.1	0.0	95142.8	2133.7	119349.6
	3	30580.6	0.0	289.8	1724.1	32594.5
	4	5764.8	0.0	130.5	28213.7	34109.0
	Total	74280.3	115934.1	106507.9	33629.0	330351.3
Northern Harrier *Circus cyaneus*	**1**	17133.0	159418.8	17425.4	3374.4	197351.6

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.7	0.0	289.8	4026.0	73343.5
	4	6527.4	0.0	146.7	42354.7	49028.8
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
American Kestrel *Falco sparverius*	**1**	16571.3	159191.7	10174.9	3171.4	189109.3
	2	54368.7	0.0	100592.5	2133.7	157094.9
	3	54013.4	0.0	289.8	3370.1	57673.3
	4	6493.7	0.0	146.7	35324.2	41964.6
	Total	131447.1	159191.7	111203.9	43999.4	445842.1
Bald Eagle *Haliaeetus leucocephalus*	**1**	6409.5	34446.8	2571.3	159.4	43587.0
	2	928.3	0.0	56196.0	2013.0	59137.3
	3	5029.0	0.0	134.9	1692.6	6856.5
	4	1333.7	0.0	39.6	7274.3	8647.6
	Total	13700.5	34446.8	58941.8	11139.3	118228.4
Merlin *Falco columbarius*	**1**	421.0	0.0	0.0	275.4	696.4
	2	21172.5	0.0	14036.2	0.0	35208.7
	3	0.0	0.0	0.0	0.0	0.0
	4	3907.2	0.0	0.0	248.2	4155.4
	Total	25500.7	0.0	14036.2	523.6	40060.5
Prairie Falcon *Falco mexicanus*	**1**	429.8	227.1	0.0	1738.0	2394.9
	2	13278.8	0.0	5973.6	0.0	19252.4
	3	0.0	0.0	0.0	1343.9	1343.9
	4	2690.8	0.0	0.0	1597.4	4288.2
	Total	16399.4	227.1	5973.6	4679.3	27279.4
Northern Bobwhite *Colinus virginianus*	**1**	15438.8	159191.7	10394.3	429.8	185454.6
	2	9119.7	0.0	78511.1	2133.7	89764.5
	3	21654.1	0.0	289.8	1692.6	23636.5
	4	1375.8	0.0	146.7	13250.6	14773.1
	Total	47588.4	159191.7	89341.9	17506.7	313628.7

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Wild Turkey *Meleagris gallopavo*	**1**	14238.9	114568.8	12857.6	2446.8	144112.1
	2	92016.8	0.0	90667.0	2072.1	184755.9
	3	20234.0	0.0	127.9	3994.5	24356.4
	4	2756.1	0.0	146.7	38807.0	41709.8
	Total	129245.8	114568.8	103799.2	47320.4	394934.2
Gray Partridge *Perdix perdix*	**1**	0.0	0.0	0.0	43.3	43.3
	2	497.7	0.0	9.4	0.0	507.1
	3	0.0	0.0	11118.5	0.0	11118.5
	4	917.5	155199.4	827.5	0.0	156944.4
	Total	1415.2	155199.4	11955.4	43.3	168613.3
Ring-necked Pheasant *Phasianus colchicus*	**1**	6527.4	0.0	146.7	42354.7	49028.8
	2	69027.7	0.0	289.8	4026.0	73343.5
	3	137624.5	0.0	110350.0	2133.7	250108.2
	4	17133.0	159418.8	17425.4	3374.4	197351.6
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Greater Prairie-Chicken *Tympanuchus cupido*	**1**	68.0	0.0	0.0	15858.1	15926.1
	2	19731.0	0.0	98.2	2028.6	21857.8
	3	39043.4	0.0	57064.2	1612.7	97720.3
	4	9068.5	61354.2	10020.5	372.1	80815.3
	Total	67910.9	61354.2	67182.9	19871.5	216319.5
Sharp-tailed Grouse *Tympanuchus phasianellus*	**1**	6459.3	0.0	0.0	37547.2	44006.5
	2	56818.8	0.0	0.0	2995.0	59813.8
	3	137624.5	0.0	57503.2	0.0	195127.7
	4	2570.3	227.1	8517.6	2944.6	14259.6
	Total	203472.9	227.1	66020.8	43486.8	313207.6
American Coot *Fulica americana*	**1**	11895.6	121691.1	13450.2	2177.8	149214.7
	2	38758.0	0.0	67794.4	1794.3	108346.7
	3	64304.7	0.0	221.2	3338.6	67864.5
	4	2559.4	0.0	146.7	25656.1	28362.2

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	Total	117517.7	121691.1	81612.5	32966.8	353788.1
Sora *Porzana carolina*	**1**	1494.5	0.0	0.0	4195.1	5689.6
	2	35808.2	0.0	0.0	661.6	36469.8
	3	17165.9	0.0	18968.0	0.0	36133.9
	4	866.3	18122.2	6193.2	293.3	25475.0
	Total	55334.9	18122.2	25161.2	5150.0	103768.3
King Rail *Rallus elegans*	**1**	0.0	0.0	16.3	3231.8	3248.1
	2	43787.5	0.0	29.6	284.6	44101.7
	3	41818.0	0.0	31287.3	460.3	73565.6
	4	1094.8	52307.7	1562.2	1330.0	56294.7
	Total	86700.3	52307.7	32895.4	5306.7	177210.1
Virginia Rail *Rallus limicola*	**1**	2462.3	0.0	55.8	13250.6	15768.7
	2	58242.4	0.0	32.2	3126.9	61401.5
	3	8822.9	0.0	53551.6	1733.6	64108.1
	4	7233.3	45940.8	8669.0	1446.6	63289.7
	Total	76760.9	45940.8	62308.6	19557.7	204568.0
Horned Lark *Eremophila alpestris*	**1**	17133.0	159418.8	17425.4	3374.4	197351.6
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.7	0.0	289.8	4026.0	73343.5
	4	6527.4	0.0	146.7	42354.7	49028.8
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Cedar waxwing *Bombycilla cedrorum*	**1**	13496.8	112468.7	7611.4	705.2	134282.1
	2	59095.9	0.0	80279.9	2074.6	141450.4
	3	11180.4	0.0	289.8	2346.2	13816.4
	4	3975.2	0.0	130.5	25823.8	29929.5
	Total	87748.3	112468.7	88311.6	30949.8	319478.4
Northern Cardinal *Cardinalis cardinalis*	**1**	15353.3	155137.2	10212.3	438.9	181141.7
	2	13681.3	0.0	74631.5	2133.7	90446.5

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	3	12340.9	0.0	289.8	2314.7	14945.4
	4	1382.4	0.0	146.7	9122.6	10651.7
	Total	42757.9	155137.2	85280.3	14009.9	297185.3
Blue Grosbeak *Guiraca caerulea*	**1**	17133.0	159418.8	17425.4	3374.4	197351.6
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.7	0.0	289.8	4026.0	73343.5
	4	6527.4	0.0	146.7	42354.7	49028.8
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Lazuli Bunting *Passerina amoena*	**1**	441.9	0.0	0.0	275.4	717.3
	2	42502.4	0.0	14877.4	0.0	57379.8
	3	856.1	0.0	0.0	653.5	1509.6
	4	3907.2	0.0	0.0	12573.4	16480.6
	Total	47707.6	0.0	14877.4	13502.3	76087.3
Indigo Bunting *Passerina cyanea*	**1**	11053.3	135496.1	8446.5	482.9	155478.8
	2	26360.1	0.0	69059.4	1840.8	97260.3
	3	2629.4	0.0	289.8	3.7	2922.9
	4	3990.3	0.0	90.9	5597.1	9678.3
	Total	44033.1	135496.1	77886.6	7924.5	265340.3
Rose-breasted Grosbeak *Pheucticus ludovicianus*	**1**	68.0	0.0	146.7	5756.3	5971.0
	2	10924.0	0.0	289.8	1031.0	12244.8
	3	0.0	0.0	41405.1	2133.7	43538.8
	4	15249.8	159191.7	8032.4	429.8	182903.7
	Total	26241.8	159191.7	49874.0	9350.8	244658.3
Black-headed Grosbeak *Pheucticus melanocephalus*	**1**	6459.4	0.0	0.0	10458.6	16918.0
	2	20405.0	0.0	0.0	2995.0	23400.0
	3	54480.0	0.0	61017.5	0.0	115497.5
	4	2930.9	1393.7	11782.7	1589.1	17696.4
	Total	84275.3	1393.7	72800.2	15042.7	173511.9

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Dickcissel *Spiza americana*	**1**	6527.4	0.0	146.7	42354.7	49028.8
	2	69027.7	0.0	289.8	4026.6	73344.1
	3	137624.5	0.0	110350.0	2133.1	250107.6
	4	17133.0	159418.8	17425.4	3374.4	197351.6
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Brown Creeper *Certhia americana*	**1**	1512.8	227.3	40.2	141.5	1921.8
	2	0.0	0.0	4696.8	1214.3	5911.1
	3	219.4	0.0	0.0	579.3	798.7
	4	0.0	0.0	0.0	1543.2	1543.2
	Total	1732.2	227.3	4737.0	3478.3	10174.8
American Crow *Corvus brachyrhynchos*	**1**	17133.0	159418.8	17425.4	3374.4	197351.6
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.7	0.0	289.8	4026.0	73343.5
	4	6527.4	0.0	146.7	42354.7	49028.8
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Blue Jay *Cyanocitta cristata*	**1**	17133.0	159418.8	17425.4	3374.4	197351.6
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.7	0.0	289.8	4026.0	73343.5
	4	6527.4	0.0	146.7	42354.7	49028.8
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Pinyon Jay *Gymnorhinus cyanocephalus*	**1**	190.5	0.0	0.0	66.7	257.2
	2	25546.7	0.0	6337.8	0.0	31884.5
	3	0.0	0.0	0.0	0.0	0.0
	4	2460.8	0.0	0.0	4573.1	7033.9
	Total	28198.0	0.0	6337.8	4639.8	39175.6
Black-billed Magpie *Pica pica*	**1**	6459.4	0.0	16.3	41785.6	48261.3
	2	63242.2	0.0	9.4	4026.0	67277.6
	3	137624.5	0.0	92258.7	1551.1	231434.3

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	4	10628.9	155426.5	14404.6	3374.4	183834.4
	Total	217955.0	155426.5	106689.0	50737.1	530807.6
Cassin's Sparrow *Aimophila cassinii*	**1**	102.5	0.0	1046.6	0.0	1149.1
	2	0.0	0.0	13365.5	0.0	13365.5
	3	770.9	0.0	0.0	653.5	1424.4
	4	1307.8	0.0	0.0	0.0	1307.8
	Total	2181.2	0.0	14412.1	653.5	17246.8
Grasshopper Sparrow *Ammodramus savannarum*	**1**	17133.4	159419.4	17427.0	3374.3	197354.1
	2	137625.2	0.0	110350.1	2134.6	250109.9
	3	69028.8	0.0	290.7	4026.4	73345.9
	4	6527.0	0.0	147.2	42355.5	49029.7
	Total	230314.4	159419.4	128215.0	51890.8	569839.6
Lark Bunting *Calamospiza melanocorys*	**1**	9031.1	33333.5	2883.9	3374.4	48622.9
	2	118406.2	0.0	90679.1	1551.1	210636.4
	3	66631.7	0.0	29.6	40260.4	106921.7
	4	6527.4	0.0	0.0	37892.9	44420.3
	Total	200596.4	33333.5	93592.6	83078.8	410601.3
McCown's Longspur *Calcarius mccownii*	**1**	723.1	227.1	644.1	2670.0	4264.3
	2	43189.5	0.0	20205.1	0.0	63394.6
	3	349.1	0.0	0.0	1997.4	2346.5
	4	5151.6	0.0	0.0	1663.3	6814.9
	Total	49413.3	227.1	20849.2	6330.7	76820.3
Chestnut-collared longspur *Calcarius ornatus*	**1**	786.4	0.0	1096.8	2425.3	4308.5
	2	78575.4	0.0	15194.7	0.0	93770.1
	3	8930.4	0.0	0.0	1997.4	10927.8
	4	3295.8	0.0	0.0	3071.8	6367.6
	Total	91588.0	0.0	16291.5	7494.5	115374.0
Lark Sparrow *Chondestes grammacus*	**1**	17133.0	159418.8	17425.4	3374.4	197351.6

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.7	0.0	289.8	4026.0	73343.5
	4	6527.4	0.0	146.7	42354.7	49028.8
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Bobolink *Dolichonyx oryzivorus*	**1**	17116.4	159418.8	17306.5	3374.4	197216.1
	2	137624.5	0.0	105852.7	2133.7	245610.9
	3	67787.1	0.0	296.6	4026.0	72109.7
	4	6527.4	0.0	146.7	42354.7	49028.8
	Total	229055.4	159418.8	123602.5	51888.8	563965.5
Dark-eyed Junco *Junco hyemalis*	**1**	97.1	0.0	0.0	61.3	158.4
	2	21512.8	0.0	3259.9	0.0	24772.7
	3	0.0	0.0	0.0	0.0	0.0
	4	0.0	0.0	0.0	2548.2	2548.2
	Total	21609.9	0.0	3259.9	2609.5	27479.3
Swamp Sparrow *Melospiza georgiana*	**1**	642.2	32215.5	1977.8	213.3	35048.8
	2	15314.3	0.0	16618.7	0.0	31933.0
	3	34807.5	0.0	0.0	0.0	34807.5
	4	0.0	0.0	0.0	15663.1	15663.1
	Total	50764.0	32215.5	18596.5	15876.4	117452.4
Song Sparrow *Melospiza melodia*	**1**	5726.5	95364.3	5867.3	44.2	107002.3
	2	101.6	0.0	12798.1	1321.5	14221.2
	3	9507.1	0.0	196.9	275.2	9979.2
	4	68.0	0.0	107.1	2330.4	2505.5
	Total	15403.2	95364.3	18969.4	3971.3	133708.2
Savannah Sparrow *Passerculus sandwichensis*	**1**	2491.5	0.0	0.0	1174.6	3666.1
	2	17050.0	0.0	0.0	1310.0	18360.0
	3	6261.5	0.0	5036.5	0.0	11298.0
	4	106.0	0.0	524.9	1061.1	1692.0
	Total	25909.0	0.0	5561.4	3545.7	35016.1

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Eastern Towhee *Pipilo erythrophthalmus*	**1**	68.0	0.0	146.7	648.1	862.8
	2	6392.7	0.0	154.7	0.0	6547.4
	3	0.0	0.0	20387.8	521.0	20908.8
	4	8131.4	101265.9	4000.5	251.5	113649.3
	Total	14592.1	101265.9	24689.7	1420.6	141968.3
Spotted Towhee *Pipilo maculatus*	**1**	3997.1	0.0	0.0	28794.7	32791.8
	2	8754.9	0.0	0.0	899.2	9654.1
	3	128801.6	0.0	39969.0	0.0	168770.6
	4	1846.1	227.1	4384.3	1908.9	8366.4
	Total	143399.7	227.1	44353.3	31602.8	219582.9
Vesper Sparrow *Pooecetes gramineus*	**1**	6527.4	0.0	146.7	17577.7	24251.8
	2	47801.7	0.0	260.2	2422.8	50484.7
	3	122768.8	0.0	69260.5	1161.5	193190.8
	4	9443.3	137923.7	15101.4	2762.0	165230.4
	Total	186541.2	137923.7	84768.8	23924.0	433157.7
Brewer's Sparrow *Spizella breweri*	**1**	1244.3	0.0	0.0	1663.0	2907.3
	2	0.0	0.0	0.0	1343.9	1343.9
	3	30866.1	0.0	2948.0	0.0	33814.1
	4	138.4	0.0	326.6	2312.5	2777.5
	Total	32248.8	0.0	3274.6	5319.4	40842.8
Chipping Sparrow *Spizella passerina*	**1**	6016.5	0.0	130.5	29668.5	35815.5
	2	33993.2	0.0	289.8	2346.2	36629.2
	3	76294.1	0.0	83993.8	2074.6	162362.5
	4	13850.0	112695.8	7668.4	1122.0	135336.2
	Total	130153.8	112695.8	92082.5	35211.3	370143.4
Field Sparrow *Spizella pusilla*	**1**	6527.4	0.0	146.7	42354.7	49028.8
	2	69027.7	0.0	289.8	4026.0	73343.5
	3	127624.5	0.0	110350.0	2133.7	240108.2
	4	17133.0	159418.8	17425.4	3374.4	197351.6

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	Total	220312.6	159418.8	128211.9	51888.8	559832.1
Pine Siskin *Carduelis pinus*	**1**	490.3	0.0	0.0	275.4	765.7
	2	43299.1	0.0	15136.3	0.0	58435.4
	3	856.1	0.0	0.0	653.5	1509.6
	4	3907.2	0.0	0.0	14754.6	18661.8
	Total	48552.7	0.0	15136.3	15683.5	79372.5
American Goldfinch *Carduelis tristis*	**1**	17133.0	159418.8	17425.4	3374.4	197351.6
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.7	0.0	289.8	4026.0	73343.5
	4	6527.4	0.0	146.7	42354.7	49028.8
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
House Finch *Carpodacus mexicanus*	**1**	11921.3	130059.2	10818.2	2242.7	155041.4
	2	31944.4	0.0	78210.2	2133.7	112288.3
	3	14652.8	0.0	289.8	3658.6	18601.2
	4	2756.1	0.0	146.7	15042.3	17945.1
	Total	61274.6	130059.2	89464.9	23077.3	303876.0
Red Crossbill *Loxia curvirostra*	**1**	9991.9	227.1	0.0	2731.3	12950.3
	2	92328.6	0.0	21908.6	0.0	114237.2
	3	12019.2	0.0	0.0	1997.4	14016.6
	4	4669.8	0.0	0.0	23974.4	28644.2
	Total	119009.5	227.1	21908.6	28703.1	169848.3
Barn Swallow *Hirundo rustica*	**1**	17133.0	159418.8	17425.4	3374.4	197351.6
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.7	0.0	289.8	4026.0	73343.5
	4	6527.4	0.0	146.7	42354.7	49028.8
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Cliff Swallow *Petrochelidon pyrrhonota*	**1**	0.0	0.0	0.0	43.3	43.3
	2	497.7	0.0	9.4	0.0	507.1

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	3	0.0	0.0	11118.5	0.0	11118.5
	4	917.5	155199.4	827.5	0.0	156944.4
	Total	1415.2	155199.4	11955.4	43.3	168613.3
Purple Martin *Progne subis*	**1**	68.0	0.0	146.7	3218.7	3433.4
	2	11935.2	0.0	289.8	950.0	13175.0
	3	0.0	0.0	53807.8	1421.2	55229.0
	4	14862.5	157549.6	8623.7	288.2	181324.0
	Total	26865.7	157549.6	62868.0	5878.1	253161.4
Bank Swallow *Riparia riparia*	**1**	1312.3	0.0	146.7	41363.8	42822.8
	2	64975.4	0.0	289.8	2896.3	68161.5
	3	113530.5	0.0	79433.6	1897.1	194861.2
	4	16380.4	159418.8	13444.6	1194.6	190438.4
	Total	196198.6	159418.8	93314.7	47351.8	496283.9
Northern Rough-winged Swallow *Stelgidopteryx ruficollis*	**1**	6527.4	0.0	146.7	42354.7	49028.8
	2	69027.7	0.0	289.8	4026.0	73343.5
	3	137624.5	0.0	110350.0	2133.7	250108.2
	4	17133.0	159418.8	17425.4	3374.4	197351.6
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Tree Swallow *Tachycineta bicolor*	**1**	0.0	0.0	146.7	33639.1	33785.8
	2	57246.1	0.0	260.2	0.0	57506.3
	3	83145.1	0.0	38959.0	460.3	122564.4
	4	9823.4	79274.8	14343.8	213.3	103655.3
	Total	150214.6	79274.8	53709.7	34312.7	317511.8
Violet-green Swallow *Tachycineta thalassina*	**1**	2460.8	0.0	0.0	8543.5	11004.3
	2	856.1	0.0	0.0	622.0	1478.1
	3	35706.9	0.0	11078.3	0.0	46785.2
	4	211.3	0.0	0.0	66.7	278.0
	Total	39235.1	0.0	11078.3	9232.2	59545.6

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Red-winged Blackbird *Agelaius phoeniceus*	**1**	17133.0	6229.5	17425.4	3374.4	44162.3
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.7	0.0	289.8	4026.0	73343.5
	4	6527.4	0.0	146.7	42354.7	49028.8
	Total	230312.6	6229.5	128211.9	51888.8	416642.8
Brewer's Blackbird *Euphagus cyanocephalus*	**1**	845.1	0.0	604.4	2731.3	4180.8
	2	53613.6	0.0	17830.5	0.0	71444.1
	3	7860.2	0.0	0.0	1997.4	9857.6
	4	6459.4	0.0	0.0	2250.9	8710.3
	Total	68778.3	0.0	18434.9	6979.6	94192.8
Bullock's Oriole *Icterus bullockii*	**1**	1036.5	227.1	6091.6	2731.3	10086.5
	2	54479.4	0.0	39233.1	0.0	93712.5
	3	19530.0	0.0	0.0	1997.4	21527.4
	4	6459.4	0.0	0.0	7680.3	14139.7
	Total	81505.3	227.1	45324.7	12409.0	139466.1
Baltimore Oriole *Icterus galbula*	**1**	15720.5	149604.4	9355.5	699.8	175380.2
	2	5740.3	0.0	80682.5	2133.7	88556.5
	3	28575.0	0.0	289.8	2790.9	31655.7
	4	1643.5	0.0	130.5	29253.0	31027.0
	Total	51679.3	149604.4	90458.3	34877.4	326619.4
Orchard Oriole *Icterus spurius*	**1**	17133.0	159418.8	17425.4	3374.4	197351.6
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.7	0.0	289.8	4026.0	73343.5
	4	6527.4	0.0	146.7	42354.7	49028.8
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Brown-headed Cowbird *Molothrus ater*	**1**	17133.0	159418.8	17425.4	3374.7	197351.9
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.7	0.0	289.8	4026.0	73343.5
	4	6527.4	0.0	146.7	42354.7	49028.8

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	Total	230312.6	159418.8	128211.9	51889.1	569832.4
Great-tailed Grackle *Quiscalus mexicanus*	**1**	1035.8	0.0	130.5	4597.7	5764.0
	2	20112.3	0.0	214.2	2790.9	23117.4
	3	37.0	0.0	41313.1	2072.1	43422.2
	4	12199.0	3992.3	4342.0	169.6	20702.9
	Total	33384.1	3992.3	45999.8	9630.3	93006.5
Common Grackle *Quiscalus quiscula*	**1**	6493.7	0.0	146.7	35324.2	41964.6
	2	54013.4	0.0	289.8	3370.1	57673.3
	3	54368.7	0.0	100592.5	2133.7	157094.9
	4	16571.3	159191.7	10174.9	3171.4	189109.3
	Total	131447.1	159191.7	111203.9	43999.4	445842.1
Eastern Meadowlark *Sturnella magna*	**1**	68.0	0.0	146.7	17465.7	17680.4
	2	49661.2	0.0	289.8	3372.5	53323.5
	3	67716.4	0.0	59317.4	2133.7	129167.5
	4	16046.7	159191.7	14880.0	2817.5	192935.9
	Total	133492.3	159191.7	74633.9	25789.4	393107.3
Western Meadowlark *Sturnella neglecta*	**1**	6527.4	0.0	146.7	42354.7	49028.8
	2	69027.7	0.0	289.8	4026.0	73343.5
	3	137624.5	0.0	110350.0	2133.7	250108.2
	4	17133.0	159418.8	17425.4	3374.4	197351.6
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Yellow-headed Blackbird *Xanthocephalus xanthocephalus*	**1**	1755.9	0.0	107.1	11598.1	13461.1
	2	55672.6	0.0	228.0	1214.0	57114.6
	3	30722.6	0.0	57855.2	1637.6	90215.4
	4	7298.4	99760.4	9777.0	1561.5	118397.3
	Total	95449.5	99760.4	67967.3	16011.2	279188.4
Loggerhead Shrike *Lanius ludovicianus*	**1**	17133.0	159418.8	17425.4	3374.4	197351.6

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.7	0.0	289.8	4026.0	73343.5
	4	6527.4	0.0	146.7	42354.7	49028.8
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Gray Catbird *Dumetella carolinensis*	**1**	16343.1	159191.7	10129.8	705.2	186369.8
	2	62619.5	0.0	78361.6	2133.7	143114.8
	3	20047.9	0.0	289.8	1684.5	22022.2
	4	3975.2	0.0	146.7	30218.6	34340.5
	Total	102985.7	159191.7	88927.9	34742.0	385847.3
Northern Mockingbird *Mimus polyglottos*	**1**	17133.0	159418.8	17425.4	3374.4	197351.6
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.7	0.0	289.8	4026.0	73343.5
	4	6527.4	0.0	146.7	42354.7	49028.8
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Brown Thrasher *Toxostoma rufum*	**1**	6527.4	0.0	146.7	42354.7	49028.8
	2	69027.7	0.0	289.8	4026.0	73343.5
	3	137624.5	0.0	110350.0	2133.7	250108.2
	4	17133.0	159418.8	17425.4	3374.4	197351.6
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Tufted Titmouse *Baeolophus bicolor*	**1**	7306.0	3992.3	7268.2	0.0	18566.5
	2	0.0	0.0	16270.0	582.6	16852.6
	3	2396.0	0.0	230.3	0.0	2626.3
	4	68.0	0.0	107.1	569.1	744.2
	Total	9770.0	3992.3	23875.6	1151.7	38789.6
Black-capped Chickadee *Poecile atricapillus*	**1**	6527.4	0.0	146.7	42354.7	49028.8
	2	69027.7	0.0	289.8	4026.0	73343.5
	3	137624.5	0.0	110350.0	2133.7	250108.2
	4	17133.0	159418.8	17425.4	3374.4	197351.6
	Total	230312.6	159418.8	128211.9	51888.8	569832.1

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Yellow-rumped Warbler *Dendroica coronata*	**1**	16.2	0.0	0.0	0.0	16.2
	2	0.0	0.0	3618.9	0.0	3618.9
	3	0.0	0.0	0.0	1098.3	1098.3
	4	0.0	0.0	0.0	0.0	0.0
	Total	16.2	0.0	3618.9	1098.3	4733.4
Yellow-throated Warbler *Dendroica dominica*	**1**	0.0	0.0	314.2	0.0	314.2
	2	0.0	0.0	0.0	521.0	521.0
	3	2.0	0.0	0.0	0.0	2.0
	4	0.0	0.0	0.0	0.0	0.0
	Total	2.0	0.0	314.2	521.0	837.2
Yellow Warbler *Dendroica petechia*	**1**	17133.0	159418.8	17425.4	3374.4	197351.6
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.7	0.0	289.8	4026.0	73343.5
	4	6527.4	0.0	146.7	42354.7	49028.8
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Common Yellowthroat *Geothlypis trichas*	**1**	17133.0	159418.8	17425.4	3374.4	197351.6
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.7	0.0	289.8	4026.0	73343.5
	4	6527.4	0.0	146.7	42354.7	49028.8
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Yellow-breasted Chat *Icteria virens*	**1**	3066.8	14843.8	102.0	285.7	18298.3
	2	59058.7	0.0	25404.3	0.0	84463.0
	3	6312.4	0.0	0.0	653.5	6965.9
	4	3907.2	0.0	0.0	20901.8	24809.0
	Total	72345.1	14843.8	25506.3	21841.0	134536.2
Black-and-white Warbler *Mniotilta varia*	**1**	441.9	0.0	0.0	275.4	717.3
	2	42502.4	0.0	14877.4	0.0	57379.8
	3	856.1	0.0	0.0	653.5	1509.6
	4	3907.2	0.0	0.0	12573.4	16480.6

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	Total	47707.6	0.0	14877.4	13502.3	76087.3
Kentucky Warbler *Oporornis formosus*	**1**	2309.3	0.0	58.9	0.0	2368.2
	2	0.0	0.0	1145.6	521.0	1666.6
	3	897.9	0.0	0.0	0.0	897.9
	4	0.0	0.0	0.0	0.0	0.0
	Total	3207.2	0.0	1204.5	521.0	4932.7
Northern Parula *Parula americana*	**1**	2353.6	1446.2	124.4	0.0	3924.2
	2	0.0	0.0	1257.4	460.3	1717.7
	3	0.0	0.0	0.0	0.0	0.0
	4	0.0	0.0	0.0	176.0	176.0
	Total	2353.6	1446.2	1381.8	636.3	5817.9
Prothonotary Warbler *Protonotaria citrea*	**1**	0.0	0.0	0.0	0.0	0.0
	2	2.0	0.0	0.0	0.0	2.0
	3	0.0	0.0	1681.1	521.0	2202.1
	4	1031.8	0.0	314.2	0.0	1346.0
	Total	1033.8	0.0	1995.3	521.0	3550.1
Ovenbird *Seiurus aurocapillus*	**1**	3907.2	0.0	0.0	18085.0	21992.2
	2	1328.4	0.0	0.0	653.5	1981.9
	3	53245.1	0.0	20511.2	0.0	73756.3
	4	612.6	78696.0	130.3	275.4	79714.3
	Total	59093.3	78696.0	20641.5	19013.9	177444.7
Louisiana Waterthrush *Seiurus motacilla*	**1**	0.0	0.0	0.0	176.0	176.0
	2	1395.6	0.0	0.0	0.0	1395.6
	3	521.0	0.0	1983.6	0.0	2504.6
	4	3418.0	1446.2	314.2	0.0	5178.4
	Total	5334.6	1446.2	2297.8	176.0	9254.6
American Redstart *Setophaga ruticilla*	**1**	3907.2	0.0	90.9	17891.5	21889.6
	2	3724.4	0.0	0.0	0.0	3724.4

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	3	47575.4	0.0	21574.9	521.0	69671.3
	4	5268.5	41723.2	548.2	275.4	47815.3
	Total	60475.5	41723.2	22214.0	18687.9	143100.6
Red-breasted Nuthatch *Sitta canadensis*	**1**	3907.2	0.0	0.0	248.2	4155.4
	2	0.0	0.0	0.0	31.5	31.5
	3	19370.0	0.0	14350.8	0.0	33720.8
	4	233.5	0.0	0.0	275.4	508.9
	Total	23510.7	0.0	14350.8	555.1	38416.6
White-breasted Nuthatch *Sitta carolinensis*	**1**	5316.7	0.0	146.7	4617.8	10081.2
	2	11799.6	0.0	289.8	1517.4	13606.8
	3	49671.3	0.0	72624.5	2074.6	124370.4
	4	15317.3	159418.8	9369.9	1413.7	185519.7
	Total	82104.9	159418.8	82430.9	9623.5	333578.1
Pygmy Nuthatch *Sitta pygmaea*	**1**	5215.1	0.0	0.0	0.3	5215.4
	2	742.4	0.0	0.0	0.0	742.4
	3	26775.4	0.0	14906.8	0.0	41682.2
	4	462.8	0.0	207.4	841.1	1511.3
	Total	33195.7	0.0	15114.2	841.4	49151.3
European Starling *Sturnus vulgaris*	**1**	6527.4	0.0	146.7	42354.7	49028.8
	2	69027.7	0.0	289.8	4026.0	73343.5
	3	137624.5	0.0	110350.0	2133.7	250108.2
	4	17133.0	159418.8	17425.4	3374.4	197351.6
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Blue-gray Gnatcatcher *Polioptila caerulea*	**1**	0.0	0.0	90.9	28.0	118.9
	2	2096.9	0.0	91.7	0.0	2188.6
	3	0.0	0.0	5477.2	521.0	5998.2
	4	3068.5	13203.2	730.4	0.0	17002.1
	Total	5165.4	13203.2	6390.2	549.0	25307.8
Western Tanager	**1**	2460.8	0.0	0.0	4573.1	7033.9

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Piranga ludoviciana						
	2	0.0	0.0	0.0	0.0	0.0
	3	25546.7	0.0	6337.8	0.0	31884.5
	4	190.5	0.0	0.0	66.7	257.2
	Total	28198.0	0.0	6337.8	4639.8	39175.6
Scarlet Tanager						
Piranga olivacea	**1**	68.0	0.0	0.0	3974.3	4042.3
	2	2821.7	0.0	29.6	1031.0	3882.3
	3	0.0	0.0	18489.0	1794.3	20283.3
	4	5648.2	20168.8	354.4	161.8	26333.2
	Total					
Marsh Wren						
Cistothorus palustris	**1**	230.7	91.3	0.0	0.0	322.0
	2	628.3	0.0	6678.5	0.0	7306.8
	3	36670.2	0.0	0.0	0.0	36670.2
	4	0.0	0.0	0.0	339.7	339.7
	Total	37529.2	91.3	6678.5	339.7	44638.7
Sedge Wren						
Cistothorus platensis	**1**	6092.7	148570.9	6667.4	0.0	161331.0
	2	0.0	0.0	19624.9	61.6	19686.5
	3	1498.1	0.0	260.2	0.0	1758.3
	4	0.0	0.0	146.7	596.9	743.6
	Total	7590.8	148570.9	26699.2	658.5	183519.4
Rock Wren						
Salpinctes obsoletus	**1**	515.6	0.0	0.0	1911.2	2426.8
	2	682.5	0.0	0.0	1997.4	2679.9
	3	48462.5	0.0	24400.0	0.0	72862.5
	4	747.4	227.1	1307.1	2731.3	5012.9
	Total	50408.0	227.1	25707.1	6639.9	82982.1
Carolina Wren						
Thryothorus ludovicianus	**1**	68.0	0.0	146.7	576.1	790.8
	2	4449.8	0.0	289.8	0.0	4739.6
	3	0.0	0.0	17602.1	582.6	18184.7
	4	7747.8	3992.3	7270.0	0.0	19010.1
	Total	12265.6	3992.3	25308.6	1158.7	42725.2

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
House Wren *Troglodytes aedon*	**1**	6527.4	0.0	146.7	42354.7	49028.8
	2	69027.7	0.0	289.8	4026.0	73343.5
	3	137624.5	0.0	110350.0	2133.7	250108.2
	4	17133.0	159418.8	17425.4	3374.4	197351.6
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Wood Thrush *Hylocichla mustelina*	**1**	8611.6	56027.3	2166.7	270.4	67076.0
	2	0.0	0.0	21153.4	1025.2	22178.6
	3	2152.9	0.0	121.3	0.0	2274.2
	4	68.0	0.0	90.9	3388.6	3547.5
	Total	10832.5	56027.3	23532.3	4684.2	95076.3
Townsend's Solitaire *Myadestes townsendi*	**1**	190.5	0.0	0.0	66.7	257.2
	2	15133.3	0.0	7772.5	0.0	22905.8
	3	0.0	0.0	0.0	0.0	0.0
	4	2460.8	0.0	0.0	248.2	2709.0
	Total	17784.6	0.0	7772.5	314.9	25872.0
Mountain Bluebird *Sialia currucoides*	**1**	3907.2	0.0	0.0	12573.4	16480.6
	2	856.1	0.0	0.0	653.5	1509.6
	3	42502.4	0.0	14877.4	0.0	57379.8
	4	441.9	0.0	0.0	275.4	717.3
	Total	47707.6	0.0	14877.4	13502.3	76087.3
Eastern Bluebird *Sialia sialis*	**1**	4112.6	0.0	146.7	29829.5	34088.8
	2	45424.8	0.0	289.8	2790.9	48505.5
	3	10069.4	0.0	89818.1	2133.7	102021.2
	4	16138.1	159159.9	9456.1	1288.4	186042.5
	Total	75744.9	159159.9	99710.7	36042.5	370658.0
American Robin *Turdus migratorius*	**1**	6527.4	0.0	146.7	42354.7	49028.8
	2	69027.7	0.0	289.8	4026.0	73343.5
	3	137624.5	0.0	110350.0	2133.7	250108.2

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	4	17133.0	159418.8	17425.4	3374.4	197351.6
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Western Wood-Pewee *Contopus sordidulus*	**1**	495.6	227.1	989.6	2473.1	4185.4
	2	44150.3	0.0	16110.1	0.0	60260.4
	3	0.0	0.0	0.0	1343.9	1343.9
	4	5151.6	0.0	0.0	1911.2	7062.8
	Total	49797.5	227.1	17099.7	5728.2	72852.5
Eastern Wood-Pewee *Contopus virens*	**1**	13308.1	100770.7	8234.9	429.8	122743.5
	2	0.0	0.0	57927.8	1796.9	59724.7
	3	10671.1	0.0	289.8	1031.0	11991.9
	4	68.0	0.0	146.7	15817.4	16032.1
	Total	24047.2	100770.7	66599.2	19075.1	210492.2
Willow Flycatcher *Empidonax traillii*	**1**	14823.9	153548.2	8626.0	643.0	177641.1
	2	27671.3	0.0	46283.2	1673.4	75627.9
	3	47031.2	0.0	289.8	1031.0	48352.0
	4	68.0	0.0	146.7	30503.3	30718.0
	Total	89594.4	153548.2	55345.7	33850.7	332339.0
Acadian Flycatcher *Empidonax virescens*	**1**	2798.4	1446.2	0.0	0.0	4244.6
	2	0.0	0.0	3754.6	0.0	3754.6
	3	0.0	0.0	29.6	0.0	29.6
	4	68.0	0.0	0.0	176.0	244.0
	Total	2866.4	1446.2	3784.2	176.0	8272.8
Great Crested Flycatcher *Myiarchus crinitus*	**1**	9310.6	126530.2	8796.4	502.4	145139.6
	2	85903.9	0.0	58584.8	230.0	144718.7
	3	15450.7	0.0	257.6	0.0	15708.3
	4	3975.2	0.0	90.9	27185.9	31252.0
	Total	114640.4	126530.2	67729.7	27918.3	336818.6
Eastern Phoebe *Sayornis phoebe*	**1**	203.9	0.0	130.5	24263.8	24598.2

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	2	26911.5	0.0	289.8	170.9	27372.2
	3	54037.4	0.0	59125.6	2093.0	115256.0
	4	10366.4	154018.3	13979.4	337.7	178701.8
	Total	91519.2	154018.3	73525.3	26865.4	345928.2
Say's Phoebe *Sayornis saya*	**1**	6459.4	0.0	0.0	38103.1	44562.5
	2	59762.1	0.0	0.0	2995.0	62757.1
	3	137624.5	0.0	89846.6	596.4	228067.5
	4	2858.8	131513.5	9433.3	2944.6	146750.2
	Total	206704.8	131513.5	99279.9	44639.1	482137.3
Eastern Kingbird *Tyrannus tyrannus*	**1**	6527.4	0.0	146.7	42354.7	49028.8
	2	69027.7	0.0	289.8	4026.0	73343.5
	3	137624.5	0.0	110350.0	2133.7	250108.2
	4	17133.0	159418.8	17425.4	3374.4	197351.6
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Western Kingbird *Tyrannus verticalis*	**1**	6527.4	0.0	146.7	42354.7	49028.8
	2	69027.7	0.0	289.8	4026.0	73343.5
	3	137624.5	0.0	110350.0	2133.7	250108.2
	4	17133.0	159418.8	17425.4	3374.4	197351.6
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Cassin's Kingbird *Tyrannus vociferans*	**1**	3907.2	0.0	0.0	20901.8	24809.0
	2	6256.4	0.0	0.0	653.5	6909.9
	3	59058.8	0.0	18653.0	0.0	77711.8
	4	628.8	0.0	0.0	275.4	904.2
	Total	69851.2	0.0	18653.0	21830.7	110334.9
Bell's Vireo *Vireo bellii*	**1**	2756.1	0.0	146.7	38807.0	41709.8
	2	20234.0	0.0	127.9	3994.5	24356.4
	3	92016.8	0.0	90667.0	2072.1	184755.9
	4	14238.9	114568.8	12857.6	2446.8	144112.1
	Total	129245.8	114568.8	103799.2	47320.4	394934.2

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Yellow-throated Vireo *Vireo flavifrons*	**1**	0.0	0.0	0.0	0.0	0.0
	2	1898.3	0.0	0.0	0.0	1898.3
	3	0.0	0.0	2639.7	521.0	3160.7
	4	2891.4	11680.3	58.9	0.0	14630.6
	Total	4789.7	11680.3	2698.6	521.0	19689.6
Warbling Vireo *Vireo gilvus*	**1**	6493.7	0.0	146.7	35324.2	41964.6
	2	54013.4	0.0	299.8	3370.1	57683.3
	3	54368.7	0.0	100592.5	2133.7	157094.9
	4	16571.3	159191.7	10174.9	3171.4	189109.3
	Total	131447.1	159191.7	111213.9	43999.4	445852.1
Red-eyed Vireo *Vireo olivaceus*	**1**	3907.2	0.0	90.9	34127.4	38125.5
	2	16745.3	0.0	260.2	1343.9	18349.4
	3	123222.2	0.0	42757.5	0.0	165979.7
	4	6854.9	25295.6	9979.4	1924.6	44054.5
	Total	150729.6	25295.6	53088.0	37395.9	266509.1
Plumbeous Vireo *Vireo plumbeus*	**1**	2460.8	0.0	0.0	248.2	2709.0
	2	0.0	0.0	0.0	0.0	0.0
	3	14390.6	0.0	6527.9	0.0	20918.5
	4	162.2	0.0	0.0	66.7	228.9
	Total	17013.6	0.0	6527.9	314.9	23856.4
House Sparrow *Passer domesticus*	**1**	6527.4	0.0	146.7	42354.7	49028.8
	2	69027.7	0.0	289.8	4026.0	73343.5
	3	137624.5	0.0	110350.0	2133.7	250108.2
	4	17133.0	159418.8	17425.4	20507.3	214484.5
	Total	230312.6	159418.8	128211.9	69021.7	586965.0
American White Pelican *Pelecanus erythrorhynchos*	**1**	4143.2	0.0	0.0	33575.1	37718.3
	2	55751.3	0.0	0.0	1711.4	57462.7
	3	113711.2	0.0	23565.5	0.0	137276.7
	4	1211.0	1391.9	6775.4	1083.8	10462.1

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	Total	174816.7	1391.9	30340.9	36370.3	242919.8
Double-crested Cormorant *Phalacrocorax auritus*	**1**	6527.4	0.0	0.0	41150.1	47677.5
	2	57967.1	0.0	29.6	4026.0	62022.7
	3	88389.0	0.0	77029.3	1551.1	166969.4
	4	6254.8	59633.8	8640.8	2553.0	77082.4
	Total	159138.3	59633.8	85699.7	49280.2	353752.0
Northern Flicker *Colaptes auratus*	**1**	17133.0	159418.8	17425.4	3374.4	197351.6
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.7	0.0	289.8	4026.0	73343.5
	4	6527.4	0.0	146.7	42334.7	49008.8
	Total	230312.6	159418.8	128211.9	51868.8	569812.1
Red-bellied Woodpecker *Melanerpes carolinus*	**1**	15325.0	159191.7	8662.8	429.8	183609.3
	2	37.0	0.0	71577.4	2133.7	73748.1
	3	12208.9	0.0	289.8	1692.6	14191.3
	4	68.0	0.0	146.7	7805.4	8020.1
	Total	27638.9	159191.7	80676.7	12061.5	279568.8
Red-headed Woodpecker *Melanerpes erythrocephalus*	**1**	16571.3	159191.7	10174.9	3171.4	189109.3
	2	54368.7	0.0	100592.5	2133.7	157094.9
	3	54013.4	0.0	289.8	3370.1	57673.3
	4	6493.7	0.0	146.7	35324.2	41964.6
	Total	131447.1	159191.7	111203.9	43999.4	445842.1
Downy Woodpecker *Picoides pubescens*	**1**	6493.7	0.0	146.7	35324.2	41964.6
	2	54013.4	0.0	289.8	3992.1	58295.3
	3	104239.4	0.0	103070.5	2133.7	209443.6
	4	16684.8	159418.8	10174.9	3176.8	189455.3
	Total	181431.3	159418.8	113681.9	44626.8	499158.8
Hairy Woodpecker *Picoides villosus*	**1**	6493.7	0.0	146.7	35324.2	41964.6
	2	54013.4	0.0	289.8	3770.1	58073.3

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	3	54368.7	0.0	100685.3	2133.7	157187.7
	4	16571.3	159191.7	10174.9	3171.4	189109.3
	Total	131447.1	159191.7	111296.7	44399.4	446334.9
Clark's Grebe *Aechmophorus clarkii*	**1**	650.9	5391.7	0.0	0.0	6042.6
	2	0.0	0.0	24463.3	0.0	24463.3
	3	708.1	0.0	0.0	0.0	708.1
	4	0.0	0.0	0.0	0.0	0.0
	Total	1359.0	5391.7	24463.3	0.0	31214.0
Western Grebe *Aechmophorus occidentalis*	**1**	61.1	0.0	3140.8	0.0	3201.9
	2	0.0	0.0	18755.1	0.0	18755.1
	3	10631.6	0.0	0.0	0.0	10631.6
	4	0.0	0.0	0.0	471.8	471.8
	Total	10692.7	0.0	21895.9	471.8	33060.4
Eared Grebe *Podiceps nigricollis*	**1**	0.0	0.0	0.0	2960.8	2960.8
	2	41528.3	0.0	0.0	284.6	41812.9
	3	32507.5	0.0	25514.6	0.0	58022.1
	4	1012.9	45530.0	836.5	1033.7	48413.1
	Total	75048.7	45530.0	26351.1	4279.1	151208.9
Pied-billed Grebe *Podilymbus podiceps*	**1**	0.0	0.0	0.0	27208.5	27208.5
	2	36328.3	0.0	0.0	336.0	36664.3
	3	80402.8	0.0	9277.2	0.0	89680.0
	4	987.3	0.0	6814.5	193.8	7995.6
	Total	117718.4	0.0	16091.7	27738.3	161548.4
Short-eared Owl *Asio flammeus*	**1**	17133.0	159418.8	17425.4	3374.4	197351.6
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.7	0.0	289.8	4026.0	73343.5
	4	6527.4	0.0	146.7	42354.7	49028.8
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Long-eared Owl	**1**	13091.4	8765.8	3586.6	999.4	26443.2

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Asio otus						
	2	76294.1	0.0	70785.4	1459.3	148538.8
	3	33261.7	0.0	287.3	956.8	34505.8
	4	6016.5	0.0	130.5	28558.1	34705.1
	Total	128663.7	8765.8	74789.8	31973.6	244192.9
Burrowing Owl *Athene cunicularia*	**1**	7570.8	45792.3	9563.6	3125.3	66052.0
	2	137624.5	0.0	90356.5	1551.1	229532.1
	3	61873.7	0.0	0.0	4026.0	65899.7
	4	6459.4	0.0	0.0	41762.8	48222.2
	Total	213528.4	45792.3	99920.1	50465.2	409706.0
Great Horned Owl *Bubo virginianus*	**1**	17133.0	159418.8	17425.4	3374.4	197351.6
	2	137624.5	0.0	110350.0	2133.7	250108.2
	3	69027.0	0.0	289.8	4026.0	73342.8
	4	6527.4	0.0	146.7	42354.7	49028.8
	Total	230311.9	159418.8	128211.9	51888.8	569831.4
Eastern Screech-Owl *Otus asio*	**1**	12974.1	112468.7	7611.4	429.8	133484.0
	2	1512.8	0.0	64635.5	2074.6	68222.9
	3	11180.4	0.0	289.8	1692.6	13162.8
	4	68.0	0.0	130.5	24602.8	24801.3
	Total	25735.3	112468.7	72667.2	28799.8	239671.0
Barred Owl *Strix varia*	**1**	68.0	0.0	146.7	569.1	783.8
	2	2941.9	0.0	289.8	0.0	3231.7
	3	0.0	0.0	26755.9	582.6	27338.5
	4	8321.4	144995.2	7766.1	0.0	161082.7
	Total	11331.3	144995.2	34958.5	1151.7	192436.7
Barn Owl *Tyto alba*	**1**	0.0	0.0	0.0	659.4	659.4
	2	905.0	0.0	0.0	997.6	1902.6
	3	0.0	0.0	32996.0	0.0	32996.0
	4	191.0	0.0	1290.6	0.0	1481.6

Appendix J:
Reptile and Amphibian Species Habitats by Status Matrix

[1] Federal - Army Corps of Engineers, Bureau of Land Management, U.S. Forest Service, U.S Fish and Wildlife Service, National Park Service and Department of Defense.
[2] Native American lands
[3] State - Nebraska Natural Resource Disitricts, Nebraska Game and Parks Commission, Univeristy of Nebraska , Nebraska Historical Society, individual cities and counties
[4] Private – Non-governmental organizations, privately-owned and unidentified

Modeled Nebraska Reptiles and Amphibians (ha)

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Small-Mouthed Salamander *Ambystoma texanum*	**1**	68.0	0.0	0	192.3	260.3
	2	0.0	0.0	0	0.0	0.0
	3	0.0	0.0	5177.6	460.3	5637.9
	4	2446.6	3030.8	88.9	0.0	5566.3
	Total	2514.6	3030.8	5266.5	652.6	11464.5
Eastern Tiger Salamander *Ambystoma tigrinum*	**1**	2756.1	0.0	146.7	39704.6	42607.4
	2	57000.2	0.0	127.9	3994.5	61122.6
	3	109146.7	0.0	96764.2	2072.1	207983.0
	4	14556.4	127467.4	12867.7	3369.0	158260.5
	Total	183459.4	127467.4	109906.5	49140.2	469973.5
American Toad *Bufo americanus*	**1**	68.0	0.0	90.9	429.6	588.5
	2	2094.9	0.0	121.3	0.0	2216.2
	3	0.0	0.0	10233.4	521.9	10755.3
	4	3793.3	6080.1	1722.9	0.0	11596.3
	Total	5956.2	6080.1	12168.5	951.5	25156.3
Great Plains Toad *Bufo cognatus*	**1**	6527.4	0.0	146.7	42354.7	49028.8
	2	69027.7	0.0	289.8	4026.0	73343.5
	3	137624.5	0.0	110350	2133.7	250108.2
	4	17133.0	159418.8	17425.4	3374.4	197351.6
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Woodhouse's Toad *Bufo woodhousii*	**1**	2756.1	0.0	146.7	39704.6	42607.4
	2	57000.2	0.0	127.9	3994.5	61122.6
	3	109146.7	0.0	96764.2	2072.1	207983.0
	4	14556.4	127467.4	12867.7	3369.0	158260.5
	Total	183459.4	127467.4	109906.5	49140.2	469973.5
Northern Cricket Frog *Acris crepitans*	**1**	68.0	0.0	146.7	26192.2	26406.9
	2	11324.3	0.0	127.9	1367.0	12819.2
	3	26465.2	0.0	58148.3	2072.1	86685.6
	4	13520.7	114341.7	10135.6	393.9	138391.9
	Total	51378.2	114341.7	68558.5	30025.2	264303.6
Cope's Gray Treefrog *Hyla chrysoscelis*	**1**	68.0	0.0	146.7	4152.6	4367.3
	2	8039.1	0.0	289.8	1027.3	9356.2

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	3	0.0	0.0	19010.1	1537.2	20547.3
	4	12212.0	3992.3	7861.8	429.8	24495.9
	Total	20319.1	3992.3	27308.4	7146.9	58766.7
Gray Treefrog *Hyla versicolor*	**1**	68.0	0.0	146.7	4152.6	4367.3
	2	8039.1	0.0	289.8	1027.3	9356.2
	3	0.0	0.0	19010.1	1537.2	20547.3
	4	12212.0	3992.3	7861.8	429.8	24495.9
	Total	20319.1	3992.3	27308.4	7146.9	58766.7
Western Chorus Frog *Pseudacris triseriata*	**1**	2756.1	0.0	146.7	39704.6	42607.4
	2	57000.2	0.0	127.9	3994.5	61122.6
	3	109146.7	0.0	96764.2	2072.1	207983.0
	4	14556.4	127467.4	12867.7	3369.0	158260.5
	Total	183459.4	127467.4	109906.5	49140.2	469973.5
Great Plains Narrowmouth Toad *Gastrophryne olivacea*	**1**	0.0	0.0	0	253.6	253.6
	2	0.0	0.0	29.6	0.0	29.6
	3	0.0	0.0	6806.5	0.0	6806.5
	4	1390.8	0.0	445.7	251.5	2088.0
	Total	1390.8	0.0	7281.8	505.1	9177.7
Plains Spadefoot *Spea bombifrons*	**1**	2756.1	0.0	146.7	39704.6	42607.4
	2	57000.2	0.0	127.9	3994.5	61122.6
	3	109146.7	0.0	96764.2	2072.1	207983.0
	4	14556.4	127467.4	12867.7	3369.0	158260.5
	Total	183459.4	127467.4	109906.5	49140.2	469973.5
Plains Leopard Frog *Rana blairi*	**1**	68.0	0.0	146.7	4974.5	5189.2
	2	12208.9	0.0	289.8	1692.6	14191.3
	3	0.0	0.0	63182.5	2074.6	65257.1
	4	14688.2	159191.7	8167.5	429.8	182477.2
	Total	26965.1	159191.7	71786.5	9171.5	267114.8
Bullfrog *Rana catesbeiana*	**1**	2756.1	0.0	146.7	33807.0	36709.8
	2	20234.0	0.0	127.9	3994.5	24356.4
	3	92016.8	0.0	90667	2072.1	184755.9
	4	14238.9	114568.8	12857.6	2446.8	144112.1
	Total	129245.8	114568.8	103799.2	42320.4	389934.2

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Northern Leopard Frog *Rana pipiens*	**1**	6527.4	0.0	146.7	42260.2	48934.3
	2	65077.2	0.0	289.8	4026.0	69393.0
	3	137624.5	0.0	92746.5	1789.4	232160.4
	4	17038.8	159418.8	17392.3	3374.4	197224.3
	Total	226267.9	159418.8	110575.3	51450.0	547712.0
Eastern Glossy Snake *Arizona elegans*	**1**	0.0	0.0	0	0.0	0.0
	2	0.0	0.0	0	0.0	0.0
	3	0.0	0.0	2574.8	0.0	2574.8
	4	0.0	0.0	0	0.0	0.0
	Total	0.0	0.0	2574.8	0.0	2574.8
Western Worm Snake *Carphophis vermis*	**1**	68.0	0.0	0	192.3	260.3
	2	1500.1	0.0	0	0.0	1500.1
	3	0.0	0.0	7501.7	582.6	8084.3
	4	4104.6	3030.8	367	0.0	7502.4
	Total	5672.7	3030.8	7868.7	774.9	17347.1
Eastern Racer *Coluber constrictor*	**1**	6444.3	0.0	146.7	41532.6	48123.6
	2	52284.7	0.0	289.8	3936.6	56511.1
	3	137624.5	0.0	93148.5	1033.7	231806.7
	4	15232.8	151260.5	15717.3	3357.8	185568.4
	Total	211586.3	151260.5	109302.3	49860.7	522009.8
Ringneck Snake *Diadophis punctatus*	**1**	68.0	0.0	146.7	3736.7	3951.4
	2	12015.3	0.0	289.8	307.0	12612.1
	3	0.0	0.0	40898	2038.2	42936.2
	4	14495.2	159191.7	8065.5	307.2	182059.6
	Total	26578.5	159191.7	49400	6389.1	241559.3
Great Plains Rat Snake *Elaphe emoryi*	**1**	68.0	0.0	0	863.5	931.5
	2	2151.8	0.0	29.6	167.1	2348.5
	3	0.0	0.0	6946	119.3	7065.3
	4	1649.8	3992.3	196.6	251.5	6090.2
	Total	3869.6	3992.3	7172.2	1401.4	16435.5
Western Rat Snake *Elaphe obsoleta*	**1**	68.0	0.0	146.7	569.1	783.8
	2	2941.9	0.0	289.8	0.0	3231.7
	3	0.0	0.0	18233.8	582.6	18816.4
	4	7514.1	3992.3	7635.8	0.0	19142.2

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	Total	10524.0	3992.3	26306.1	1151.7	41974.1
Western Fox Snake *Elaphe vulpina*	**1**	68.0	0.0	146.7	569.1	783.8
	2	2396.0	0.0	287.3	0.0	2683.3
	3	0.0	0.0	25858.2	582.6	26440.8
	4	8177.3	159191.7	7638.3	0.0	175007.3
	Total	10641.3	159191.7	33930.5	1151.7	204915.2
Western Hognose Snake *Heterodon nasicus*	**1**	6459.4	0.0	0	40772.7	47232.1
	2	59695.3	0.0	2.5	4022.3	63720.1
	3	137624.5	0.0	88822	676.5	227123.0
	4	7125.3	1402.6	9351	1711.7	19590.6
	Total	210904.5	1402.6	98175.5	47183.2	357665.8
Eastern Hognose Snake *Heterodon platirhinos*	**1**	0.0	0.0	16.3	12301.9	12318.2
	2	12493.2	0.0	75.6	1031.0	13599.8
	3	0.0	0.0	44243.5	1673.4	45916.9
	4	9543.9	155199.4	7226.2	178.3	172147.8
	Total	22037.1	155199.4	51561.6	15184.6	243982.7
Prairie Kingsnake *Lampropeltis calligaster*	**1**	68.0	0.0	146.7	569.1	783.8
	2	2941.9	0.0	289.8	0.0	3231.7
	3	0.0	0.0	18233.8	582.6	18816.4
	4	7514.1	3992.3	7535.8	0.0	19042.2
	Total	10524.0	3992.3	26206.1	1151.7	41874.1
Common Kingsnake *Lampropeltis getula*	**1**	68.0	0.0	90.9	4666.7	4825.6
	2	6081.8	0.0	61.8	1031.0	7174.6
	3	0.0	0.0	28141.2	2011.4	30152.6
	4	6107.4	3992.4	1410.5	410.9	11921.2
	Total	12257.2	3992.4	29704.4	8120.0	54074.0
Milk Snake *Lampropeltis triangulum*	**1**	6527.4	0.0	146.7	42354.7	49028.8
	2	69027.7	0.0	289.8	4026.0	73343.5
	3	137624.5	0.0	110350	2133.7	250108.2
	4	17133.0	159418.8	17425.4	3374.4	197351.6
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Smooth Green Snake *Liochlorophis vernalis*	**1**	0.0	0.0	0	3899.1	3899.1
	2	1990.3	0.0	29.6	1692.6	3712.5

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	3	63.1	0.0	25016.2	1693.1	26772.4
	4	5407.7	21506.9	843.7	161.8	27920.1
	Total	7461.1	21506.9	25889.5	7446.6	62304.1
Coachwhip *Masticophis flagellum*	**1**	0.0	0.0	0	0.0	0.0
	2	0.0	0.0	0	0.0	0.0
	3	0.0	0.0	3994.9	0.0	3994.9
	4	78.2	0.0	0	0.0	78.2
	Total	78.2	0.0	3994.9	0.0	4073.1
Northern Water Snake *Nerodia sipedon*	**1**	68.0	0.0	146.7	40509.2	40723.9
	2	67936.2	0.0	289.8	2028.6	70254.6
	3	83145.1	0.0	80072.9	2133.7	165351.7
	4	16402.4	159191.7	15910.9	643.0	192148.0
	Total	167551.7	159191.7	96420.3	45314.5	468478.2
Gopher Snake *Pituophis catenifer*	**1**	6527.4	0.0	146.7	42354.7	49028.8
	2	69027.7	0.0	289.8	4026.0	73343.5
	3	137624.5	0.0	110350	2133.7	250108.2
	4	17133.0	159418.8	17425.4	3374.4	197351.6
	Total	230312.6	159418.8	128211.9	51888.8	569832.1
Graham's Crayfish Snake *Regina grahamii*	**1**	68.0	0.0	146.7	569.1	783.8
	2	2941.9	0.0	289.8	0.0	3231.7
	3	0.0	0.0	18233.8	582.6	18816.4
	4	7514.1	3992.3	7635.8	0.0	19142.2
	Total	10524.0	3992.3	26306.1	1151.7	41974.1
Brown Snake *Storeria dekayi*	**1**	68.0	0.0	146.7	4550.5	4765.2
	2	11589.9	0.0	289.8	1031.0	12910.7
	3	0.0	0.0	22347.6	1537.2	23884.8
	4	10585.1	3992.3	7902	419.5	22898.9
	Total	22243.0	3992.3	30686.1	7538.2	64459.6
Redbelly Snake *Storeria occipitomaculata*	**1**	0.0	0.0	0	3943.4	3943.4
	2	3090.1	0.0	0	1692.6	4782.7
	3	0.0	0.0	18908.3	1735.3	20643.6
	4	3231.2	0.0	341.2	159.4	3731.8
	Total	6321.3	0.0	19249.5	7530.7	33101.5
Plains Blackhead Snake	**1**	0.0	0.0	0	0.0	0.0

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Tantilla nigriceps						
	2	420.5	0.0	0	0.0	420.5
	3	0.0	0.0	7300	0.0	7300.0
	4	16.5	0.0	33.2	0.0	49.7
	Total	437.0	0.0	7333.2	0.0	7770.2
Western Terrestrial Garter Snake *Thamnophis elegans*	**1**	3907.2	0.0	0	883.4	4790.6
	2	0.0	0.0	0	1098.3	1098.3
	3	35661.2	0.0	11475.7	0.0	47136.9
	4	644.0	0.0	0	2726.0	3370.0
	Total	40212.4	0.0	11475.7	4707.7	56395.8
Western Ribbon Snake *Thamnophis proximus*	**1**	68.0	0.0	90.9	230.5	389.4
	2	2152.9	0.0	61.8	0.0	2214.7
	3	0.0	0.0	9412.4	856.0	10268.4
	4	8110.6	25410.1	1639.3	21.3	35181.3
	Total	10331.5	25410.1	11204.40	1107.8	48053.8
Plains Garter Snake *Thamnophis radix*	**1**	2756.1	0.0	146.7	39918.8	42821.6
	2	60950.5	0.0	127.9	3994.5	65072.9
	3	92016.8	0.0	95277.3	3072.1	190366.2
	4	14555.0	114752.4	13521.2	2695.6	145524.2
	Total	170278.4	114752.4	109073.1	49681.0	443784.9
Common Garter Snake *Thamnophis sirtalis*	**1**	2756.1	0.0	146.7	38807.0	41709.8
	2	20234.0	0.0	127.9	3994.5	24356.4
	3	92016.8	0.0	90667	2072.1	184755.9
	4	13238.9	114568.8	12857.6	2446.8	143112.1
	Total	128245.8	114568.8	103799.2	47320.4	393934.2
Lined Snake *Tropidoclonion lineatum*	**1**	68.0	0.0	130.5	3981.2	4179.7
	2	9557.0	0.0	121.3	474.1	10152.4
	3	0.0	0.0	24357.6	1916.0	26273.6
	4	10885.4	3992.3	2026.2	307.2	17211.1
	Total	20510.4	3992.3	26635.6	6678.5	57816.8
Lesser Earless Lizard *Holbrookia maculata*	**1**	762.6	0.0	0	36304.0	37066.6
	2	55619.3	0.0	0	579.1	56198.4
	3	83182.1	0.0	24244.7	59.0	107485.8
	4	1632.4	0.0	6814.5	1798.7	10245.6
	Total	141196.4	0.0	31059.2	38740.8	210996.4

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Short-Horned Lizard *Phrynosoma douglasii*	**1**	5681.7	0.0	0	1076.2	6757.9
	2	0.0	0.0	0	1132.3	1132.3
	3	54442.4	0.0	16314.7	0.0	70757.1
	4	738.5	227.1	1389	1145.9	3500.5
	Total	60862.6	227.1	17703.7	3354.4	82147.8
Sagebrush Lizard *Sceloporus graciosus*	**1**	27.0	0.0	0	0.0	27.0
	2	296.6	0.0	0	1098.3	1394.9
	3	10520.5	0.0	266	0.0	10786.5
	4	441.1	0.0	317.5	1085.3	1843.9
	Total	11285.2	0.0	583.5	2183.6	14052.3
Fence Lizard *Sceloporus undulatus*	**1**	6444.3	0.0	0	38822.3	45266.6
	2	57187.1	0.0	0	3076.1	60263.2
	3	84317.8	0.0	51605.7	712.5	136636.0
	4	2360.7	10941.9	7604.7	2001.5	22908.8
	Total	150309.9	10941.9	59210.4	44612.4	265074.6
Five-Lined Skink *Eumeces fasciatus*	**1**	0.0	0.0	0	176.0	176.0
	2	0.0	0.0	0	0.0	0.0
	3	0.0	0.0	2590.2	0.0	2590.2
	4	1.2	3030.8	0	0.0	3032.0
	Total	1.2	3030.8	2590.2	176.0	5798.2
Many-Lined Skink *Eumeces multivirgatus*	**1**	6459.4	0.0	0	29104.2	35563.6
	2	48115.9	0.0	0	2333.4	50449.3
	3	137522.9	0.0	41111.8	0.0	178634.7
	4	1783.4	227.1	7901.6	2944.6	12856.7
	Total	193881.6	227.1	49013.4	34382.2	277504.3
Great Plains Skink *Eumeces obsoletus*	**1**	0.0	0.0	0	0.0	0.0
	2	1805.8	0.0	0	0.0	1805.8
	3	37.0	0.0	6073.1	0.0	6110.1
	4	73.9	0.0	68.5	249.1	391.5
	Total	1916.7	0.0	6141.6	249.1	8307.4
Northern Prairie Skink *Eumeces septentrionalis*	**1**	68.0	0.0	146.7	10746.7	10961.4
	2	12162.1	0.0	289.8	1031.0	13482.9
	3	0.0	0.0	32751.5	2133.7	34885.2

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	4	13490.2	159.0	8460.9	178.3	22288.4
	Total	25720.3	159.0	41648.9	14089.7	81617.9
Six-Lined Racerunner *Cnemidophorus sexlineatus*	**1**	1577.5	0.0	146.7	40707.7	42431.9
	2	69003.7	0.0	289.8	2862.3	72155.8
	3	83080.5	0.0	90392	2074.6	175547.1
	4	16378.3	159191.7	16535.8	643.0	192748.8
	Total	170040.0	159191.7	107364.3	46287.6	482883.6
Copperhead *Agkistrodon contortrix*	**1**	68.0	0.0	0	192.3	260.3
	2	0.0	0.0	0	0.0	0.0
	3	0.0	0.0	5177.6	460.3	5637.9
	4	2446.6	3030.8	88.9	0.0	5566.3
	Total	2514.6	3030.8	5266.5	652.6	11464.5
Timber Rattlesnake *Crotalus horridus*	**1**	68.0	0.0	0	192.3	260.3
	2	1500.1	0.0	0	0.0	1500.1
	3	0.0	0.0	7501.7	582.6	8084.3
	4	4104.6	3030.8	367	367.0	7869.4
	Total	5672.7	3030.8	7868.7	1141.9	17714.1
Prairie Rattlesnake *Crotalus viridus*	**1**	6459.4	0.0	0	37531.7	43991.1
	2	56818.8	0.0	0	2995.0	59813.8
	3	137624.5	0.0	75690.5	0.0	213315.0
	4	2082.7	21009.1	93559.9	2944.6	119596.3
	Total	202985.4	21009.1	169250.4	43471.3	436716.2
		6459.4	0.0	0	37531.7	43991.1
Massasauga *Sistrurus catenatus*	**1**	0.0	0.0	0	279.9	279.9
	2	0.0	0.0	32.2	0.0	32.2
	3	0.0	0.0	3910.6	0.0	3910.6
	4	192.9	1584.7	196.6	0.0	1974.2
	Total	192.9	1584.7	4139.4	279.9	6196.9
Common Snapping Turtle *Chelydra serpentina*	**1**	2756.1	0.0	146.7	40839.1	43741.9
	2	67443.7	0.0	287.3	3994.5	71725.5
	3	96800.8	0.0	102064.4	2072.1	200937.3
	4	16221.1	150895.7	16251.1	2848.2	186216.1
	Total	183221.7	150895.7	118749.5	49753.9	502620.8
Painted Turtle	**1**	2756.1	0.0	146.7	40839.1	43741.9

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Chrysemys picta						
	2	67443.7	0.0	287.3	3994.5	71725.5
	3	96800.8	0.0	102064.4	2072.1	200937.3
	4	16221.1	150895.7	16251.1	2848.2	186216.1
	Total	183221.7	150895.7	118749.5	49753.9	502620.8
Blanding's Turtle *Emydoidea blandingii*	**1**	1380.3	0.0	146.7	40095.8	41622.8
	2	65440.1	0.0	260.2	1411.5	67111.8
	3	83154.6	0.0	48364.2	1537.2	133056.0
	4	13963.3	155199.4	15123	391.5	184677.2
	Total	163938.3	155199.4	63894.1	43436.0	426467.8
False Map Turtle *Graptemys pseudogeographica*	**1**	0.0	0.0	146.7	167.5	314.2
	2	2396.0	0.0	194.1	0.0	2590.1
	3	0.0	0.0	20040.3	521.0	20561.3
	4	6644.7	66795.5	3962.5	0.0	77402.7
	Total	9040.7	66795.5	24343.6	688.5	100868.3
Ornate Box Turtle *Terrapene ornata*	**1**	1348.8	0.0	146.7	40396.2	41891.7
	2	59938.7	0.0	223.7	2028.6	62191.0
	3	127688.0	0.0	97926.8	2133.7	227748.5
	4	16445.5	131624.0	15423.3	1723.9	165216.7
	Total	205421.0	131624.0	113720.5	46282.4	497047.9
Slider *Trachemys scripta*	**1**	0.0	0.0	0	176.0	176.0
	2	0.0	0.0	0	0.0	0.0
	3	0.0	0.0	2427.7	0.0	2427.7
	4	705.2	3080.2	0	0.0	3785.4
	Total	705.2	3080.2	2427.7	176.0	6389.1
Yellow Mud Turtle *Kinosternon flavescens*	**1**	0.0	0.0	0	1335.4	1335.4
	2	40224.7	0.0	0	0.0	40224.7
	3	6618.2	0.0	13194.2	0.0	19812.4
	4	309.9	0.0	795.5	193.8	1299.2
	Total	47152.8	0.0	13989.7	1529.2	62671.7
Smooth Softshell *Apalone mutica*	**1**	1650.4	0.0	146.7	5233.3	7030.4
	2	10200.8	0.0	289.8	1692.6	12183.2
	3	15836.1	0.0	42434	2074.6	60344.7
	4	15156.2	159418.8	8065.5	944.5	183585.0
	Total	42843.5	159418.8	50936	9945.0	263143.3

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Spiny Softshell Turtle *Apalone spinifera*	**1**	1278.7	0.0	146.7	37731.1	39156.5
	2	19604.0	0.0	127.9	3960.6	23692.5
	3	63836.7	0.0	70504.8	2072.1	136413.6
	4	13616.6	114341.7	11354.7	2040.7	141353.7
	Total	98336.0	114341.7	82134.1	45804.5	340616.3

Appendix K:
Mammal Species Habitats by Status Matrix

[1] Federal - Army Corps of Engineers, Bureau of Land Management, U.S. Forest Service, U.S Fish and Wildlife Service, National Park Service and Department of Defense.
[2] Native American lands
[3] State - Nebraska Natural Resource Disitricts, Nebraska Game and Parks Commission, Univeristy of Nebraska , Nebraska Historical Society, individual cities and counties
[4] Private – Non-governmental organizations, privately-owned and unidentified

Modeled Nebraska Mammals (ha)

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Pronghorn *Antilocapra americana*	**1**	5151.6	0.0	0	17103.9	17103.9
	2	9197.8	0.0	0	2333.4	2333.4
	3	64423.6	0.0	16860.7	0.0	16860.7
	4	981.4	0.0	1705.1	2664.6	4369.7
	Total	79754.4	0.0	18565.8	22101.9	40667.7
Wapiti (Elk) *Cervus elaphus*	**1**	3907.2	0.0	0	248.2	248.2
	2	0.0	0.0	0	0.0	0.0
	3	21172.5	0.0	14036.2	0.0	14036.2
	4	421.0	0.0	0	275.4	275.4
	Total	25500.7	0.0	14036.2	523.6	14559.8
Mule deer *Odocoileus hemionus*	**1**	6425.7	0.0	55.8	38203.7	38259.5
	2	66874.8	0.0	168.5	4026.0	4194.5
	3	136124.6	0.0	89196.6	1108.4	90305.0
	4	8439.5	103391.5	15258.7	3104.0	18362.7
	Total	217864.6	103391.5	104679.6	46442.1	151121.7
White-tailed deer *Odocoileus virginianus*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Coyote *Canis latrans*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Gray fox *Urocyon cinereoargenteus*	**1**	6493.7	0.0	146.7	14333.6	14480.3
	2	21979.3	0.0	289.8	3656.1	3945.9
	3	50804.5	0.0	96060.2	2133.7	98193.9
	4	16047.6	159418.8	10048.7	3157.4	13206.1
	Total	95325.1	159418.8	106545.4	23280.8	129826.2

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Swift fox *Vulpes velox*	**1**	6444.3	0.0	0	2383.0	2383.0
	2	14144.7	0.0	0	2659.1	2659.1
	3	62588.7	0.0	31603.4	0.0	31603.4
	4	899.4	227.1	1929.2	2731.3	4660.5
	Total	84077.1	227.1	33532.6	7773.4	41306.0
Red fox *Vulpes vulpes*	**1**	6493.7	0.0	107.1	35324.2	35431.3
	2	53972.5	0.0	289.8	3992.1	4281.9
	3	105916.0	0.0	104572	2133.7	106705.7
	4	15647.3	159418.8	10199.4	3176.8	13376.2
	Total	182029.5	159418.8	115168.3	44626.8	159795.1
Bobcat *Lynx rufus*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Mountain lion *Puma concolor*	**1**	5948.5	0.0	0	248.2	248.2
	2	734.2	0.0	0	653.5	653.5
	3	23069.6	0.0	16305.2	0.0	16305.2
	4	598.5	0.0	57.7	672.7	730.4
	Total	30350.8	0.0	16362.9	1574.4	17937.3
River otter *Lontra canadensis*	**1**	572.7	0.0	0	7145.1	7145.1
	2	16526.4	0.0	29.6	1692.6	1722.2
	3	15378.2	0.0	42132.4	1735.3	43867.7
	4	5064.9	23248.0	966.9	161.8	1128.7
	Total	37542.2	23248.0	43128.9	10734.8	53863.7
Striped skunk *Mephitis mephitis*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Long-tailed weasel *Mustela frenata*	**1**	6527.4	0.0	146.7	42354.7	42501.4

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Least weasel *Mustela nivalis*	**1**	679.9	0.0	146.7	31281.7	31428.4
	2	42094.9	0.0	260.2	1692.6	1952.8
	3	30730.0	0.0	53125.6	2133.7	55259.3
	4	15738.9	158976.6	9135.5	396.9	9532.4
	Total	89243.7	158976.6	62668.0	35504.9	98172.9
Mink *Mustela vison*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Eastern Spotted skunk *Spilogale putorius*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	13762.4	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	106450.5	159418.8	128211.9	51888.8	180100.7
Badger *Taxidea taxus*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Raccoon *Procyon lotor*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Townsend's Big-eared bat *Corynorhinus townsendii*	**1**	0.0	0.0	0	0.3	0.3
	2	0.0	0.0	0	0.0	0.0

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	3	11209.4	0.0	5604.5	0.0	5604.5
	4	162.2	0.0	0	5.4	5.4
	Total	11371.6	0.0	5604.5	5.7	5610.2
Big Brown bat *Eptesicus fuscus*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110354.5	2133.7	112488.2
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128216.4	51888.8	180105.2
Silver-haired bat *Lasionycteris noctivagans*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Red bat *Lasiurus borealis*	**1**	6527.4	0.0	146.7	29930.7	30077.4
	2	58664.8	0.0	289.8	4026.0	4315.8
	3	69619.0	0.0	101502.3	2133.7	103636.0
	4	16553.1	159383.6	17386.3	2616.1	20002.4
	Total	151364.3	159383.6	119325.1	38706.5	158031.6
Hoary bat *Lasiurus cinereus*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Western Small-footed myotis *Myotis ciliolabrum*	**1**	5178.6	0.0	0	12384.3	12384.3
	2	4898.0	0.0	0	2333.4	2333.4
	3	123760.2	0.0	46679	0.0	46679.0
	4	1210.7	227.1	6065.1	2944.6	9009.7
	Total	135047.5	227.1	52744.1	17662.3	70406.4
Little Brown bat *Myotis lucifugus*	**1**	3975.2	0.0	146.7	3381.2	3527.9
	2	4559.1	0.0	127.9	0.0	127.9
	3	59283.6	0.0	39358.7	521.0	39879.7

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	4	7371.9	114568.8	6219.1	1144.6	7363.7
	Total	75189.8	114568.8	45852.4	5046.8	50899.2
Northern Long-eared myotis *Myotis septentrionalis*	**1**	68.0	0.0	146.7	12077.7	12224.4
	2	10866.8	0.0	287.3	303.3	590.6
	3	0.0	0.0	50471.6	1459.3	51930.9
	4	12105.3	91484.9	3545.9	307.2	3853.1
	Total	23040.1	91484.9	54451.5	14147.5	68599.0
Fringe-tailed myotis *Myotis thysanodes*	**1**	3907.2	0.0	0	248.2	248.2
	2	0.0	0.0	0	653.5	653.5
	3	21172.5	0.0	16524.5	0.0	16524.5
	4	421.0	0.0	0	275.4	275.4
	Total	25500.7	0.0	16524.5	1177.1	17701.6
Long-legged myotis *Myotis volans*	**1**	3907.0	0.0	0	248.2	248.2
	2	0.0	0.0	0	0.0	0.0
	3	51195.1	0.0	14932.2	0.0	14932.2
	4	689.9	227.1	0	1142.2	1142.2
	Total	55792.0	227.1	14932.2	1390.4	16322.6
Evening bat *Nycticeius humeralis*	**1**	68.0	0.0	0	176.0	176.0
	2	0.0	0.0	29.6	0.0	29.6
	3	0.0	0.0	5154.4	460.3	5614.7
	4	3939.5	1446.2	124.4	0.0	124.4
	Total	4007.5	1446.2	5308.4	636.3	5944.7
Eastern pipistrelle *Pipistrellus subflavus*	**1**	0.0	0.0	0	176.0	176.0
	2	0.0	0.0	0	0.0	0.0
	3	0.0	0.0	2119.2	0.0	2119.2
	4	2464.3	3992.3	0	0.0	0.0
	Total	2464.3	3992.3	2119.2	176.0	2295.2
Northern Short-tailed Shrew *Blarina brevicauda*	**1**	0.0	0.0	146.7	29209.6	29356.3
	2	15946.4	0.0	257.8	2028.6	2286.4
	3	61272.8	0.0	44207.3	1727.8	45935.1
	4	13236.2	111261.4	8522.5	391.5	8914.0

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	Total	90455.4	111261.4	53134.3	33357.5	86491.8
Elliot's Short-tailed shrew *Blarina hylophaga*	**1**	68.0	0.0	130.5	534.1	664.6
	2	5537.5	0.0	214.2	0.0	214.2
	3	0.0	0.0	26777.5	804.6	27582.1
	4	5957.3	3992.3	1169	0.0	1169.0
	Total	11562.8	3992.3	28291.2	1338.7	29629.9
Least shrew *Cryptotis parva*	**1**	1057.8	0.0	146.7	22884.9	23031.6
	2	25435.5	0.0	289.8	1525.5	1815.3
	3	30588.0	0.0	71096.8	1796.9	72893.7
	4	15800.6	159191.7	9211.4	1002.8	10214.2
	Total	72881.9	159191.7	80744.7	27210.1	107954.8
Masked shrew *Sorex cinereus*	**1**	6493.7	0.0	146.7	34000.2	34146.9
	2	66084.2	0.0	289.8	3992.1	4281.9
	3	44267.7	0.0	101707.2	2133.7	103840.9
	4	16517.5	159159.9	13615.8	2423.2	16039.0
	Total	133363.1	159159.9	115759.5	42549.2	158308.7
Merriam's shrew *Sorex merriami*	**1**	3907.2	0.0	0	248.2	248.2
	2	0.0	0.0	0	0.0	0.0
	3	16885.5	0.0	12467.7	0.0	12467.7
	4	533.0	227.1	0	667.4	667.4
	Total	21325.7	227.1	12467.7	915.6	13383.3
Eastern mole *Scalopus aquaticus*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Black-tailed jackrabbit *Lepus californicus*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
White-tailed jackrabbit *Lepus townsendii*	**1**	6459.4	0.0	55.8	38966.1	39021.9
	2	66874.8	0.0	168.5	4026.0	4194.5
	3	137624.5	0.0	89092.1	1108.4	90200.5
	4	8521.4	103356.3	15258.7	3104.0	18362.7
	Total	219480.1	103356.3	104575.1	47204.5	151779.6
Desert cottontail *Sylvilagus audubonii*	**1**	6459.4	0.0	0	10396.5	10396.5
	2	19530.0	0.0	0	2995.0	2995.0
	3	101237.9	0.0	47434.7	0.0	47434.7
	4	1105.7	227.1	2805.1	2925.2	5730.3
	Total	128333.0	227.1	50239.8	16316.7	66556.5
Eastern cottontail *Sylvilagus floridanus*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	13762.4	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	106450.5	159418.8	128211.9	51888.8	180100.7
Virginia opossum *Didelphis virginiana*	**1**	6493.7	0.0	146.7	31036.0	31182.7
	2	34733.0	0.0	289.8	3370.1	3659.9
	3	36556.6	0.0	98115.7	2133.7	100249.4
	4	16337.1	159156.5	9747.5	3152.0	12899.5
	Total	94120.4	159156.5	108299.7	39691.8	147991.5
Beaver *Castor canadensis*	**1**	2187.5	0.0	146.7	20631.5	20778.2
	2	56932.5	0.0	289.8	2028.6	2318.4
	3	75798.4	0.0	97634.8	2074.6	99709.4
	4	13318.8	118627.9	9844.1	1723.9	11568.0
	Total	148237.2	118627.9	107915.4	26458.6	134374.0
Meadow Jumping mouse *Zapus hudsonius*	**1**	830.1	0.0	146.7	39219.1	39365.8
	2	60386.7	0.0	289.8	2028.6	2318.4
	3	39670.6	0.0	78706.2	2133.7	80839.9
	4	16116.2	159191.7	16059.8	643.0	16702.8
	Total	117003.6	159191.7	95202.5	44024.4	139226.9

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Porcupine *Erethizon dorsatum*	**1**	6493.7	0.0	146.7	37881.0	38027.7
	2	66791.4	0.0	221.2	3992.1	4213.3
	3	103204.0	0.0	104934.6	2072.1	107006.7
	4	15596.8	123503.2	13482.2	2962.9	16445.1
	Total	192085.9	123503.2	118784.7	46908.1	165692.8
Plains Pocket gopher *Geomys bursarius*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Northern Pocket gopher *Thomomys talpoides*	**1**	0.0	0.0	0	0.0	0.0
	2	0.0	0.0	0	0.0	0.0
	3	33753.5	0.0	4.9	0.0	4.9
	4	260.0	227.1	898.5	866.8	1765.3
	Total	34013.5	227.1	903.4	866.8	1770.2
Hispid Pocket mouse *Chaetodipus hispidus*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Ord's Kangaroo rat *Dipodomys ordii*	**1**	6459.4	0.0	0	41090.5	41090.5
	2	57689.4	0.0	0	4026.0	4026.0
	3	99823.8	0.0	66889.2	1551.1	68440.3
	4	6262.5	498.4	8341.6	2556.8	10898.4
	Total	170235.1	498.4	75230.8	49224.4	124455.2
Olive-backed Pocket mouse *Perognathus fasciatus*	**1**	5151.6	0.0	0	2250.9	2250.9
	2	3601.5	0.0	0	1997.4	1997.4
	3	50363.6	0.0	26267.7	0.0	26267.7
	4	746.8	227.1	1216	2731.3	3947.3
	Total	59863.5	227.1	27483.7	6979.6	34463.3

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
Plains Pocket mouse *Perognathus flavescens*	**1**	6527.4	0.0	0	41168.5	41168.5
	2	61825.7	0.0	29.6	4026.0	4055.6
	3	104186.6	0.0	84441.9	2133.7	86575.6
	4	10685.3	81362.9	9034.2	2556.7	11590.9
	Total	183225.0	81362.9	93505.7	49884.9	143390.6
Silky Pocket mouse *Perognathus flavus*	**1**	6459.4	0.0	0	2069.0	2069.0
	2	7835.0	0.0	0	2995.0	2995.0
	3	69291.6	0.0	31911	0.0	31911.0
	4	976.7	227.1	2545.4	2731.3	5276.7
	Total	84562.7	227.1	34456.4	7795.3	42251.7
Prairie vole *Microtus ochrogaster*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Meadow vole *Microtus pennsylvanicus*	**1**	0.0	0.0	0	192.3	192.3
	2	2096.9	0.0	59.5	0.0	59.5
	3	0.0	0.0	6548	582.6	7130.6
	4	3057.5	3080.2	1647.4	0.0	1647.4
	Total	5154.4	3080.2	8254.9	774.9	9029.8
Pine vole/Woodland vole *Microtus pinetorum*	**1**	0.0	0.0	0	192.3	192.3
	2	2096.9	0.0	59.5	0.0	59.5
	3	0.0	0.0	6548	582.6	7130.6
	4	3057.5	3080.2	1647.4	0.0	1647.4
	Total	5154.4	3080.2	8254.9	774.9	9029.8
House mouse *Mus musculus*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Bushy-tailed woodrat *Neotoma cinerea*	**1**	5948.5	0.0	0	248.2	248.2

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	2	734.2	0.0	0	653.5	653.5
	3	28792.2	0.0	17795.9	0.0	17795.9
	4	626.9	227.1	57.7	672.7	730.4
	Total	36101.8	227.1	17853.6	1574.4	19428.0
Eastern woodrat *Neotoma floridana*	**1**	0.0	0.0	0	13376.5	13376.5
	2	2594.0	0.0	0	997.6	997.6
	3	0.0	0.0	40495.7	300.8	40796.5
	4	195.4	1991.0	870.2	251.5	1121.7
	Total	2789.4	1991.0	41365.9	14926.4	56292.3
Muskrat *Ondatra zibethicus*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Northern Grasshopper mouse *Onychomys leucogaster*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
White-footed mouse *Peromyscus leucopus*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Deer mouse *Peromyscus maniculatus*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Norway rat *Rattus norvegicus*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Western Harvest mouse *Reithrodontomys megalotis*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Plains Harvest mouse *Reithrodontomys montanus*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	137624.5	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	230312.6	159418.8	128211.9	51888.8	180100.7
Hispid Cotton rat *Sigmodon hispidus*	**1**	0.0	0.0	90.9	456.0	546.9
	2	350.7	0.0	32.2	0.0	32.2
	3	0.0	0.0	6281.5	582.2	6863.7
	4	2671.7	3992.3	921.8	0.0	921.8
	Total	3022.4	3992.3	7326.4	1038.2	8364.6
Southern Bog lemming *Synaptomys cooperi*	**1**	0.0	0.0	55.8	11871.7	11927.5
	2	11952.3	0.0	32.2	1031.0	1063.2
	3	63.1	0.0	34203.1	1794.3	35997.4
	4	7228.0	53368.8	3856.4	410.9	4267.3
	Total	19243.4	53368.8	38147.5	15107.9	53255.4
Black-tailed Prairie dog *Cynomys ludovicianus*	**1**	6527.4	0.0	0	41093.4	41093.4
	2	66136.7	0.0	29.6	4026.0	4055.6
	3	125481.4	0.0	91245	1551.1	92796.1
	4	9076.1	33333.5	3143.6	3374.4	6518.0
	Total	207221.6	33333.5	94418.2	50044.9	144463.1
Southern Flying squirrel *Glaucomys volans*	**1**	0.0	0.0	0	0.0	0.0
	2	0.0	0.0	0	0.0	0.0
	3	0.0	0.0	123.4	0.0	123.4

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	4	43.1	961.5	0	0.0	0.0
	Total	43.1	961.5	123.4	0.0	123.4
Woodchuck *Marmota monax*	**1**	68.0	0.0	90.9	4227.9	4318.8
	2	4064.9	0.0	121.3	1031.0	1152.3
	3	63.1	0.0	28594.9	1855.9	30450.8
	4	9273.1	54628.9	2265.4	429.8	2695.2
	Total	13469.1	54628.9	31072.5	7544.6	38617.1
Grey squirrel *Sciurus carolinensis*	**1**	68.0	0.0	0	192.3	192.3
	2	0.0	0.0	0	0.0	0.0
	3	0.0	0.0	5837.5	460.3	6297.8
	4	3791.2	3992.3	321.3	0.0	321.3
	Total	3859.2	3992.3	6158.8	652.6	6811.4
Fox squirrel *Sciurus niger*	**1**	6493.7	0.0	146.7	30508.7	30655.4
	2	43132.5	0.0	289.8	3656.1	3945.9
	3	98204.8	0.0	91947.8	2133.7	94081.5
	4	16316.7	159418.8	9148.6	3176.8	12325.4
	Total	164147.7	159418.8	101532.9	39475.3	141008.2
Wyoming Ground squirrel *Spermophilus elegans*	**1**	0.0	0.0	0	0.0	0.0
	2	0.0	0.0	0	0.0	0.0
	3	0.0	0.0	0	0.0	0.0
	4	0.0	0.0	0	141966.0	141966.0
	Total	0.0	0.0	0.0	141966.0	141966.0
Franklin's Ground squirrel *Spermophilus franklinii*	**1**	68.0	0.0	146.7	11561.5	11708.2
	2	16689.9	0.0	289.8	1031.0	1320.8
	3	14011.7	0.0	62354.7	2133.7	64488.4
	4	15567.9	159191.7	8619.2	429.8	9049.0
	Total	46337.5	159191.7	71410.4	15156.0	86566.4
Spotted Ground squirrel *Spermophilus spilosoma*	**1**	6459.4	0.0	0	36285.0	36285.0
	2	56818.8	0.0	0	2995.0	2995.0
	3	99823.8	0.0	58311.5	0.0	58311.5
	4	1662.6	789.4	8526.2	1589.1	10115.3

Common Name Scientific Name	Status	Federal[1]	Native[2]	State[3]	Private[4]	Total
	Total	164764.6	789.4	66837.7	40869.1	107706.8
Thirteen-lined Ground squirrel *Spermophilus tridecemlineatus*	**1**	6527.4	0.0	146.7	42354.7	42501.4
	2	69027.7	0.0	289.8	4026.0	4315.8
	3	13762.4	0.0	110350	2133.7	112483.7
	4	17133.0	159418.8	17425.4	3374.4	20799.8
	Total	106450.5	159418.8	128211.9	51888.8	180100.7
Least chipmunk *Tamias minimus*	**1**	607.7	0.0	0	0.3	0.3
	2	0.0	0.0	0	0.0	0.0
	3	10605.6	0.0	8315	0.0	8315.0
	4	516.3	227.1	0	466.9	466.9
	Total	11729.6	227.1	8315.0	467.2	8782.2
Eastern chipmunk *Tamias striatus*	**1**	68.0	0.0	0	192.3	192.3
	2	0.0	0.0	0	0.0	0.0
	3	0.0	0.0	6030.2	460.3	6490.5
	4	2514.5	3080.2	178	0.0	178.0
	Total	2582.5	3080.2	6208.2	652.6	6860.8
Nine-banded armadillo *Dasypus novemcinctus*	**1**	68.0	0.0	130.5	4562.5	4693.0
	2	9218.6	0.0	214.2	1031.0	1245.2
	3	0.0	0.0	34717.6	1492.1	36209.7
	4	6935.0	0.0	2508.2	429.8	2938.0
	Total	16221.6	0.0	37570.5	7515.4	45085.9

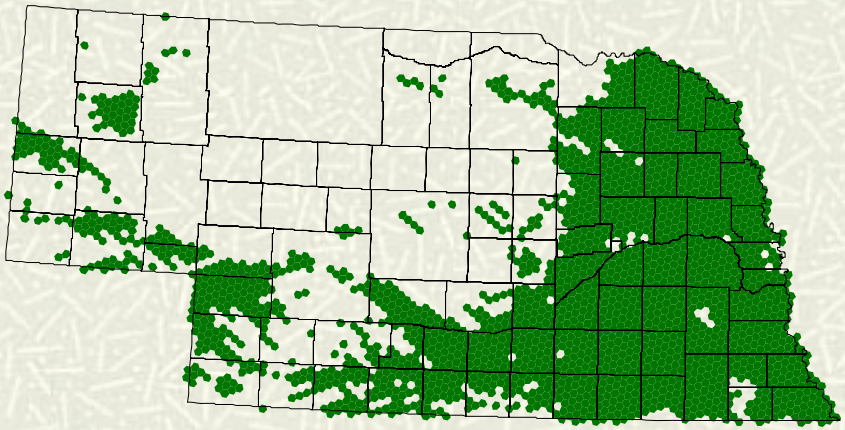
Nebraska GAP Analysis

Appendix L

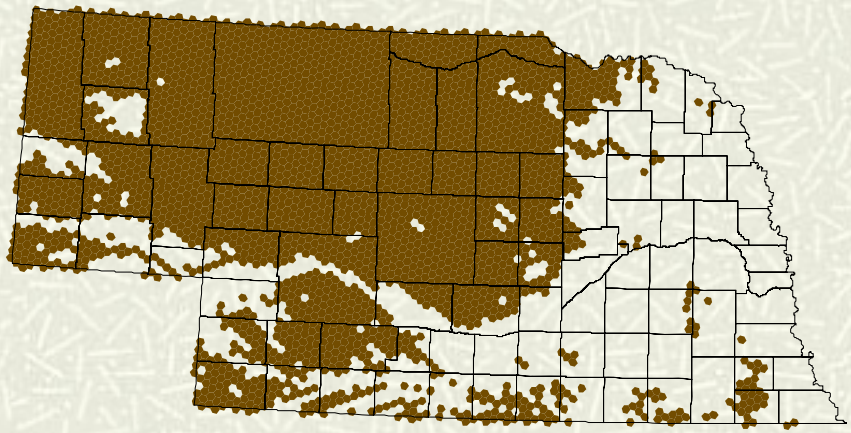
Part 1:

Pervasiveness Analysis for Species Richness of Total Vertebrates and Birds

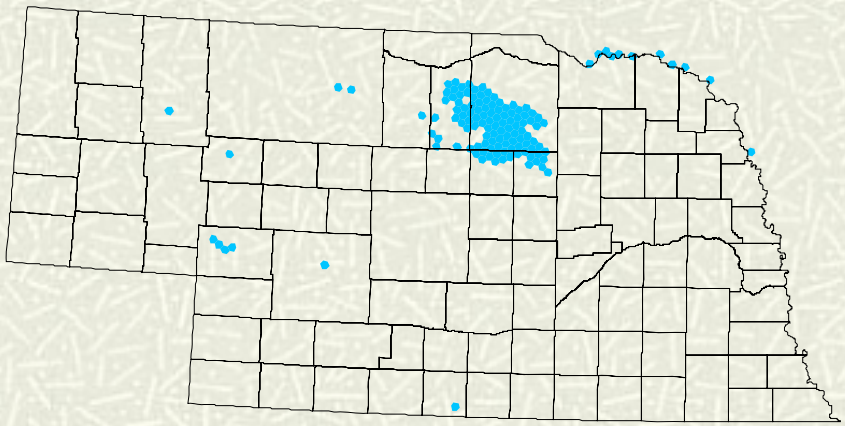
Land Cover Pervasiveness & Landscape Connectivity



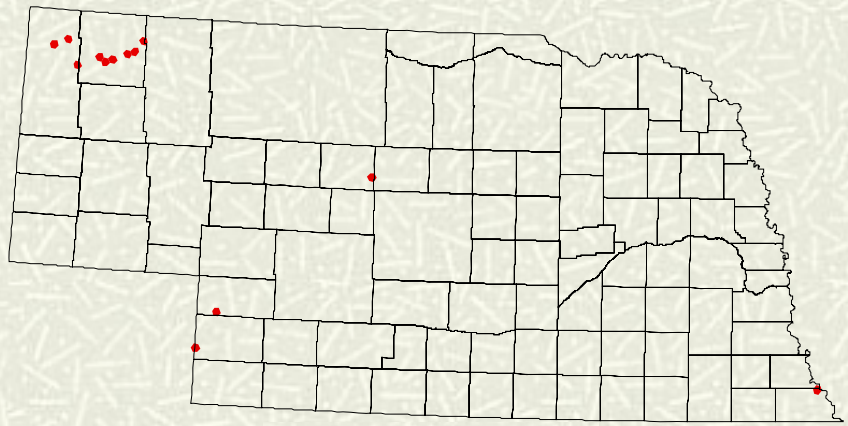
Anthropogenic Mask



Grassland Mask

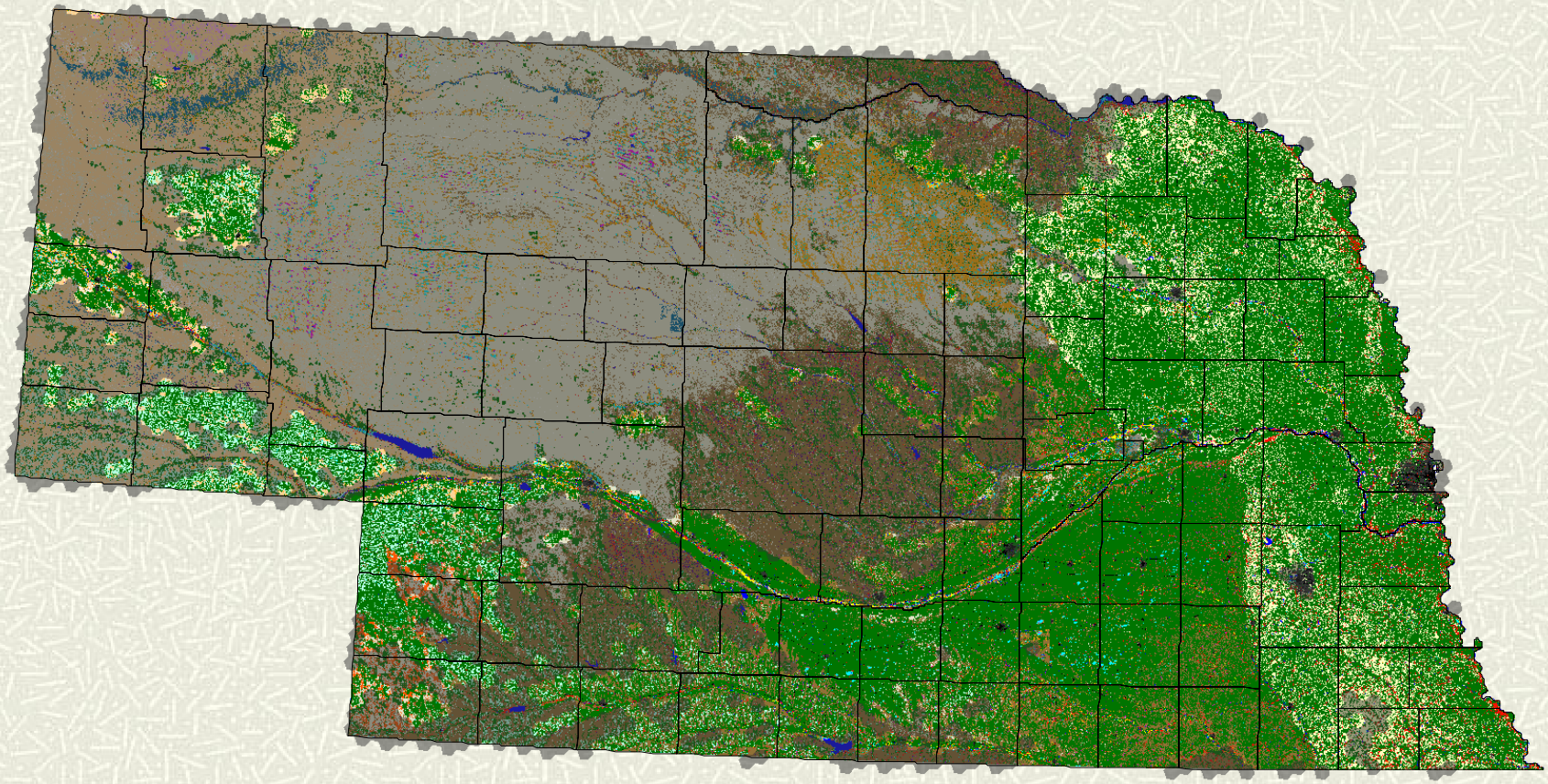


Wetland Mask

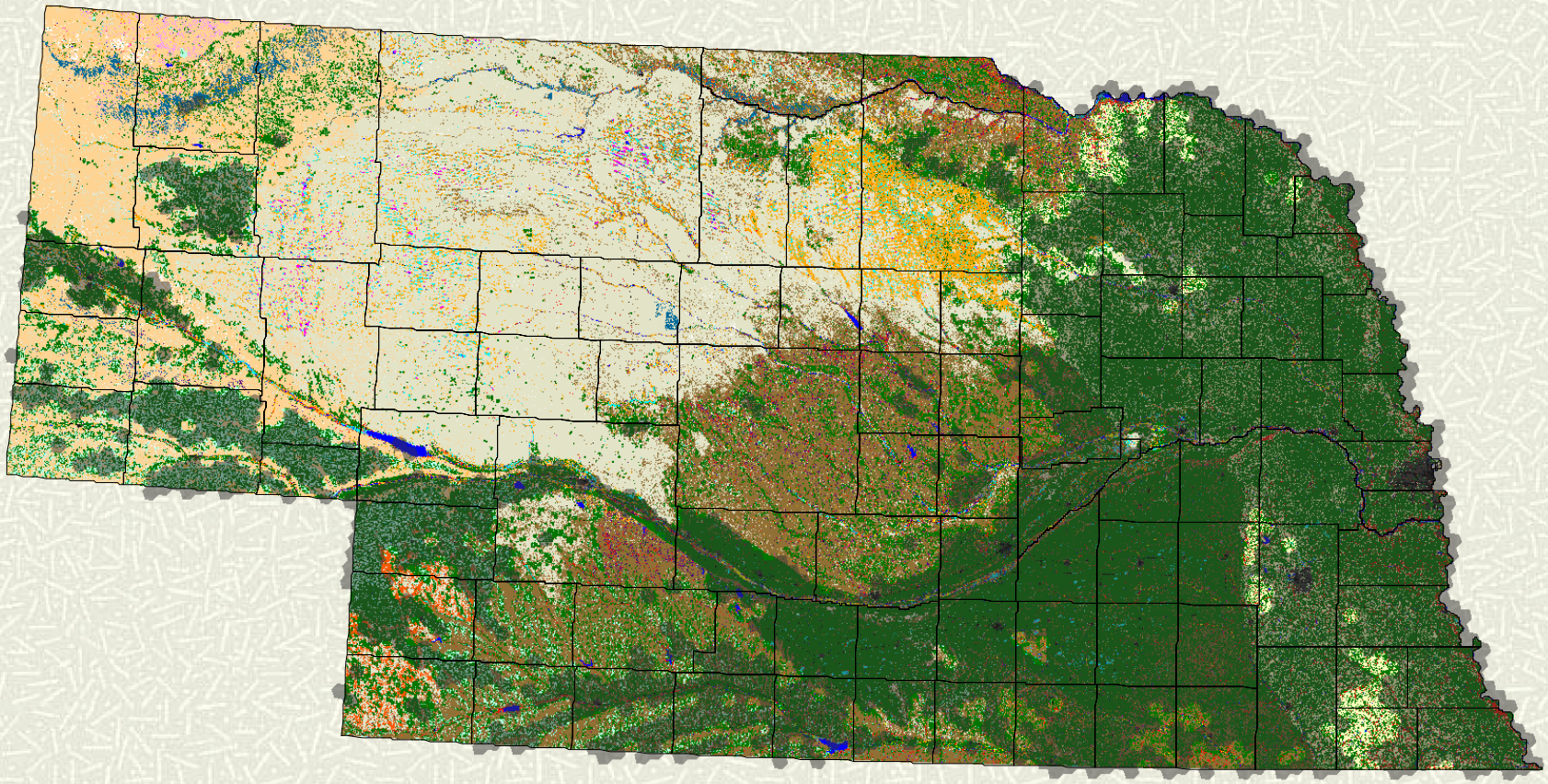


Woodland Mask

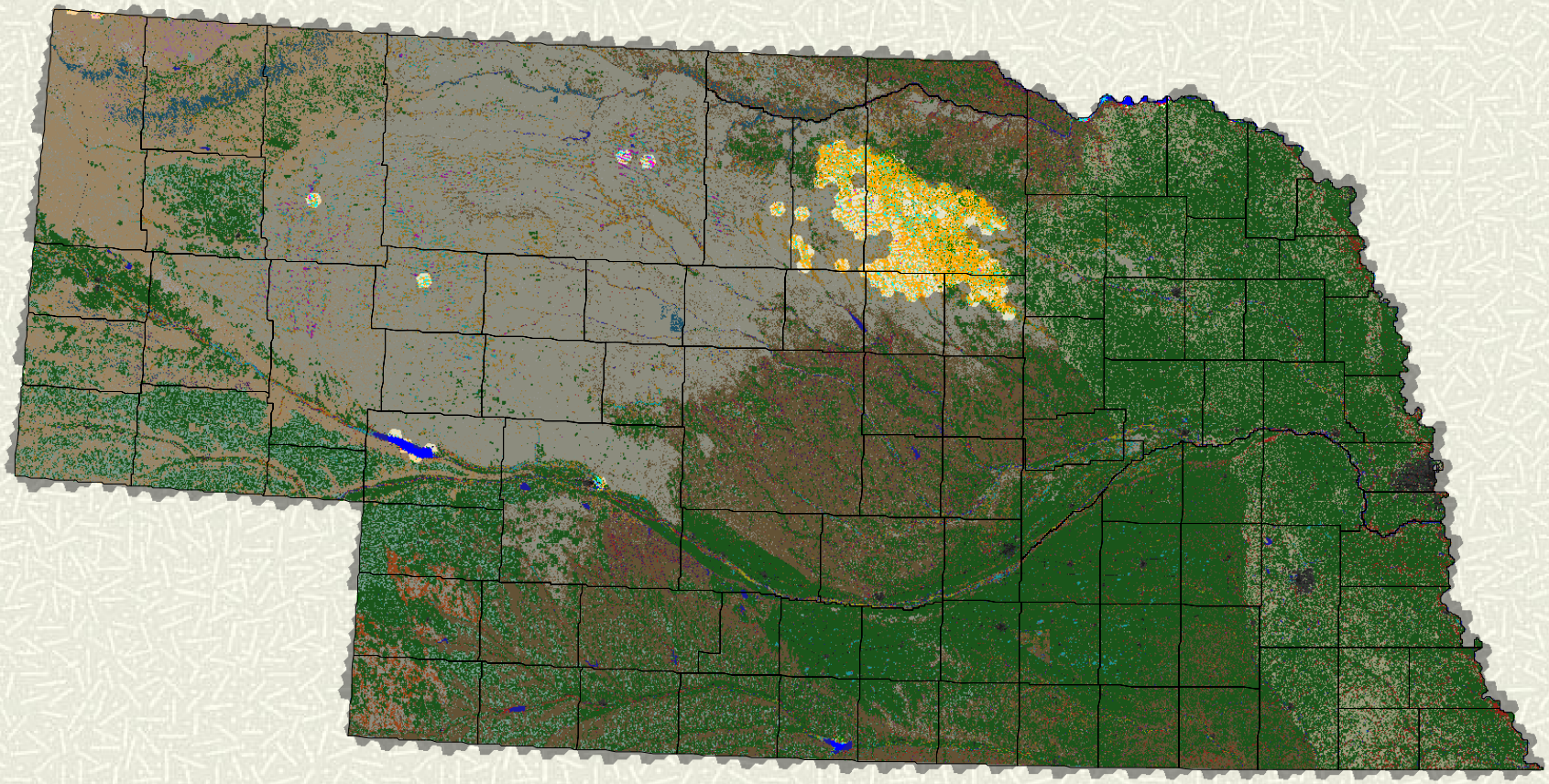
Pervasive Anthropogenic Classes



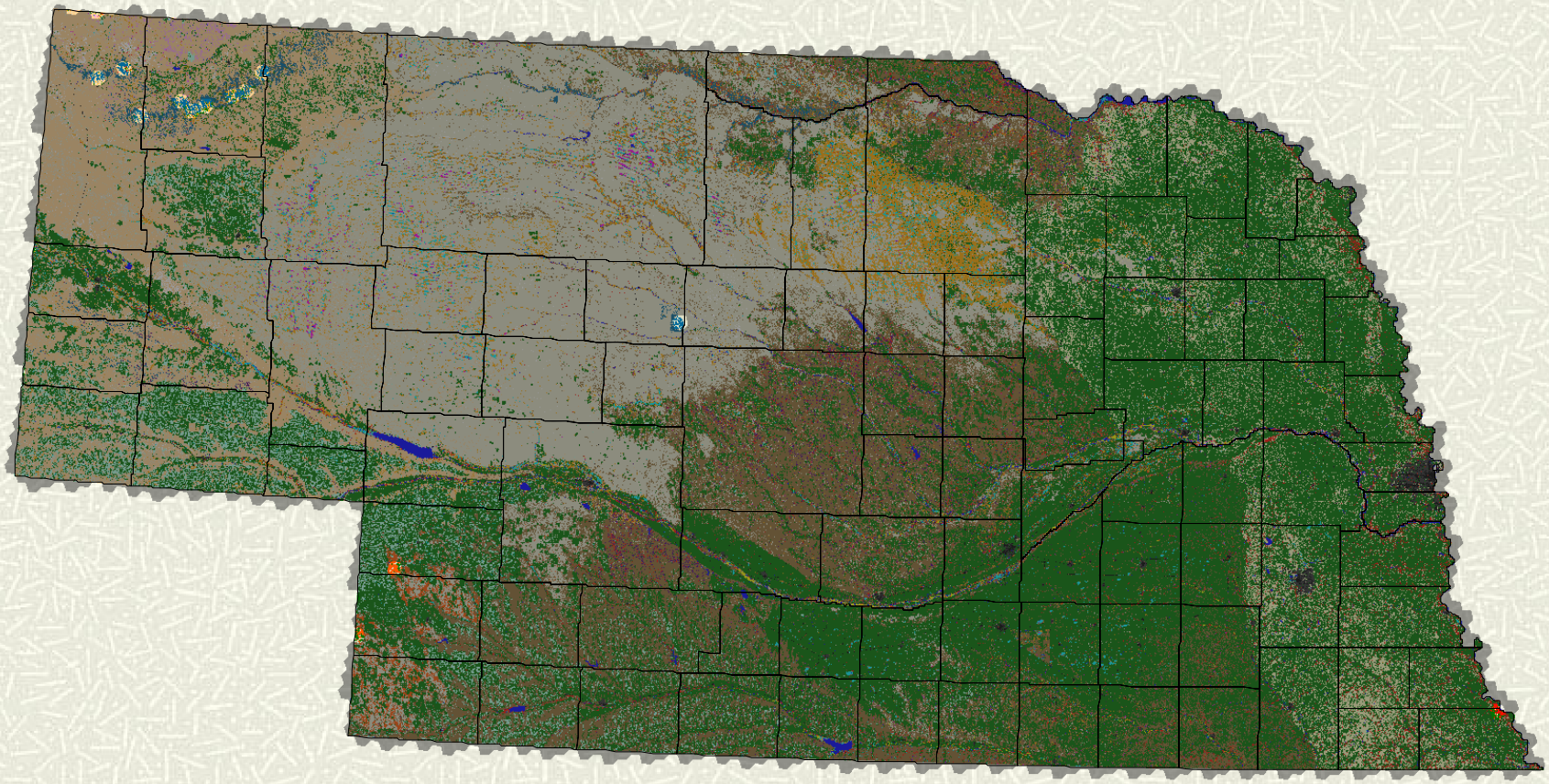
Pervasive Grassland Classes

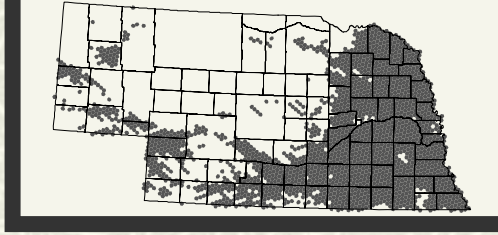


Pervasive Wetland Classes



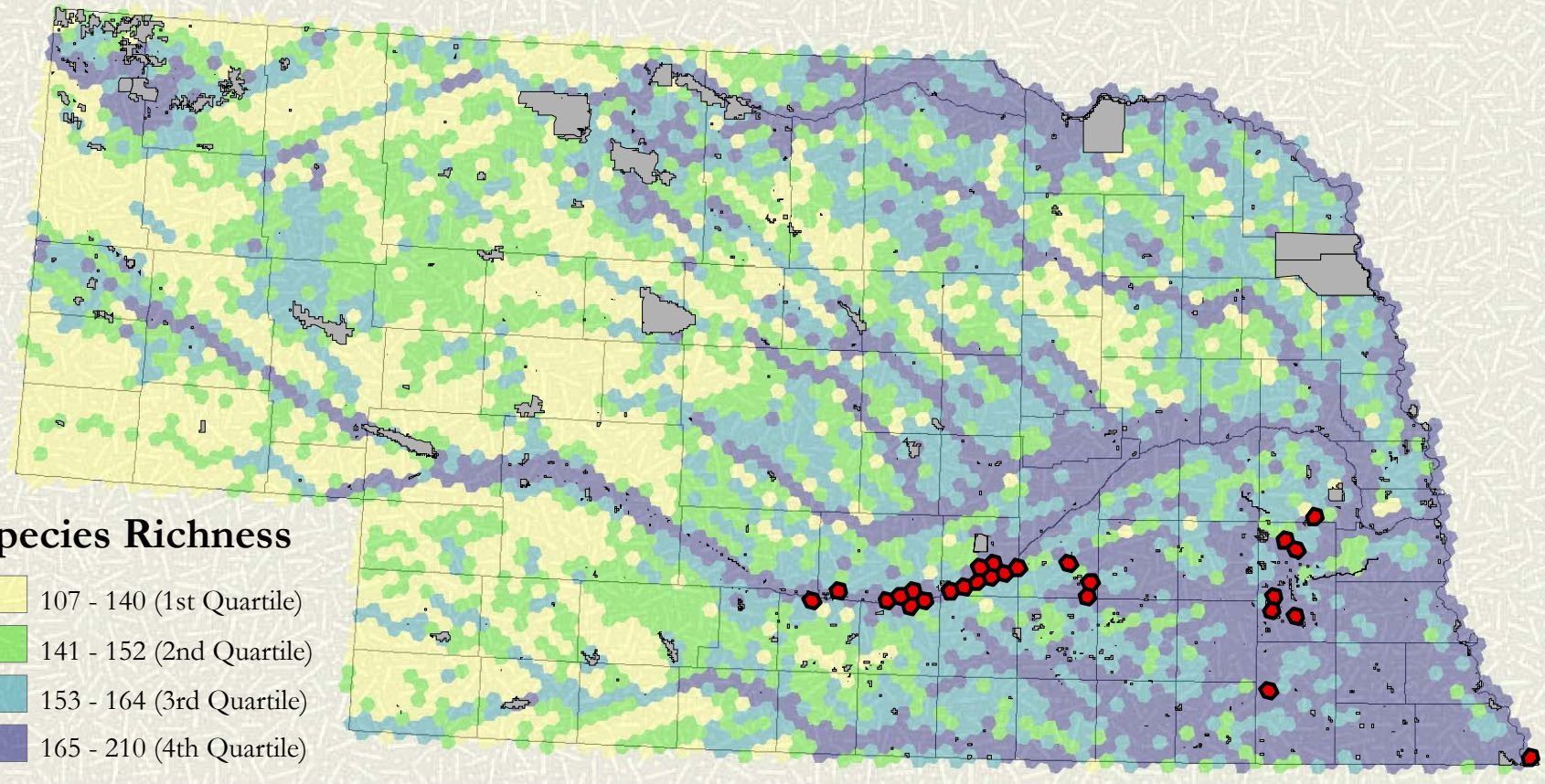
Pervasive Woodland Classes



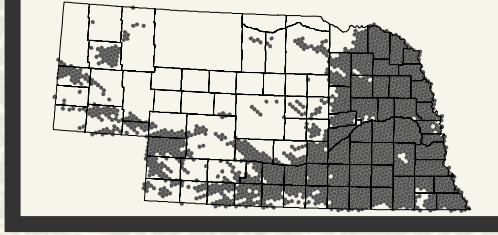


Gap Analysis of Terrestrial Vertebrates

Anthropogenic Mask

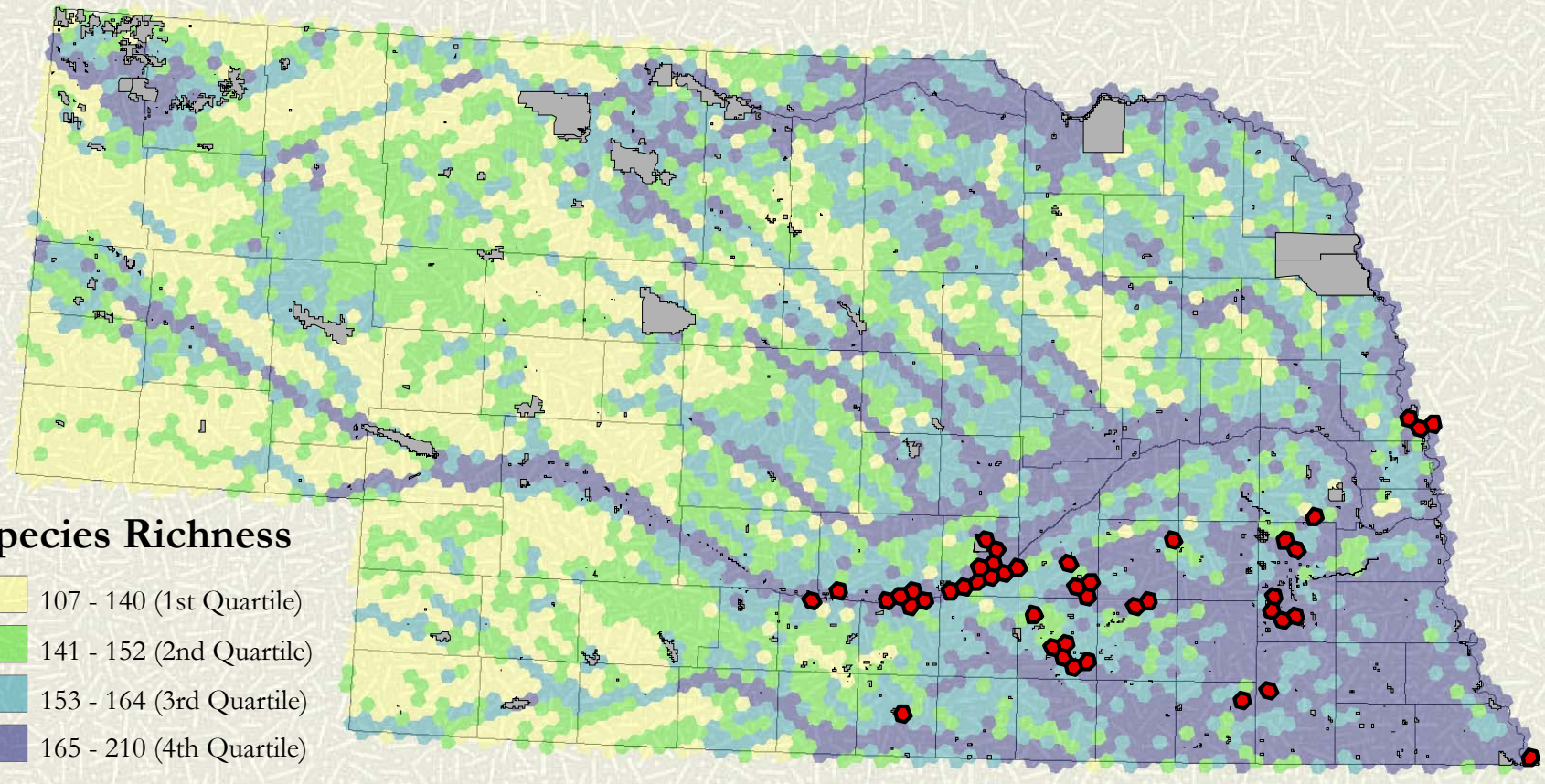


Mgmt Status 1 x Richness Quartile 4

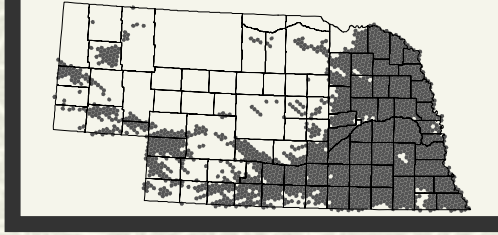


Gap Analysis of Terrestrial Vertebrates

Anthropogenic Mask

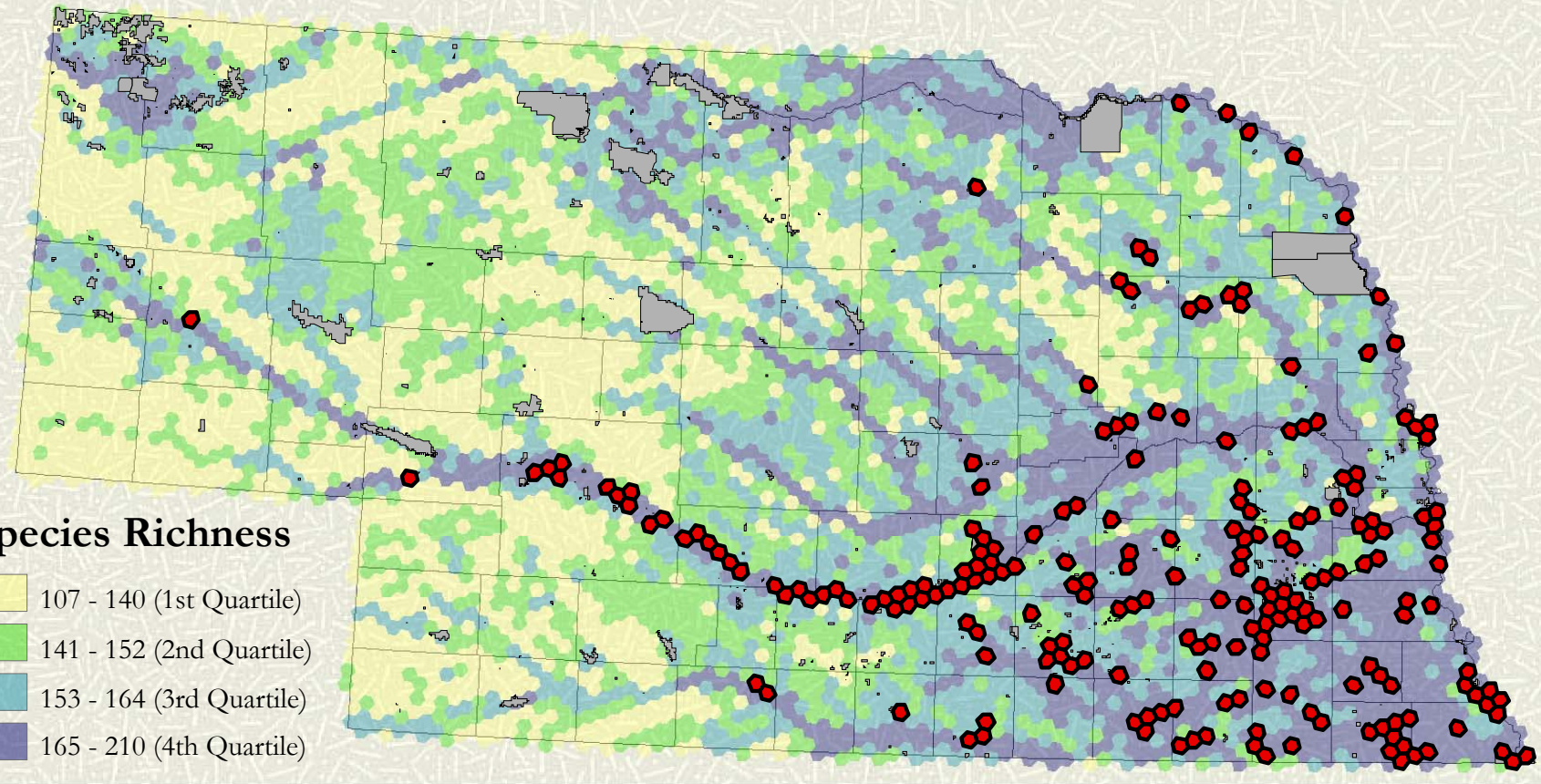


Mgmt Status 1,2 x Richness Quartile 4

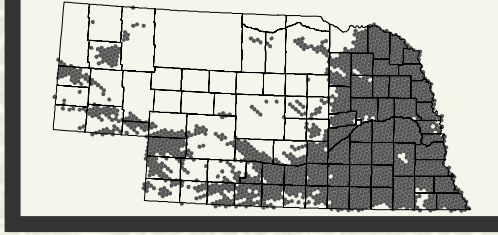


Gap Analysis of Terrestrial Vertebrates

Anthropogenic Mask

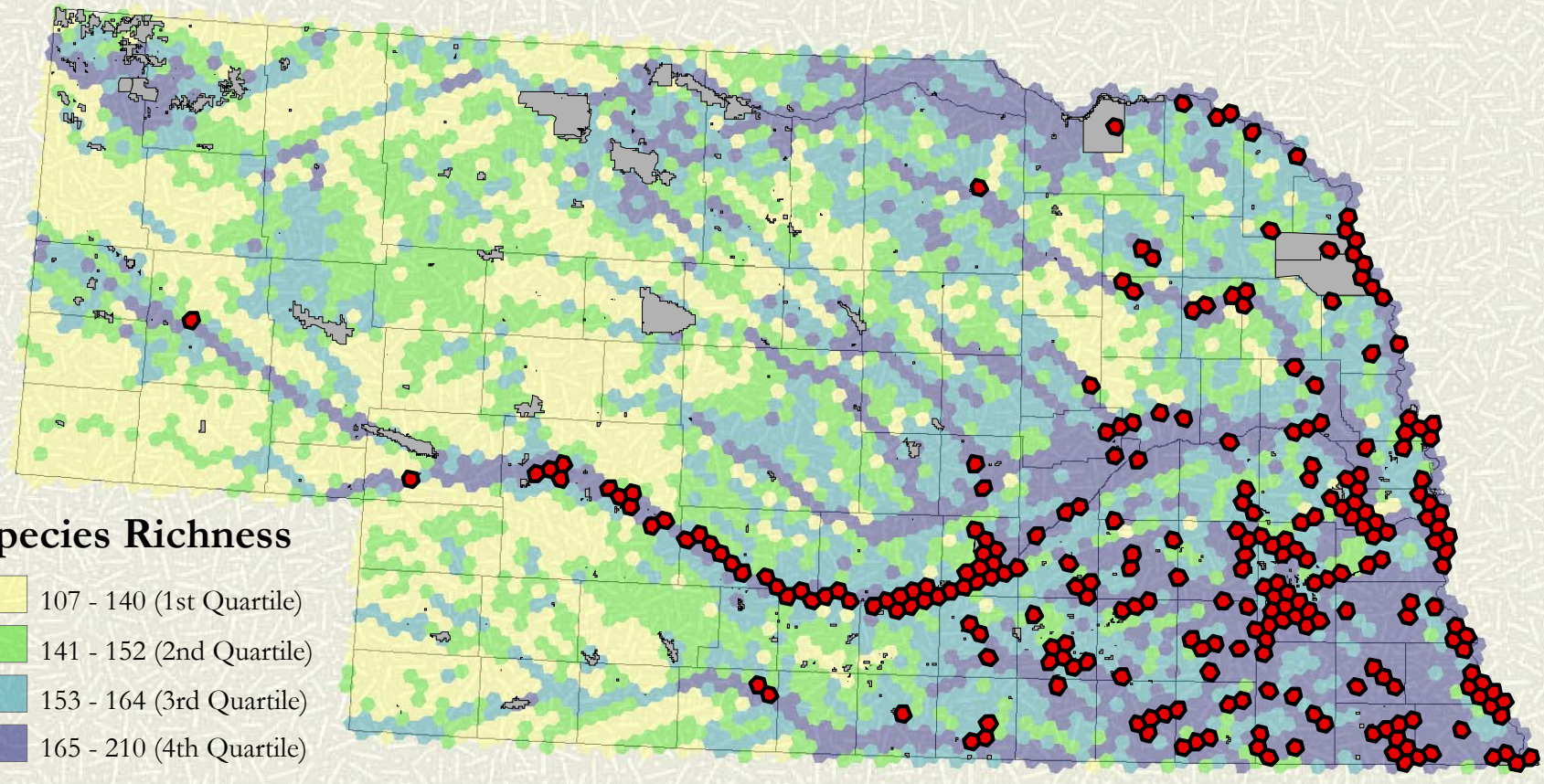


Mgmt Status 1,2,3 x Richness Quartile 4

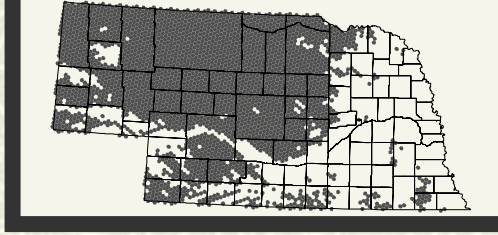


Gap Analysis of Terrestrial Vertebrates

Anthropogenic Mask

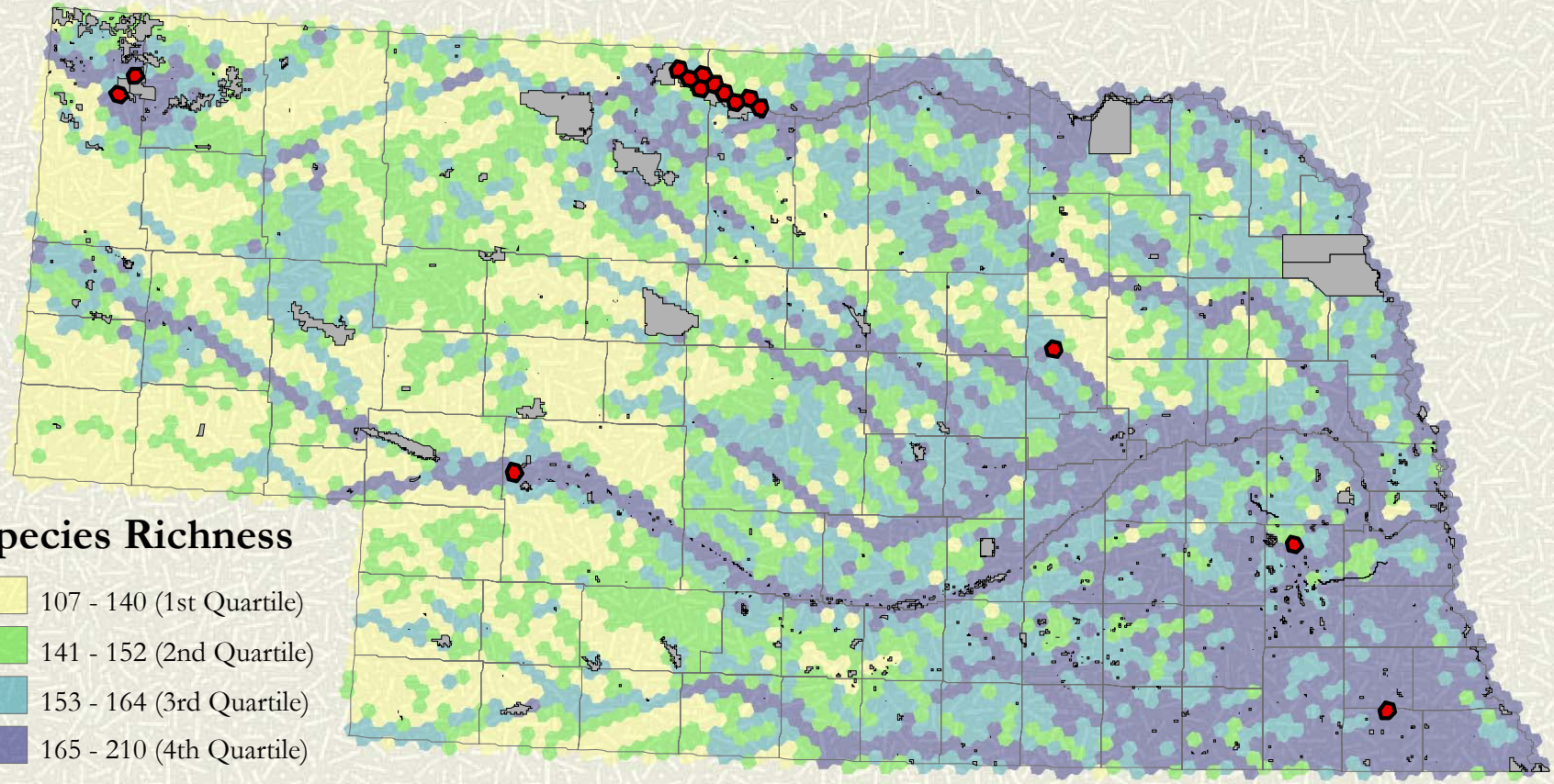


Mgmt Status 1-4 x Richness Quartile 4

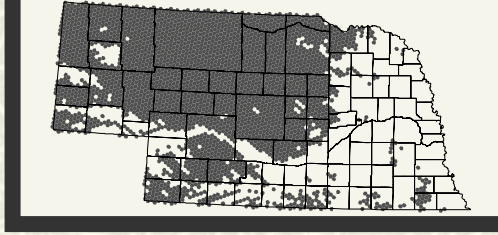


Gap Analysis of Terrestrial Vertebrates

Grassland Mask

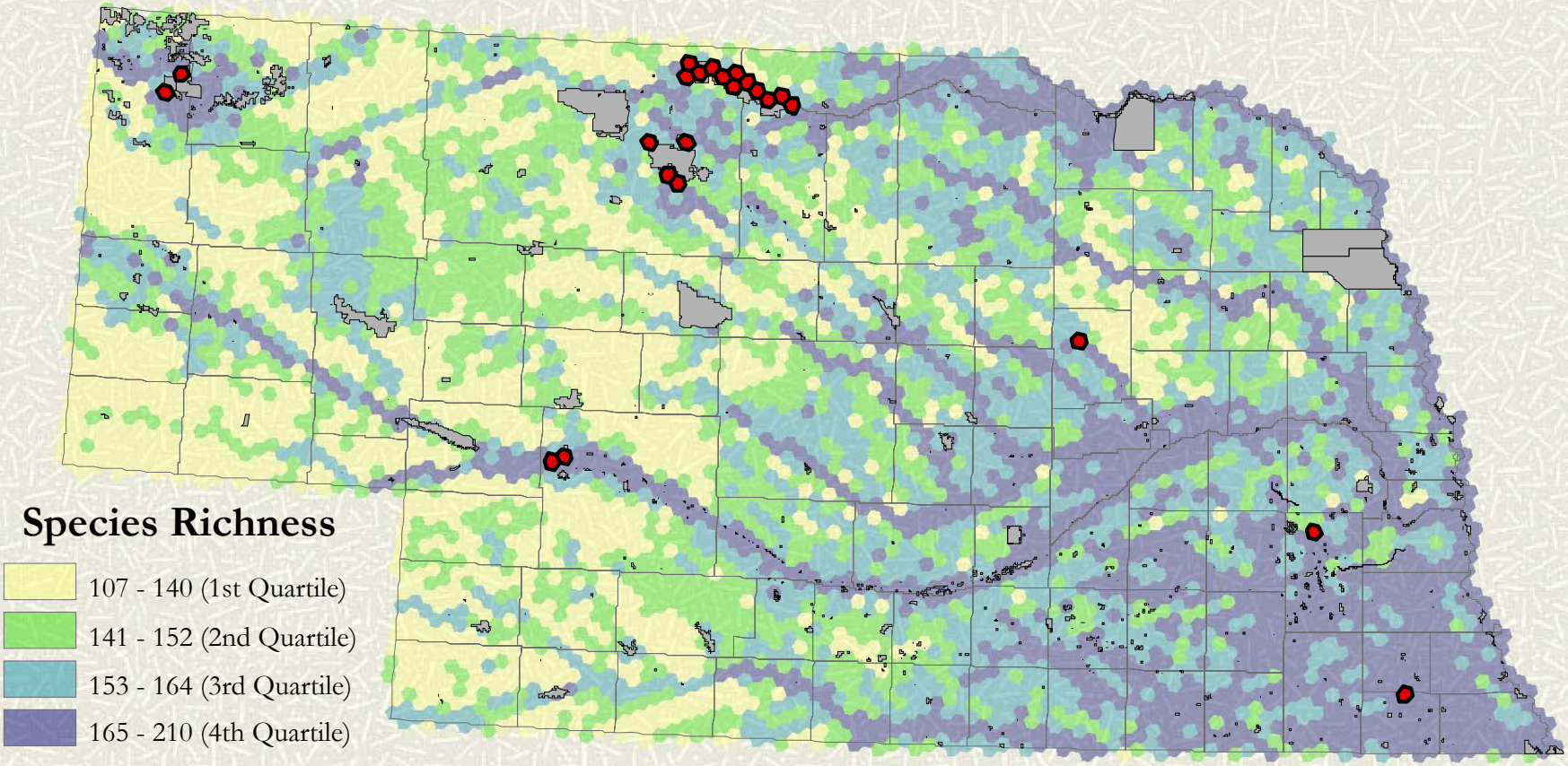


Mgmt Status 1 x Richness Quartile 4

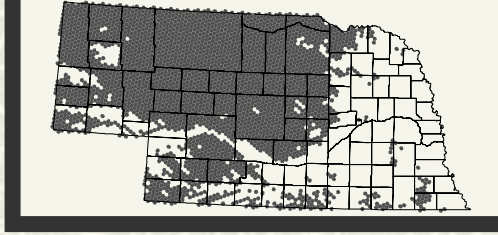


Gap Analysis of Terrestrial Vertebrates

Grassland Mask

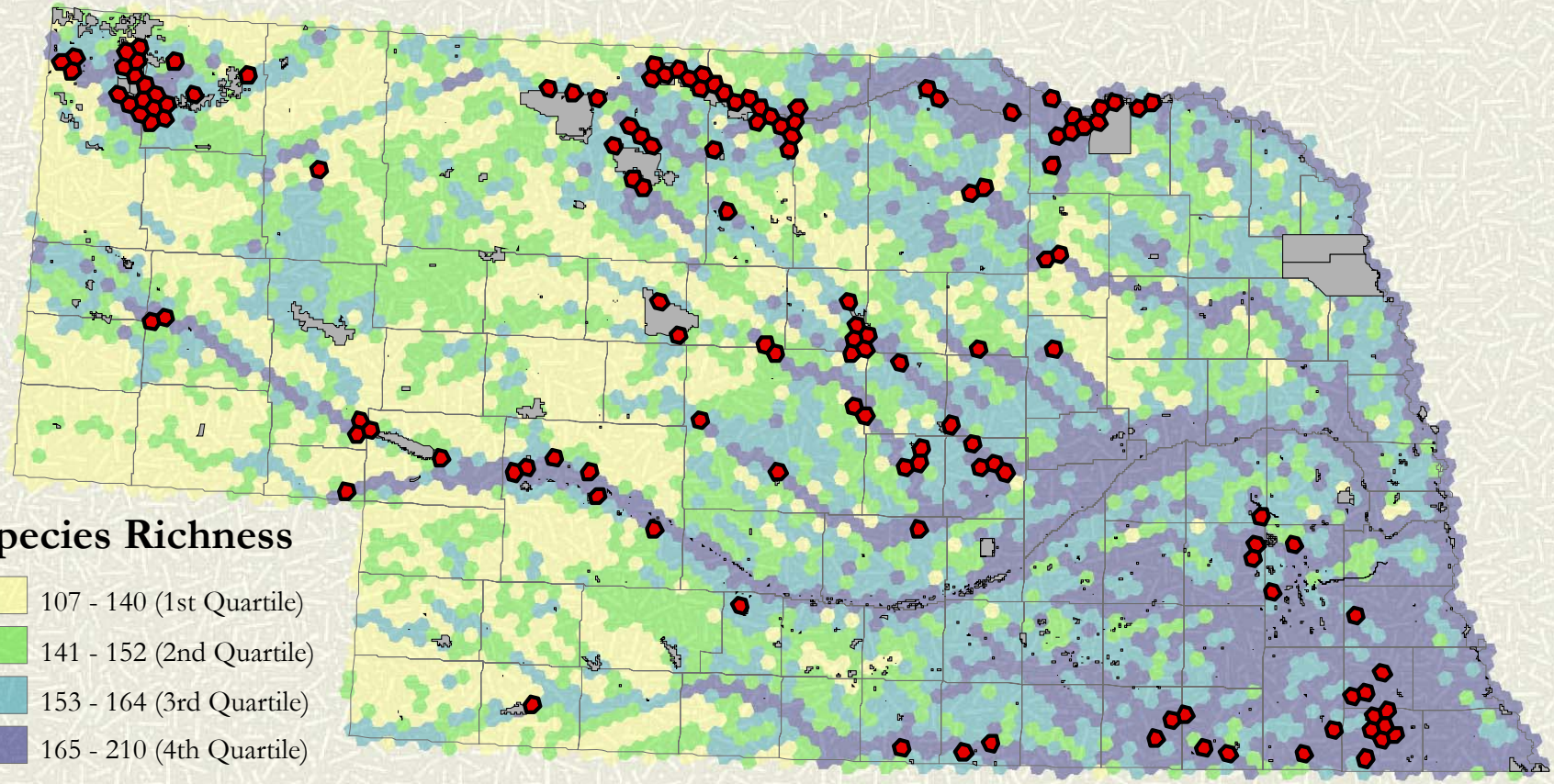


Mgmt Status 1,2 x Richness Quartile 4

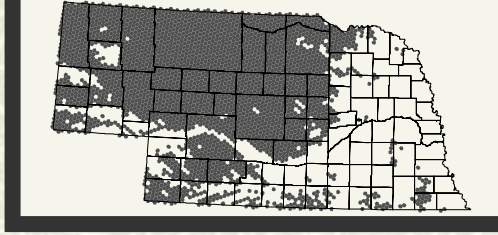


Gap Analysis of Terrestrial Vertebrates

Grassland Mask

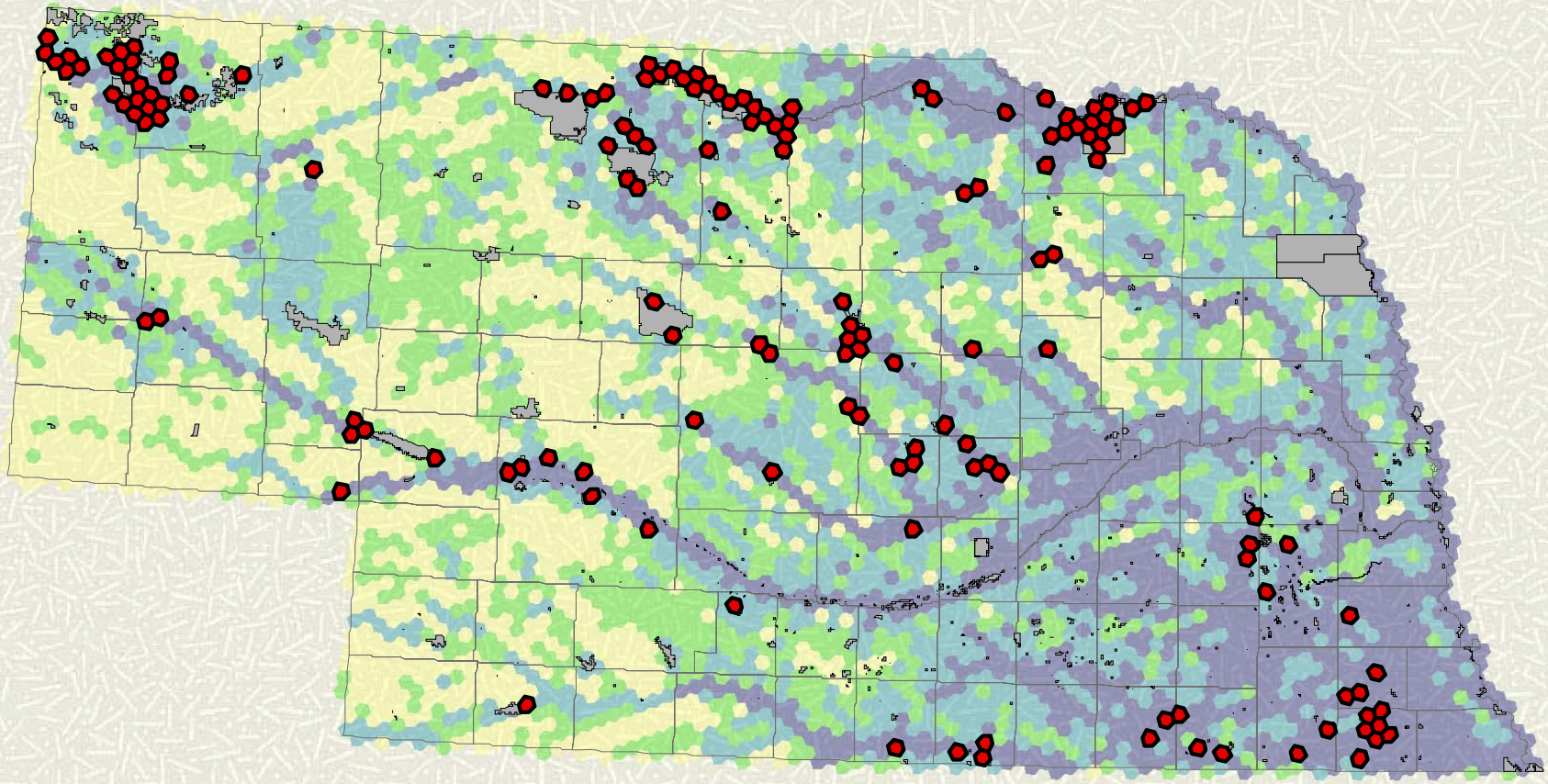


Mgmt Status 1,2,3 x Richness Quartile 4

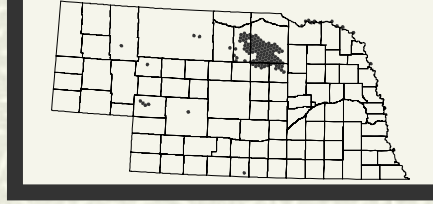


Gap Analysis of Terrestrial Vertebrates

Grassland Mask

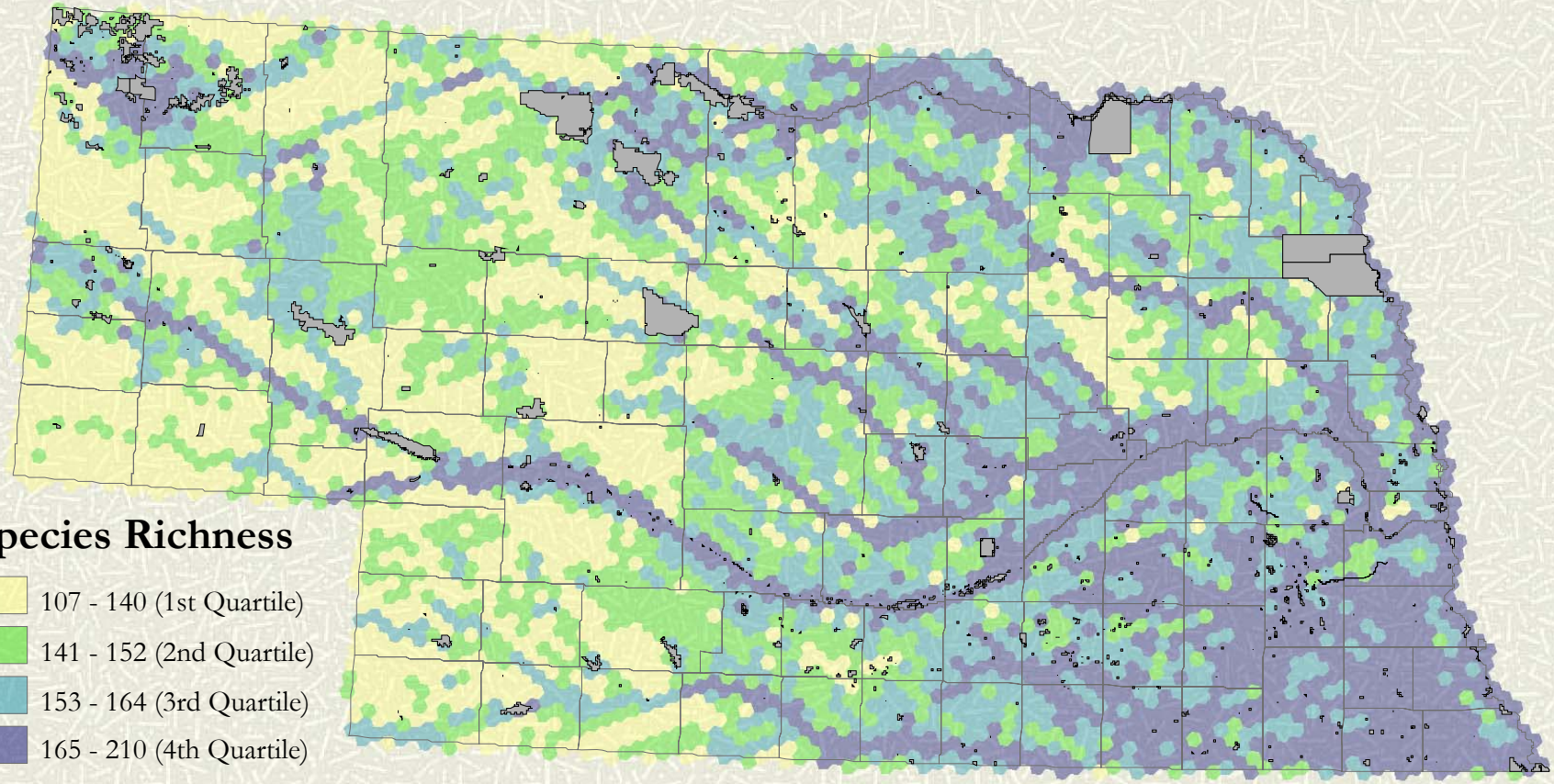


Mgmt Status 1-4 x Richness Quartile 4



Gap Analysis of Terrestrial Vertebrates

Wetland Mask



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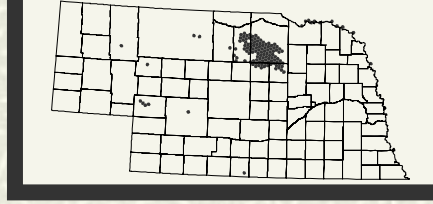
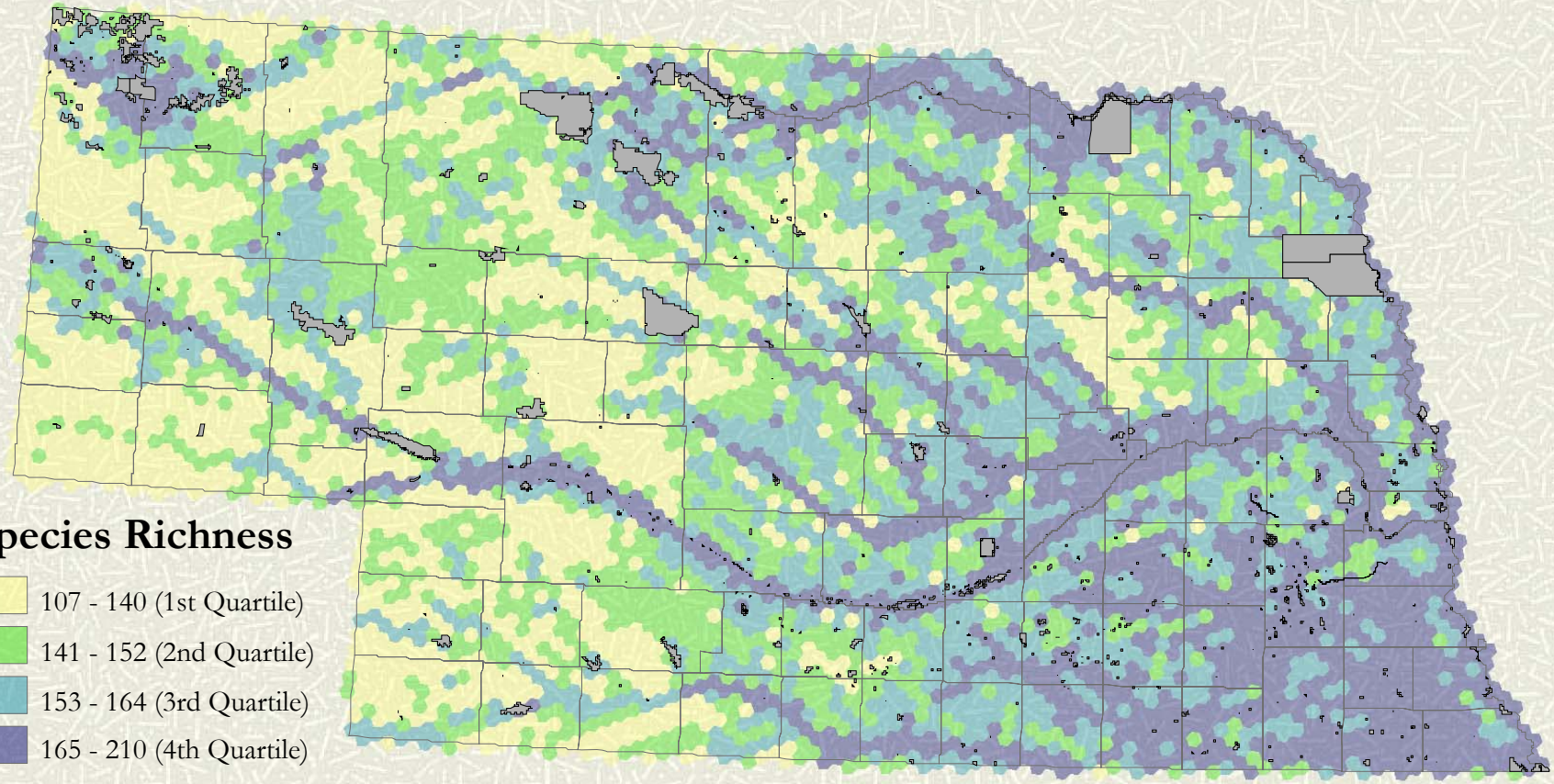


Gap Analysis of Terrestrial Vertebrates

Wetland Mask



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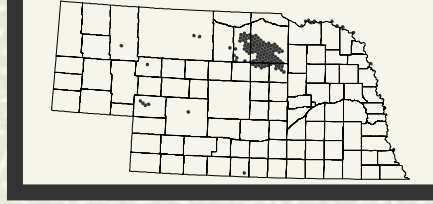
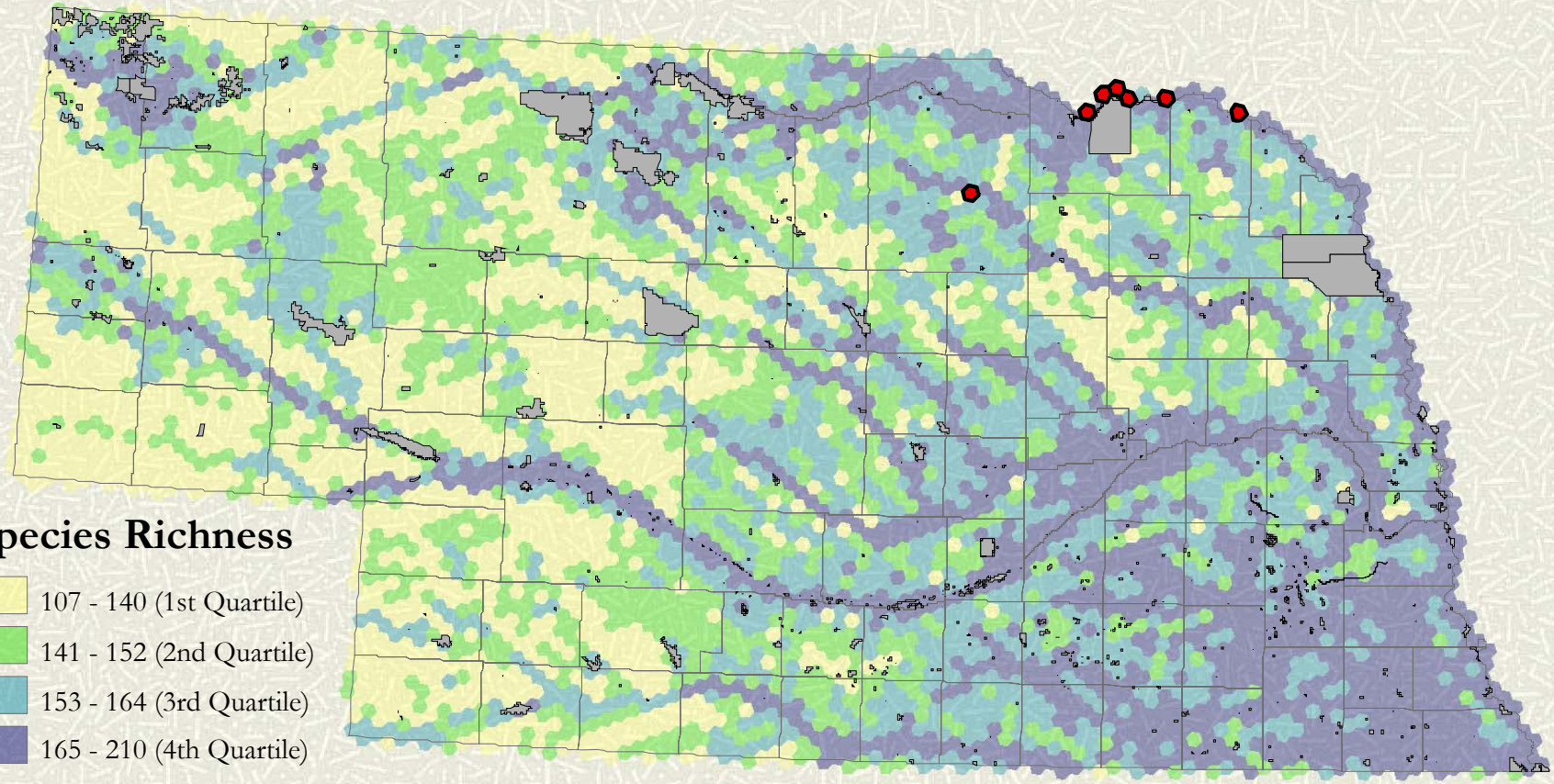
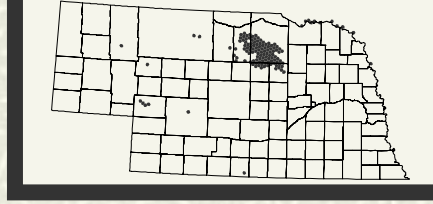


Gap Analysis of Terrestrial Vertebrates

Wetland Mask

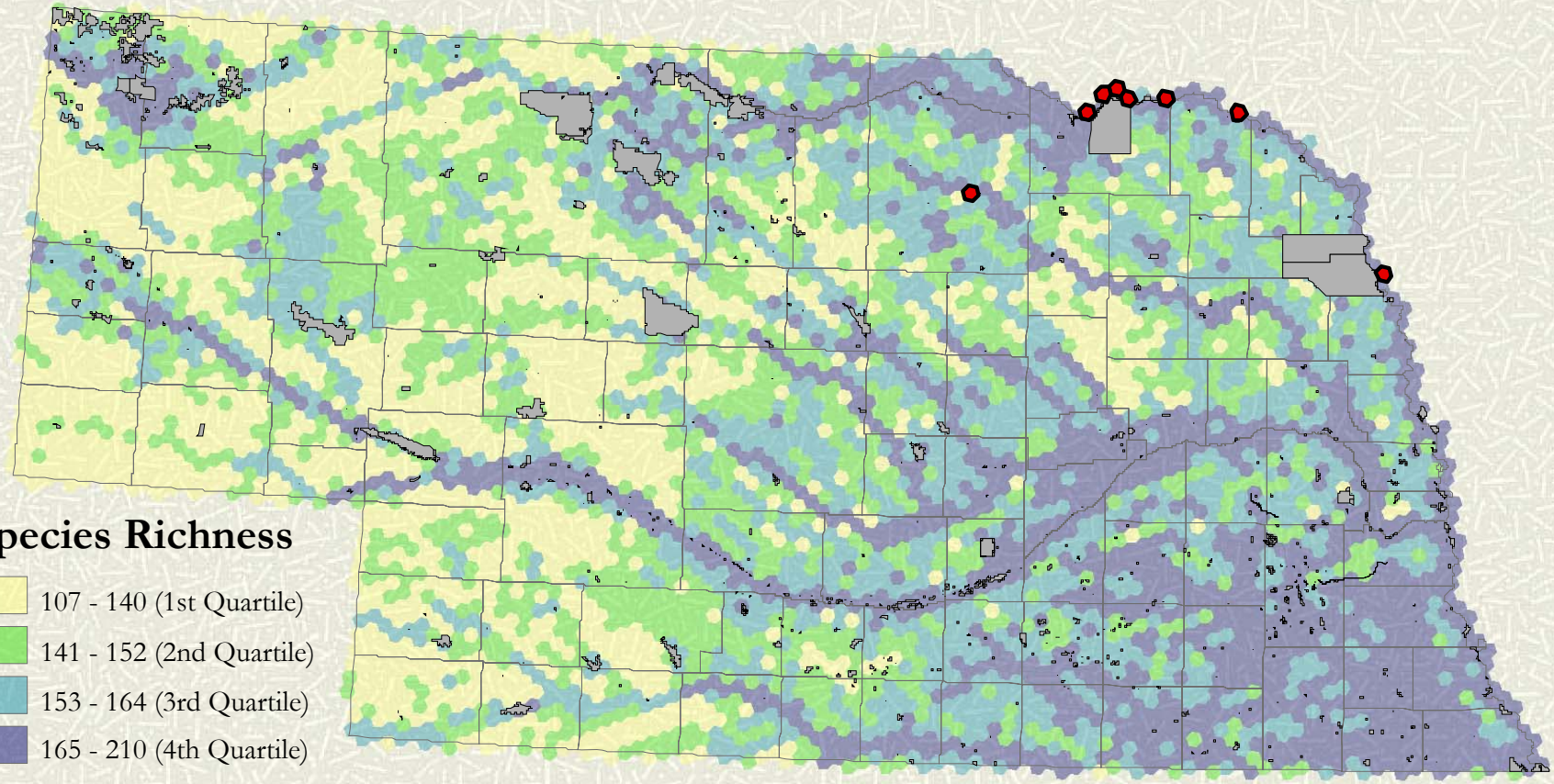


Mgmt Status 1,2,3 x Richness Quartile 4

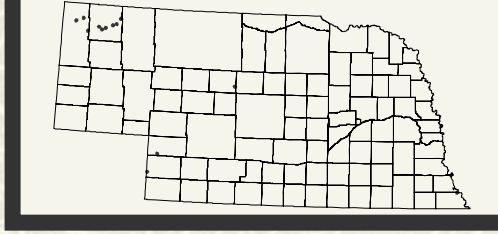


Gap Analysis of Terrestrial Vertebrates

Wetland Mask

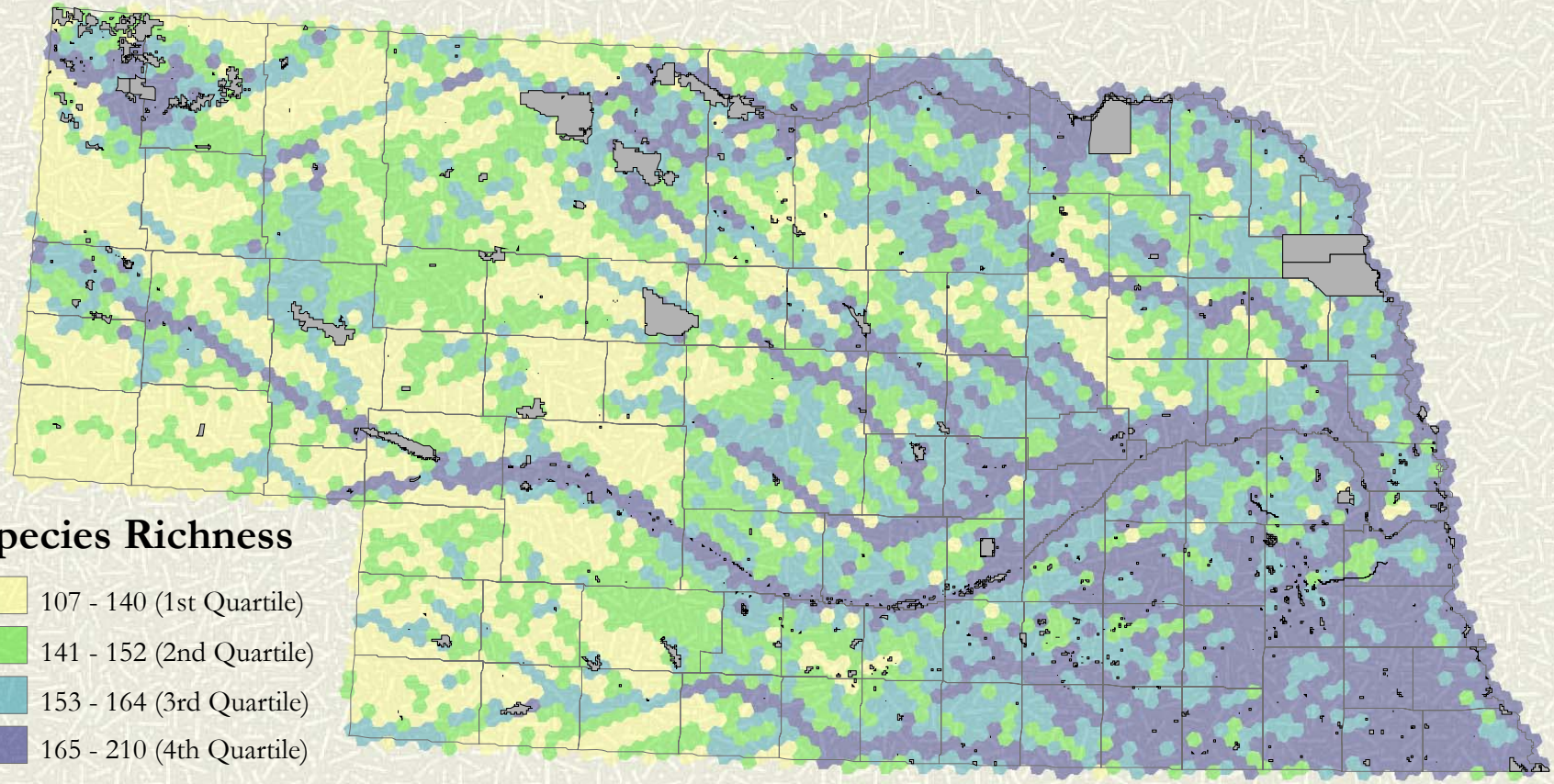


Mgmt Status 1-4 x Richness Quartile 4

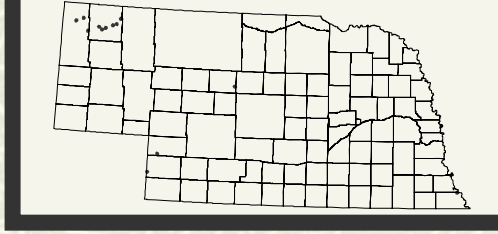


Gap Analysis of Terrestrial Vertebrates

Woodland Mask

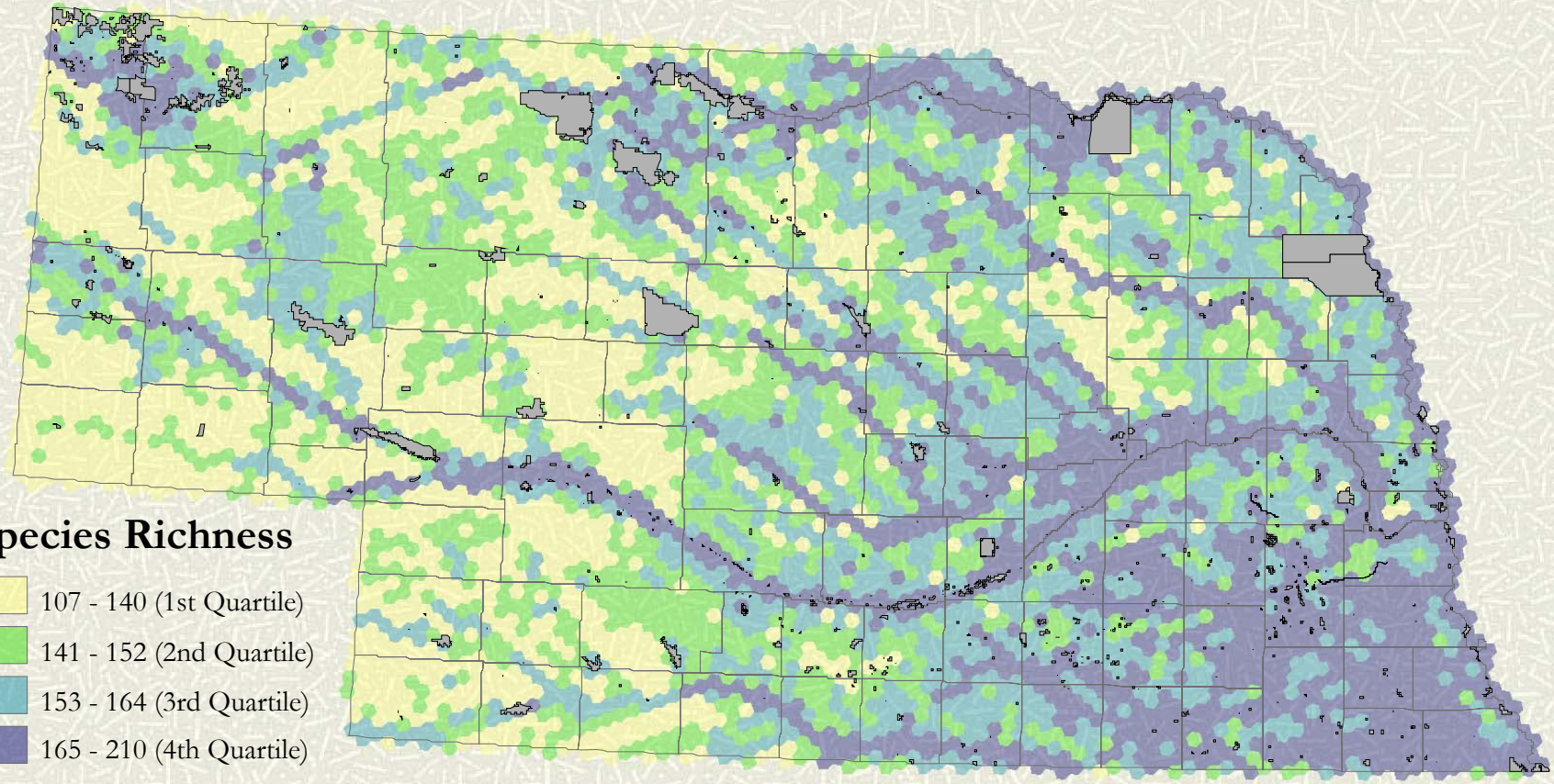


Mgmt Status 1 x Richness Quartile 4

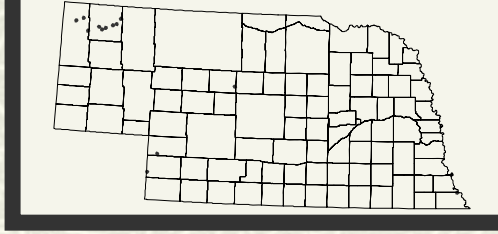


Gap Analysis of Terrestrial Vertebrates

Woodland Mask

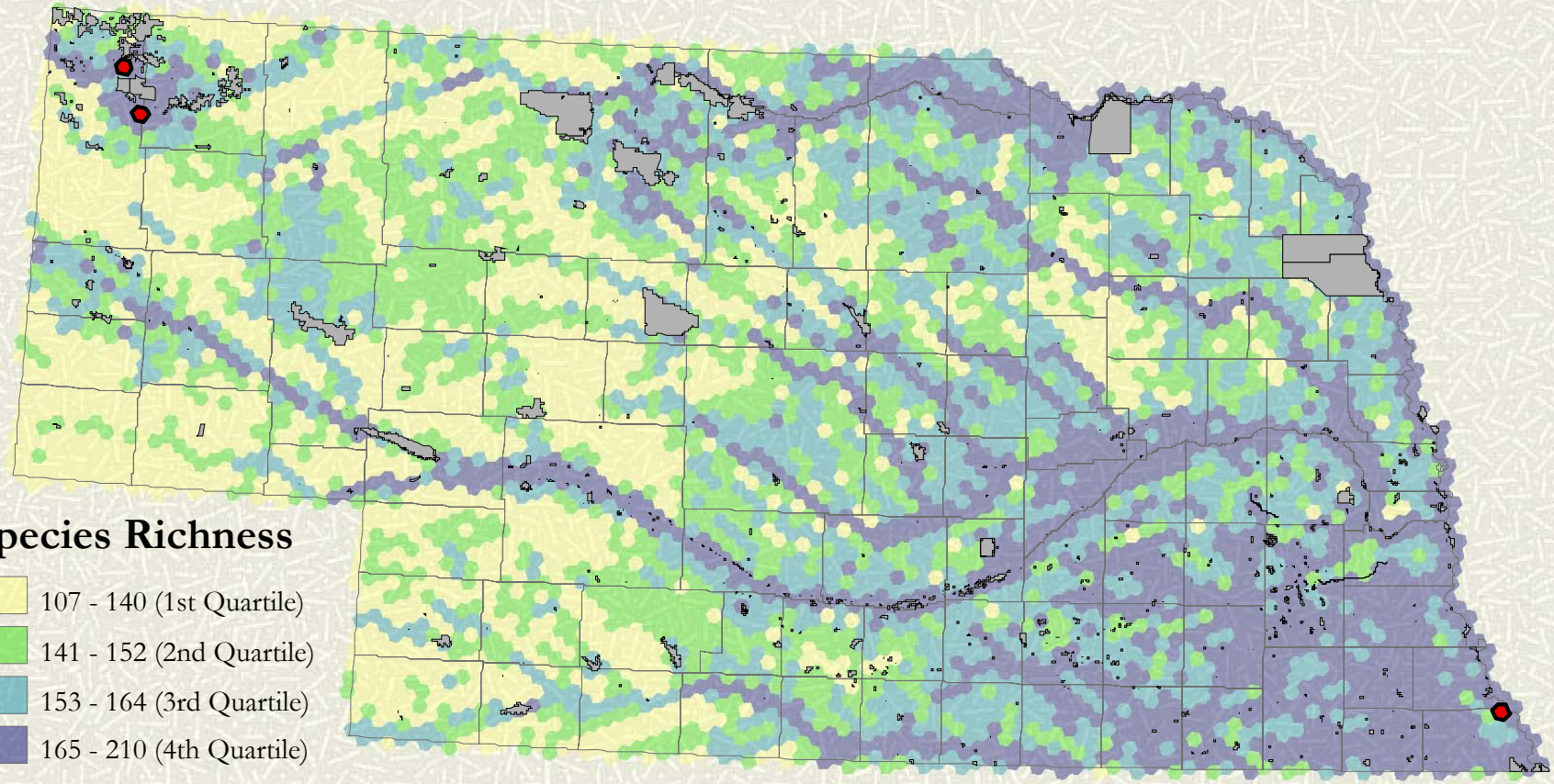


Mgmt Status 1,2 x Richness Quartile 4

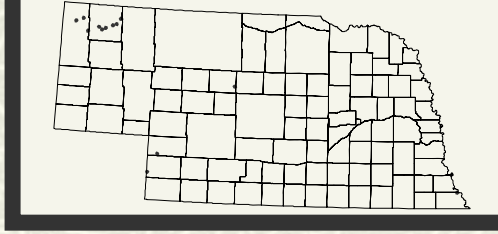


Gap Analysis of Terrestrial Vertebrates

Woodland Mask

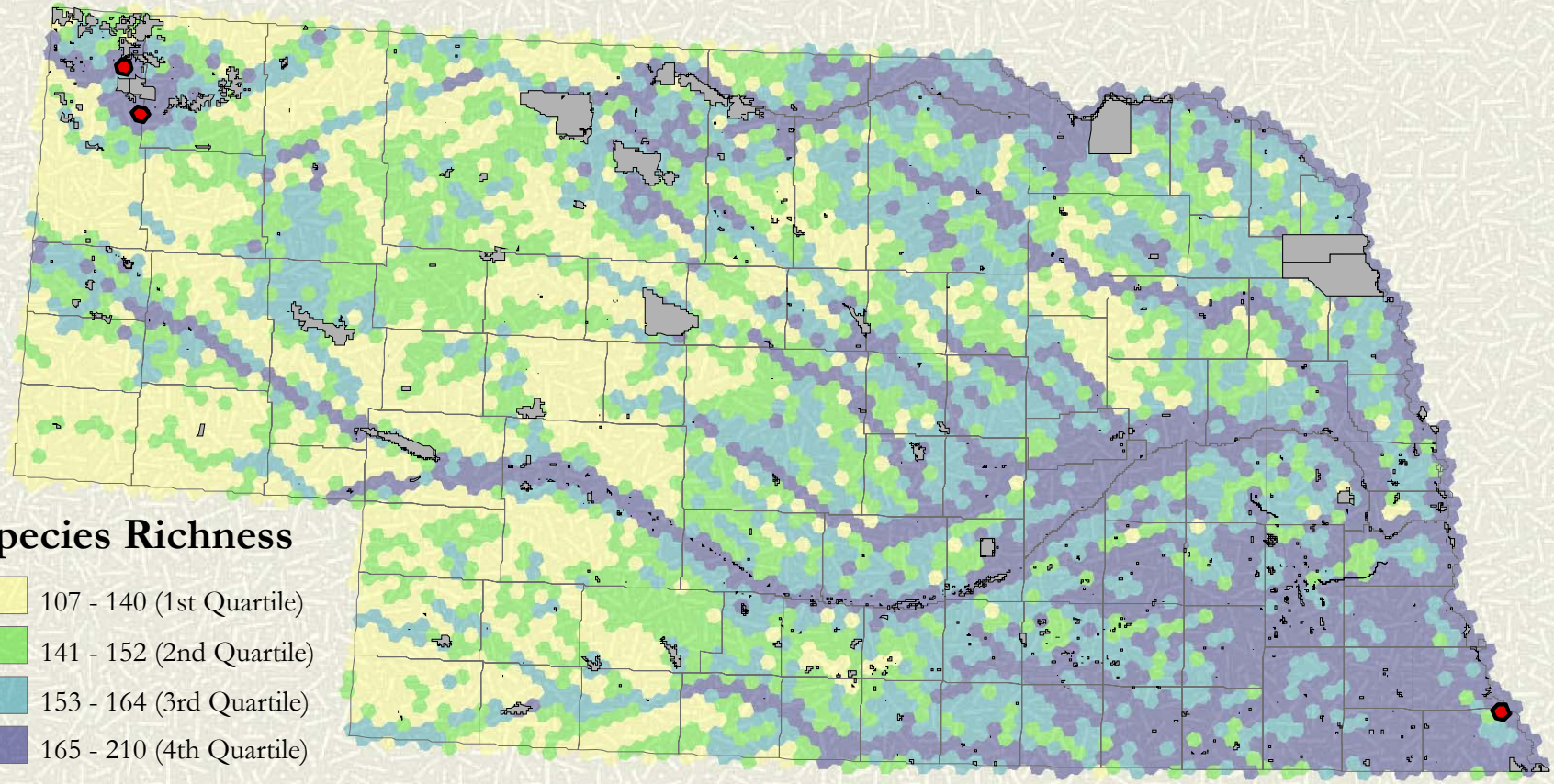


Mgmt Status 1,2,3 x Richness Quartile 4

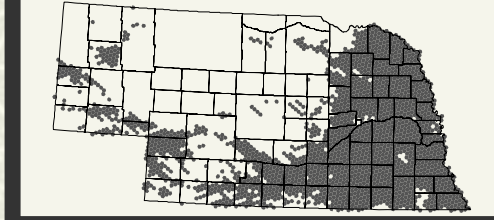


Gap Analysis of Terrestrial Vertebrates

Woodland Mask



Mgmt Status 1-4 x Richness Quartile 4



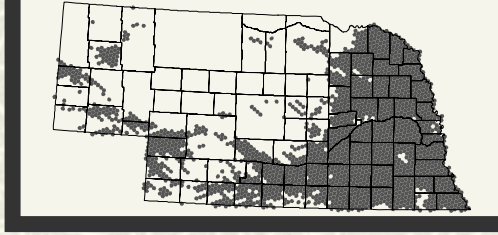
Gap Analysis of Birds

Anthropogenic Mask

Species Richness

- 60 - 78 (1st Quartile)
- 79 - 85 (2nd Quartile)
- 86 - 92 (3rd Quartile)
- 93 - 114 (4th Quartile)

Mgmt Status 1 x Richness Quartile 4



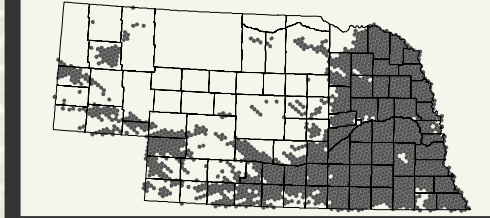
Gap Analysis of Birds

Anthropogenic Mask

Species Richness

- 60 - 78 (1st Quartile)
- 79 - 85 (2nd Quartile)
- 86 - 92 (3rd Quartile)
- 93 - 114 (4th Quartile)

Mgmt Status 1,2 x Richness Quartile 4



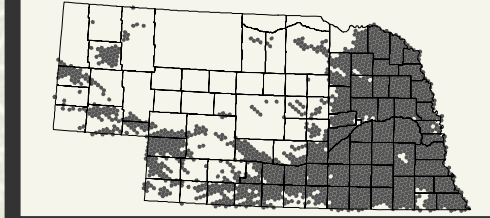
Gap Analysis of Birds

Anthropogenic Mask

Species Richness

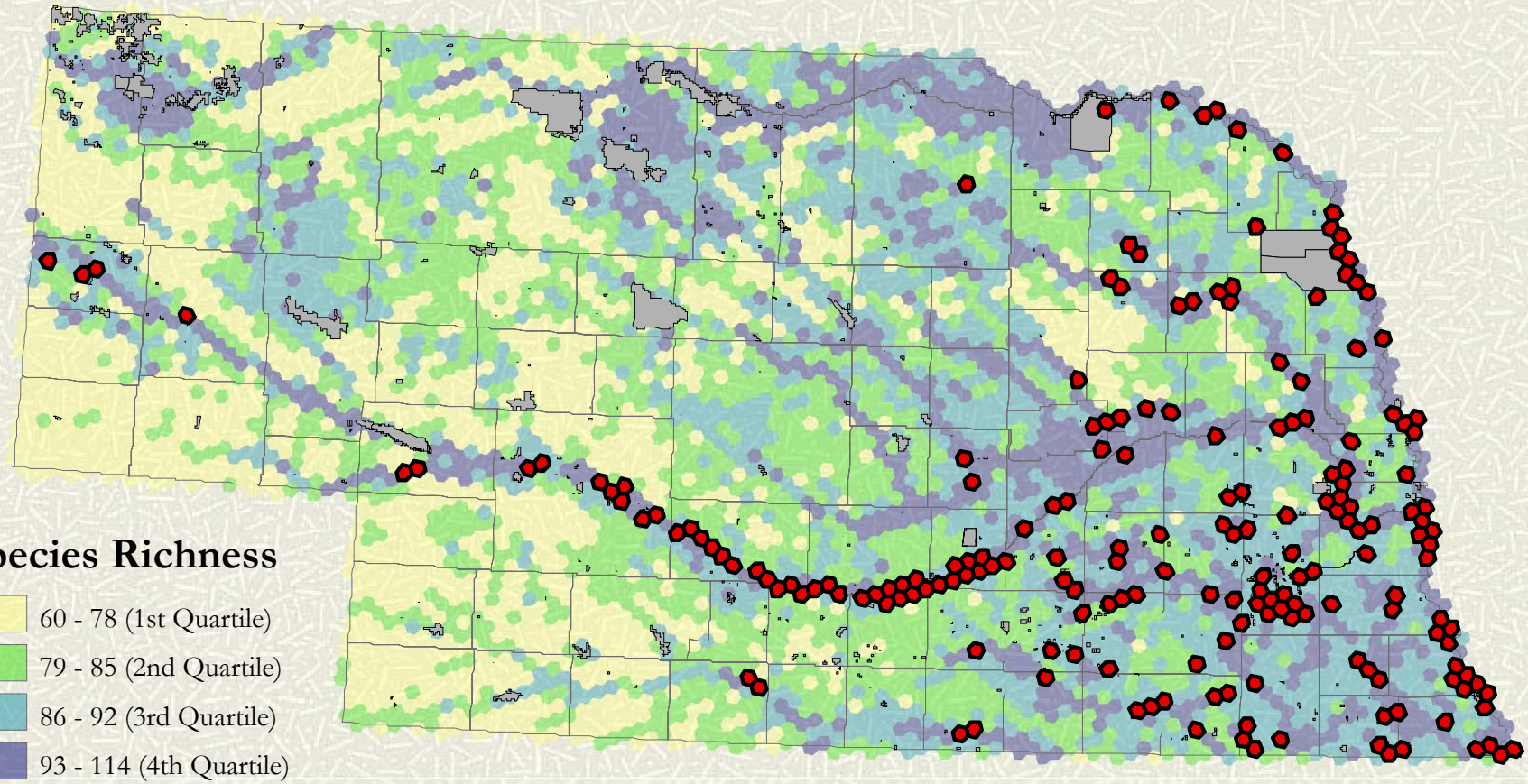
- 60 - 78 (1st Quartile)
- 79 - 85 (2nd Quartile)
- 86 - 92 (3rd Quartile)
- 93 - 114 (4th Quartile)

Mgmt Status 1.2.3 x Richness Quartile 4

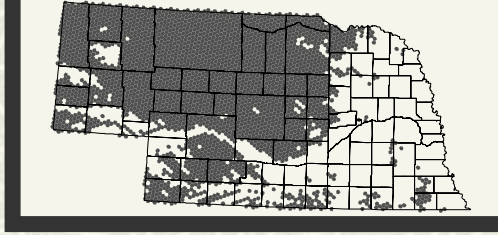


Gap Analysis of Birds

Anthropogenic Mask

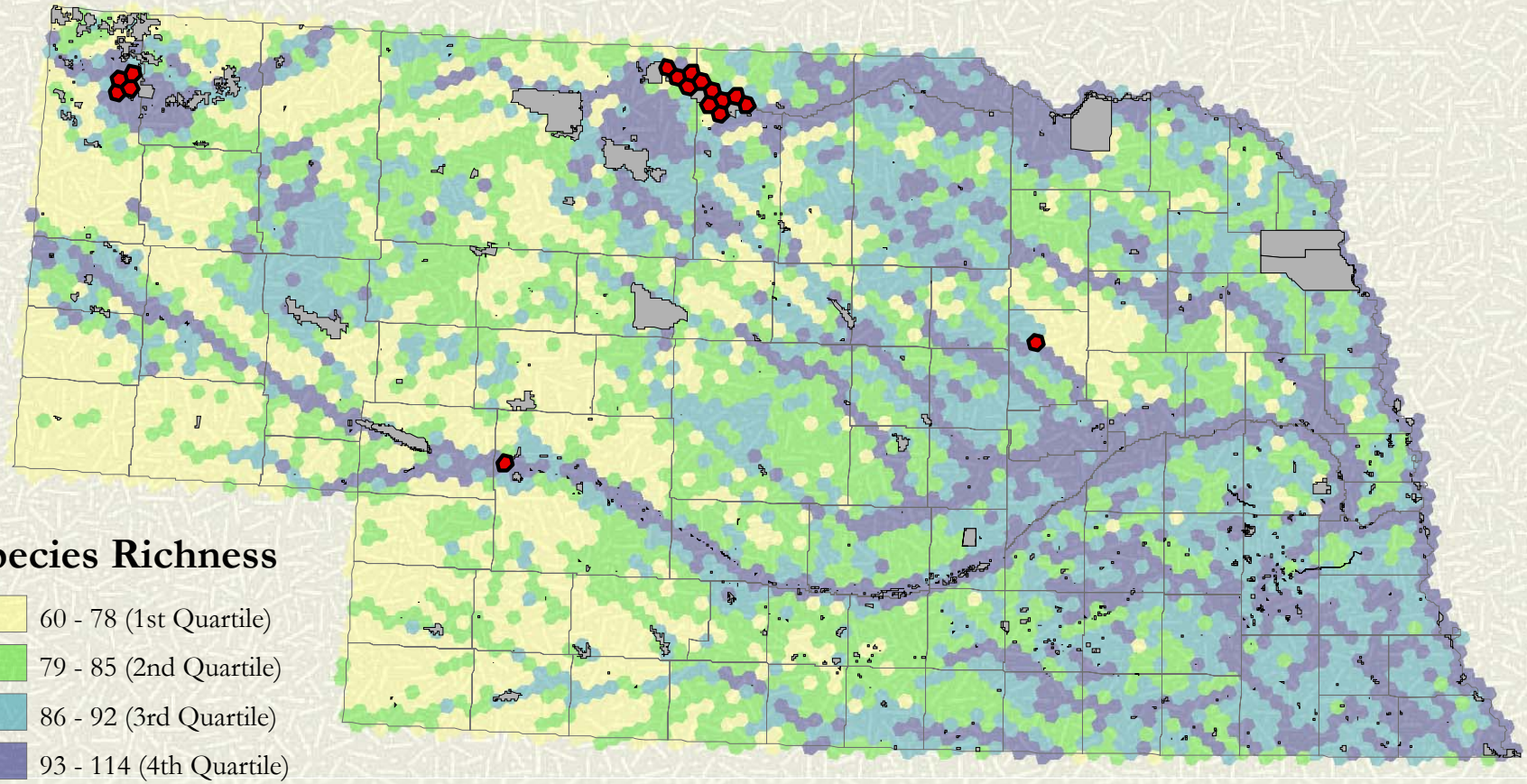


Mgmt Status 1-4 x Richness Quartile 4

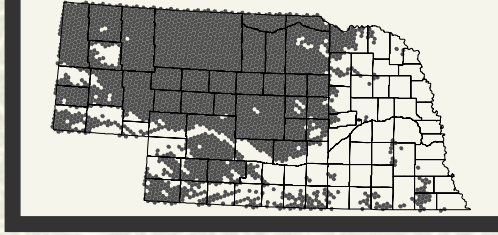


Gap Analysis of Birds

Grassland Mask

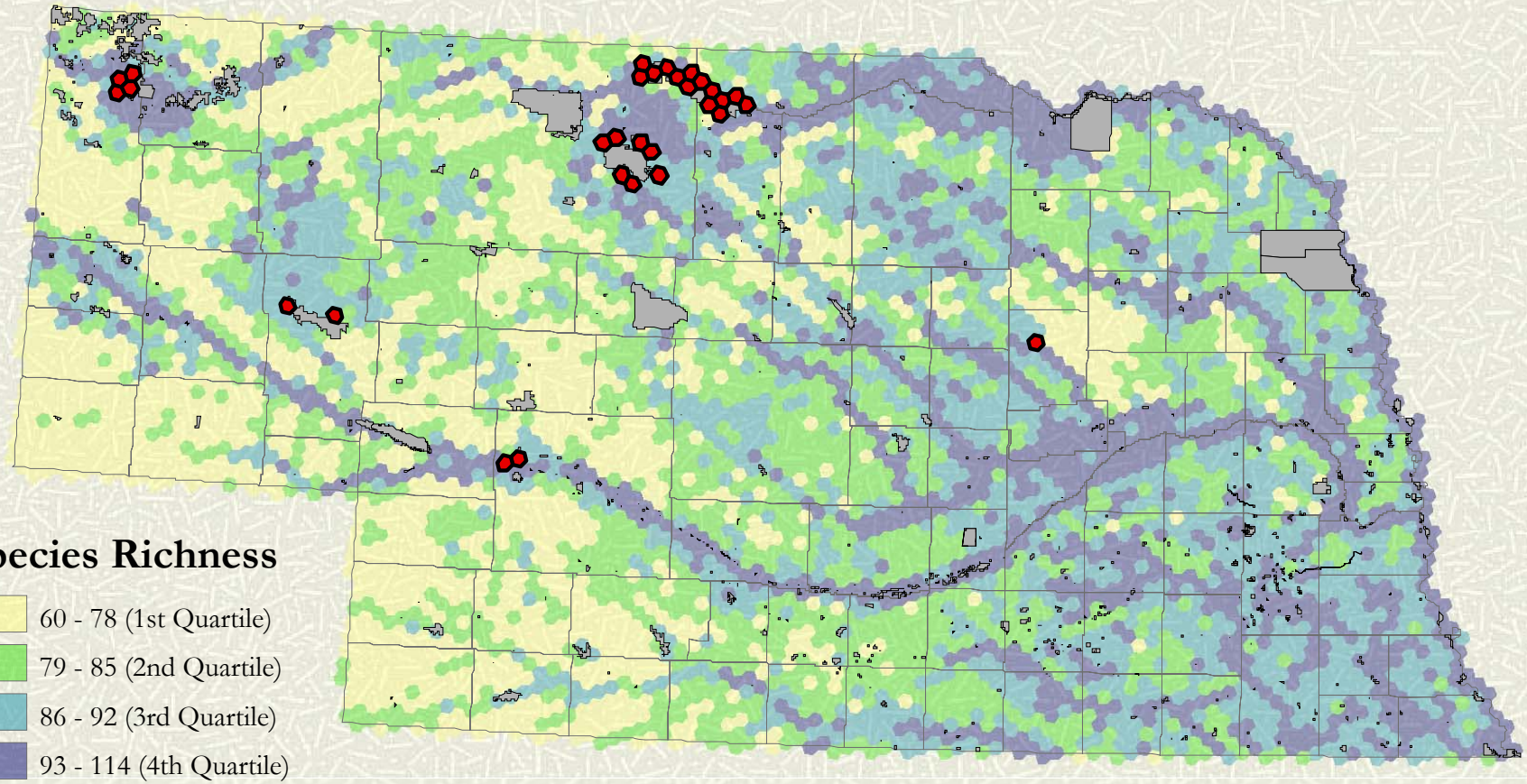


Mgmt Status 1 x Richness Quartile 4

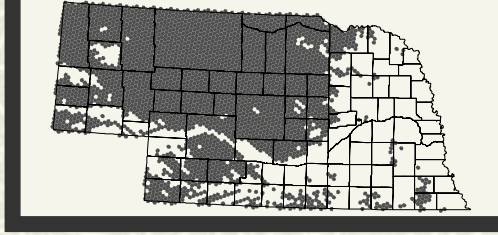


Gap Analysis of Birds

Grassland Mask

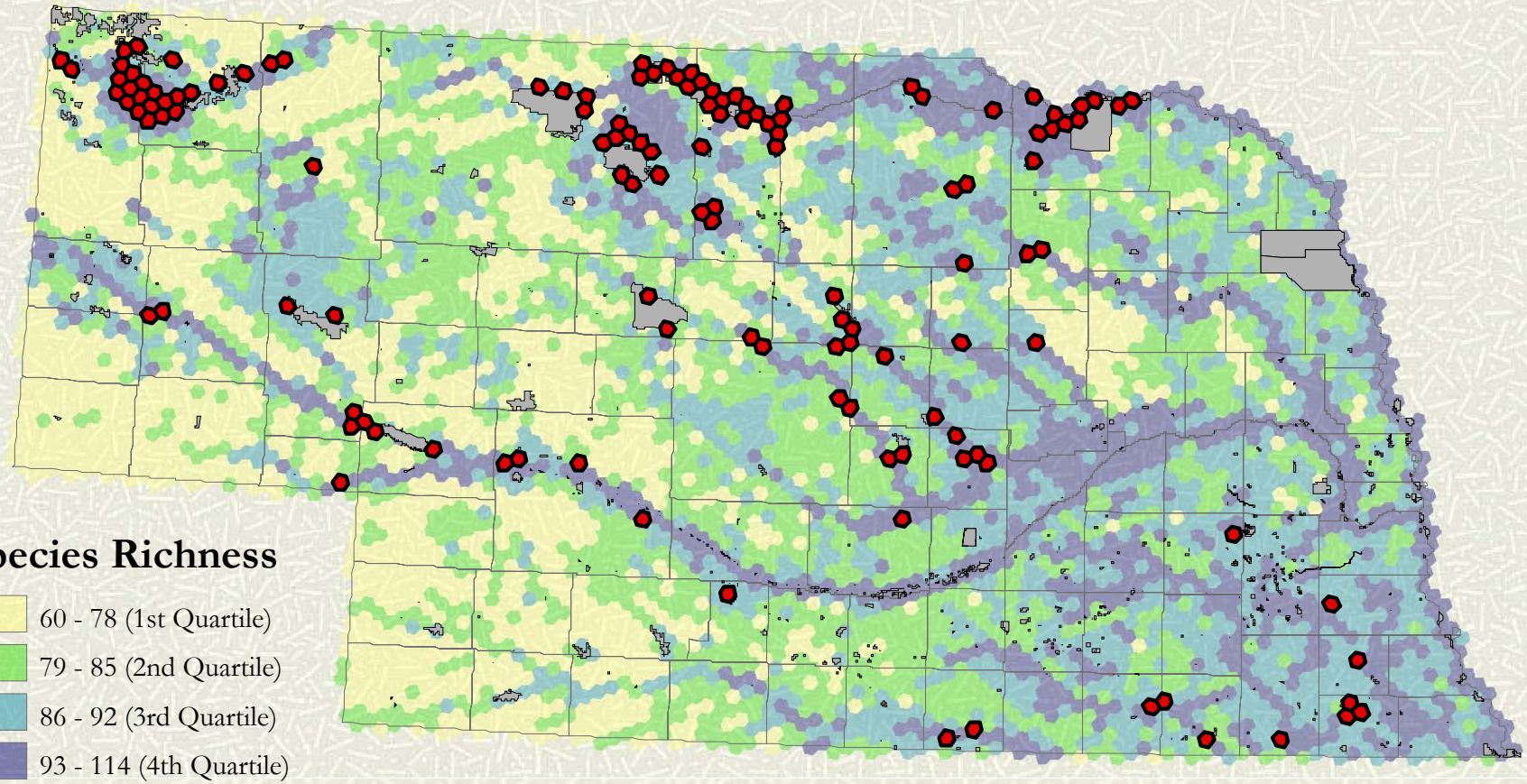


Mgmt Status 1,2 x Richness Quartile 4

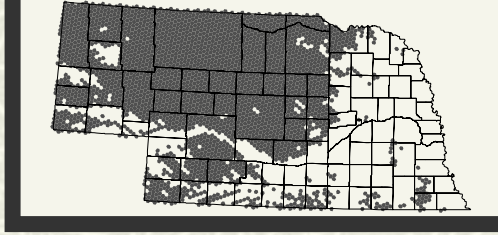


Gap Analysis of Birds

Grassland Mask

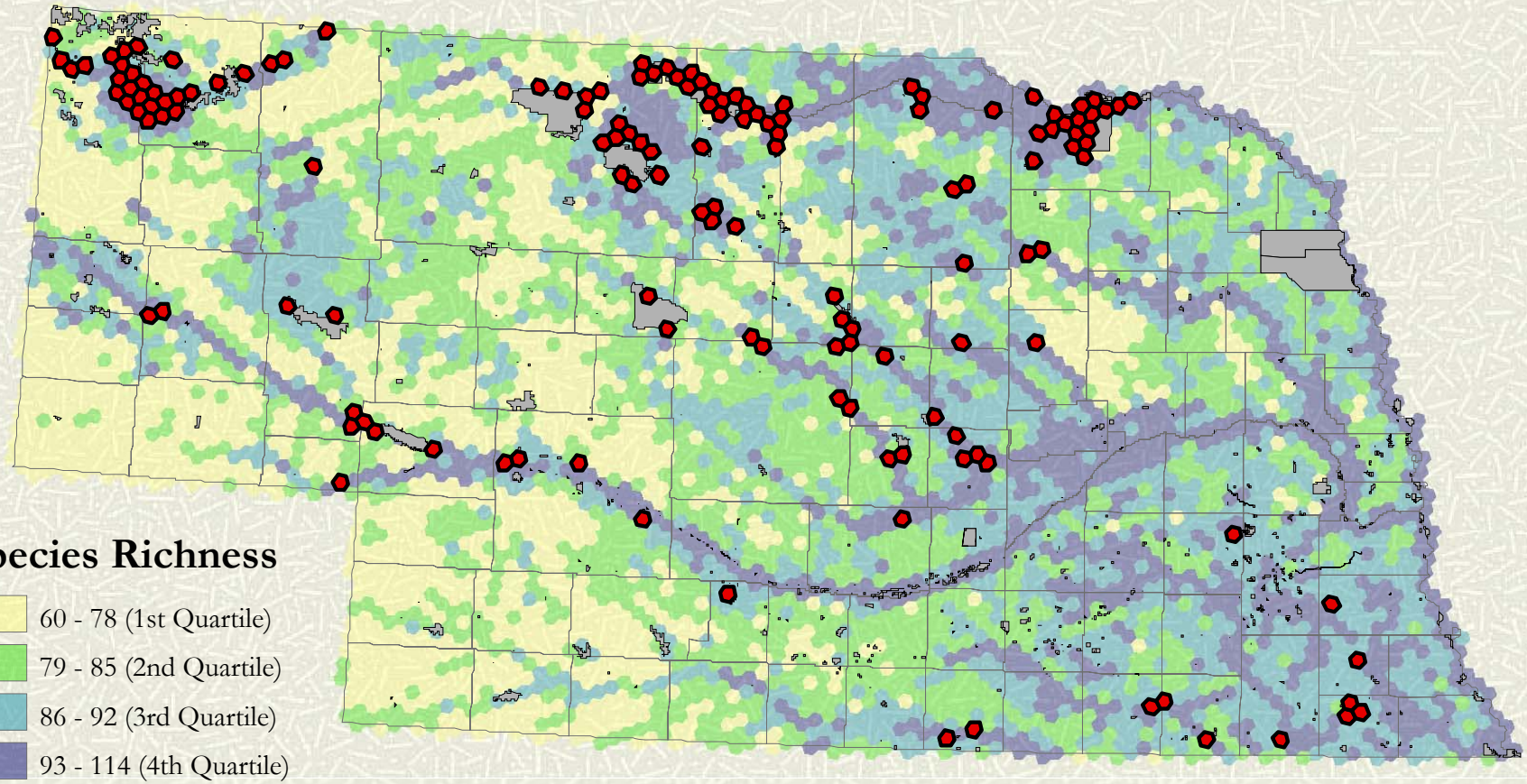


Mgmt Status 1,2,3 x Richness Quartile 4

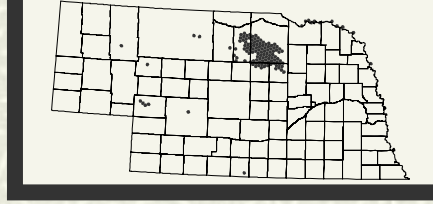


Gap Analysis of Birds

Grassland Mask

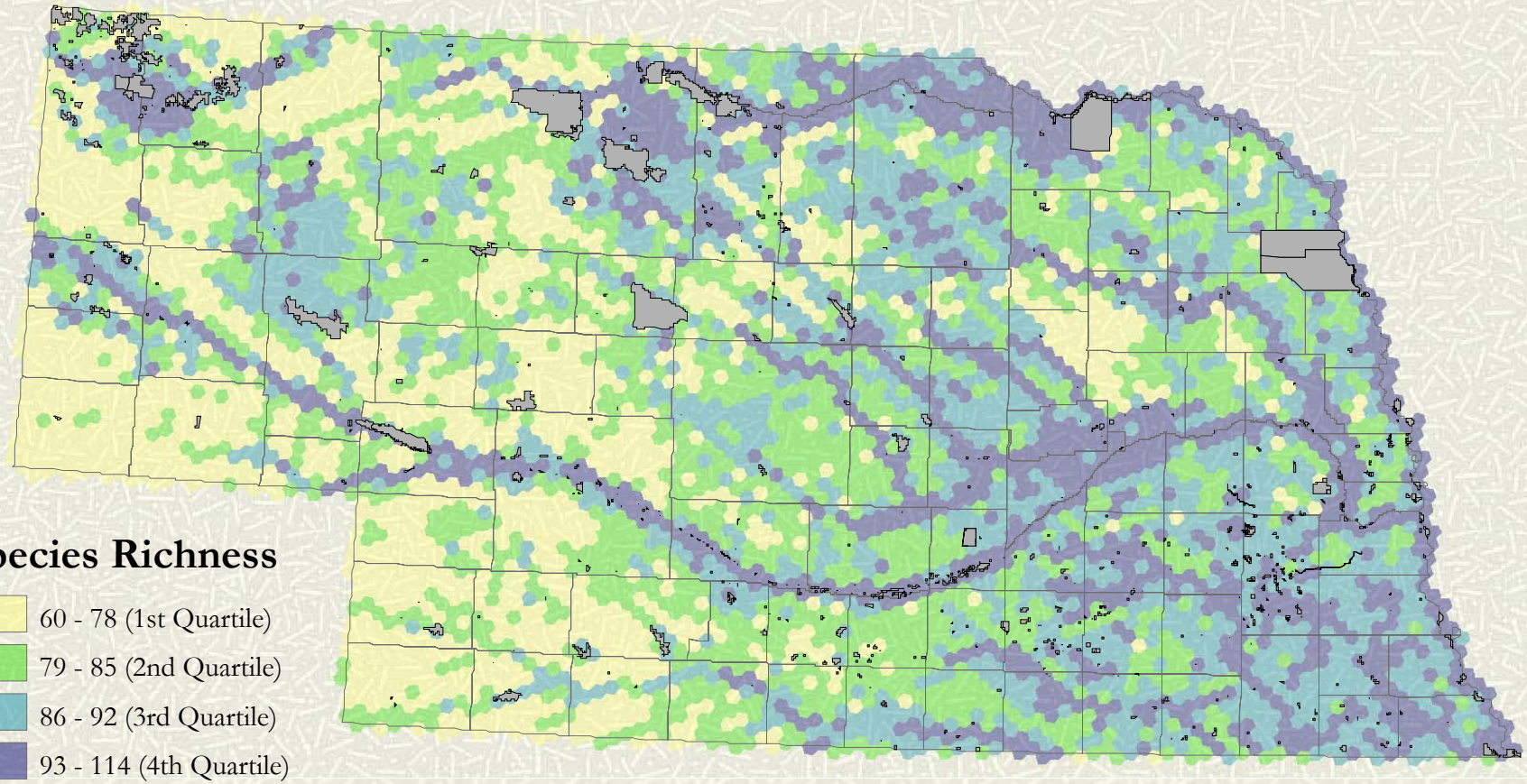


Mgmt Status 1-4 x Richness Quartile 4

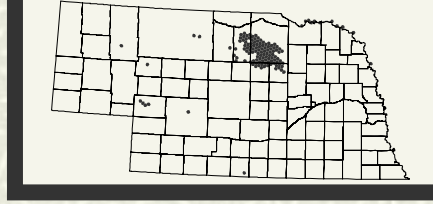


Gap Analysis of Birds

Wetland Mask

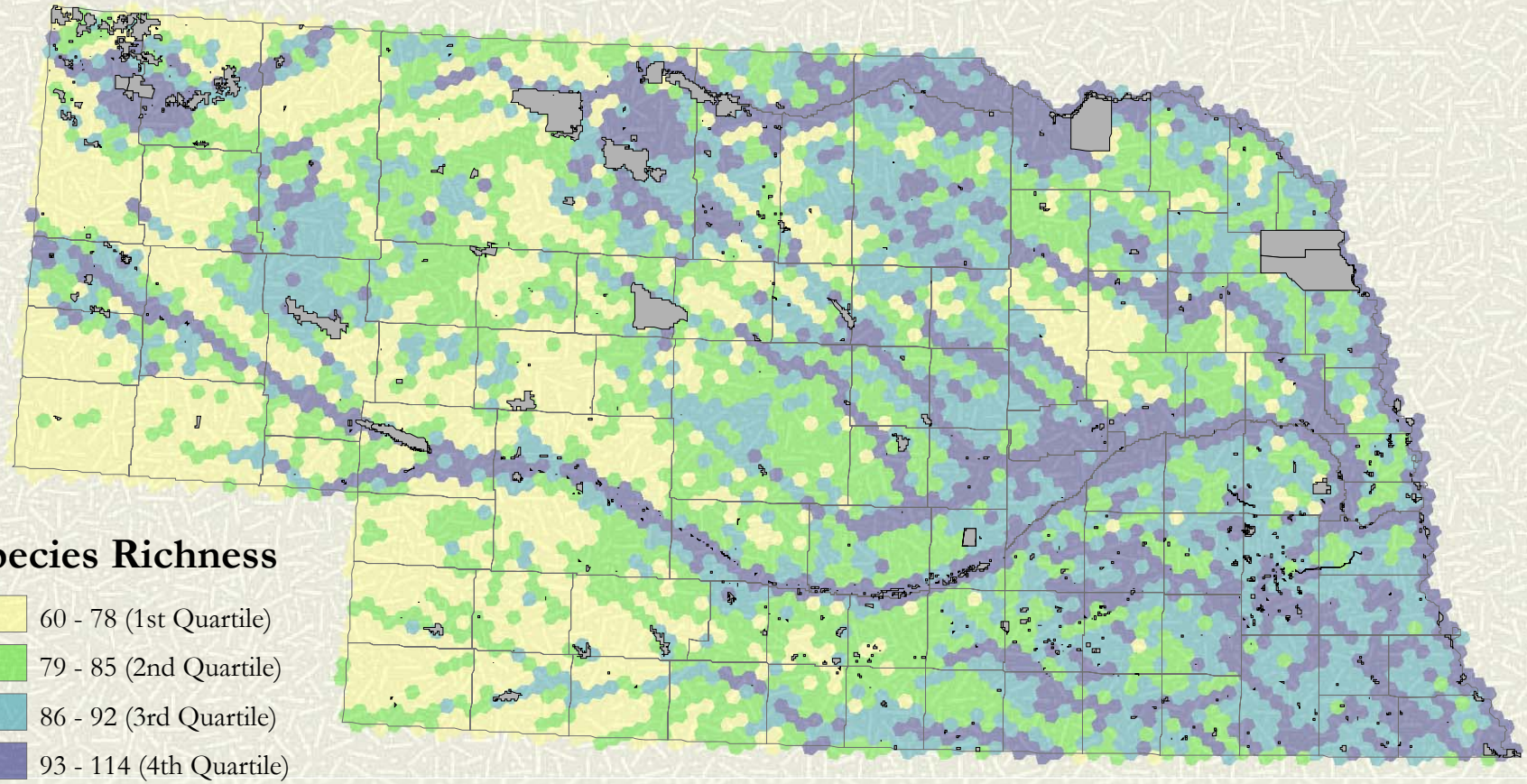


Mgmt Status 1 x Richness Quartile 4

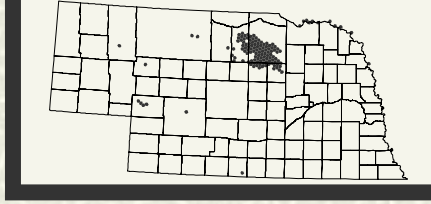


Gap Analysis of Birds

Wetland Mask

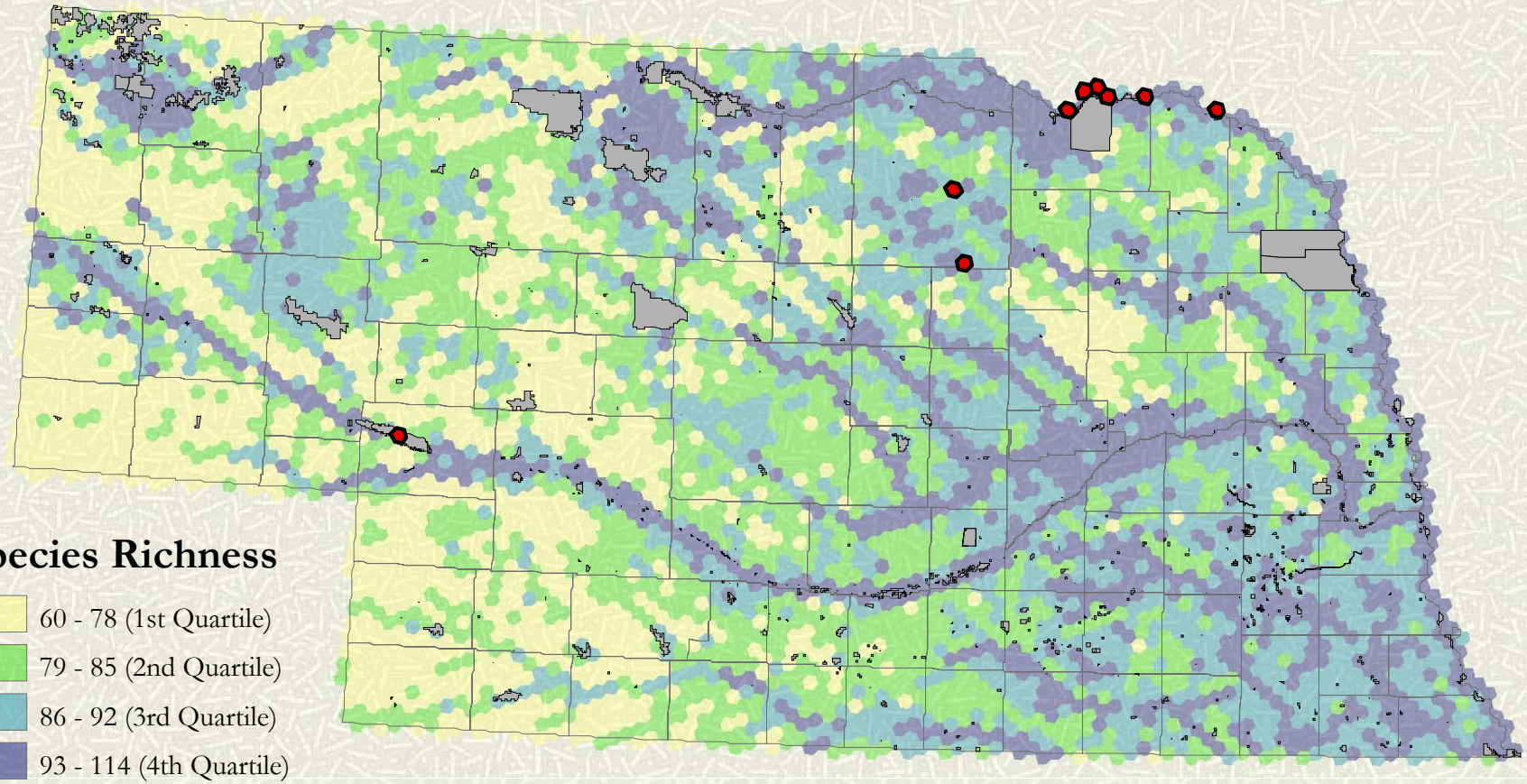


Mgmt Status 1,2 x Richness Quartile 4



Gap Analysis of Birds

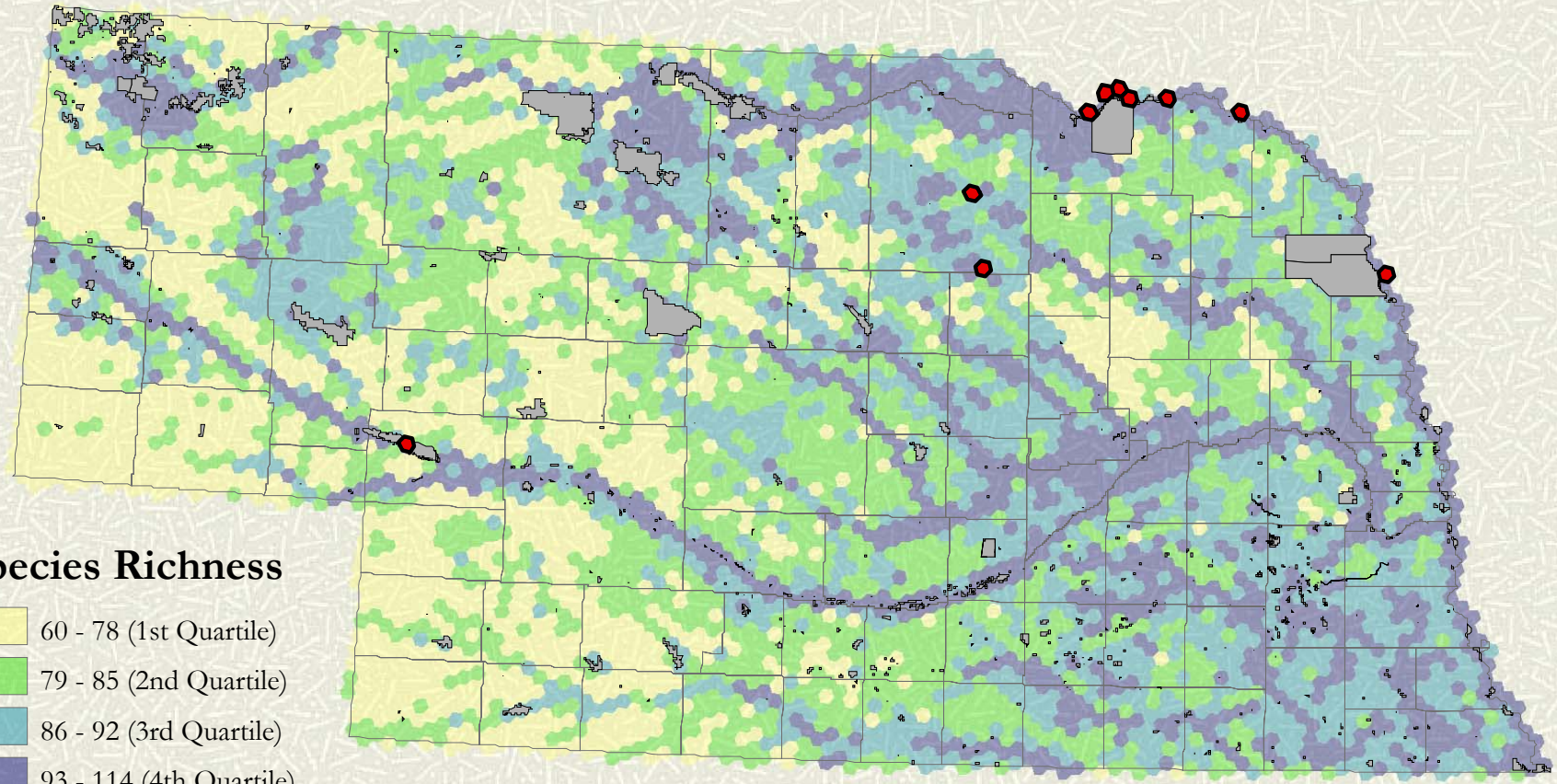
Wetland Mask



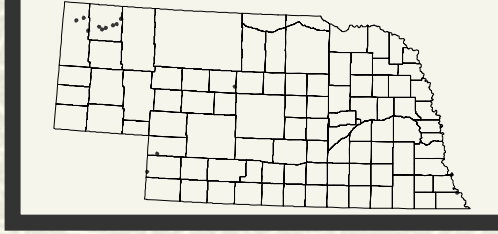
Mgmt Status 1,2,3 x Richness Quartile 4

Gap Analysis of Birds

Wetland Mask

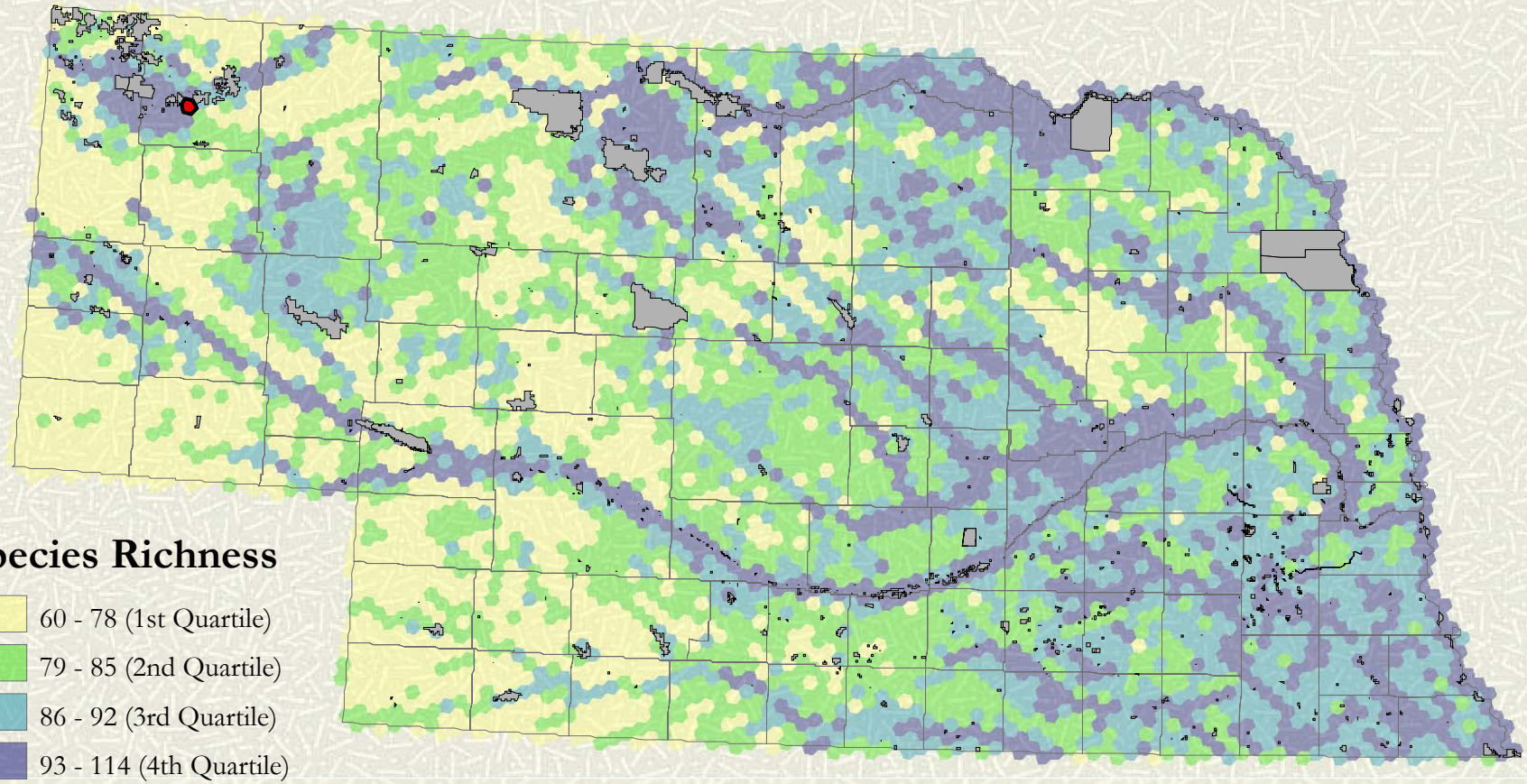


Mgmt Status 1-4 x Richness Quartile 4

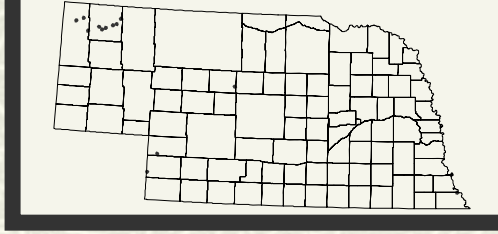


Gap Analysis of Birds

Woodland Mask

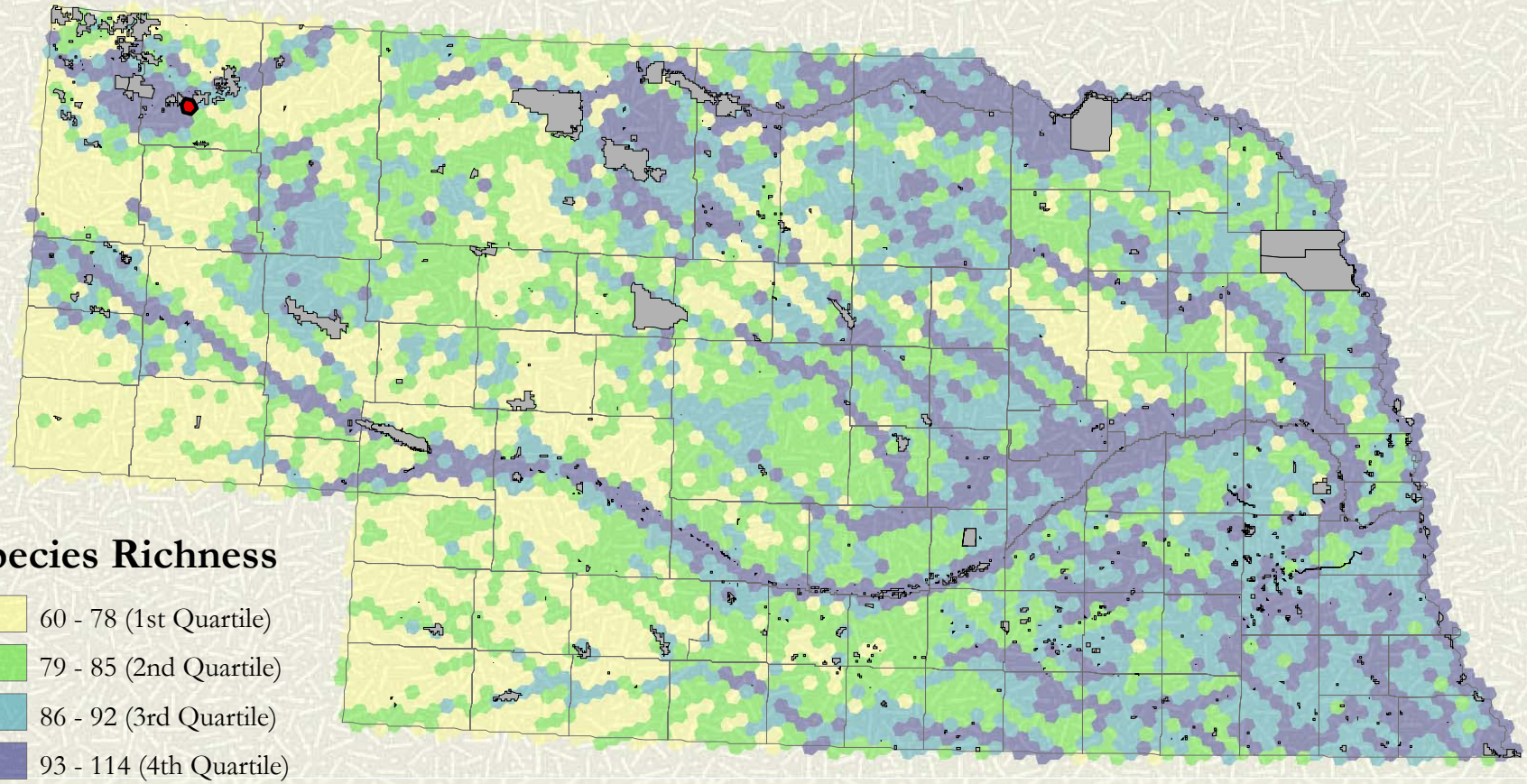


Mgmt Status 1 x Richness Quartile 4

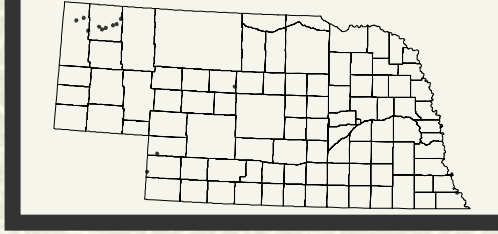


Gap Analysis of Birds

Woodland Mask

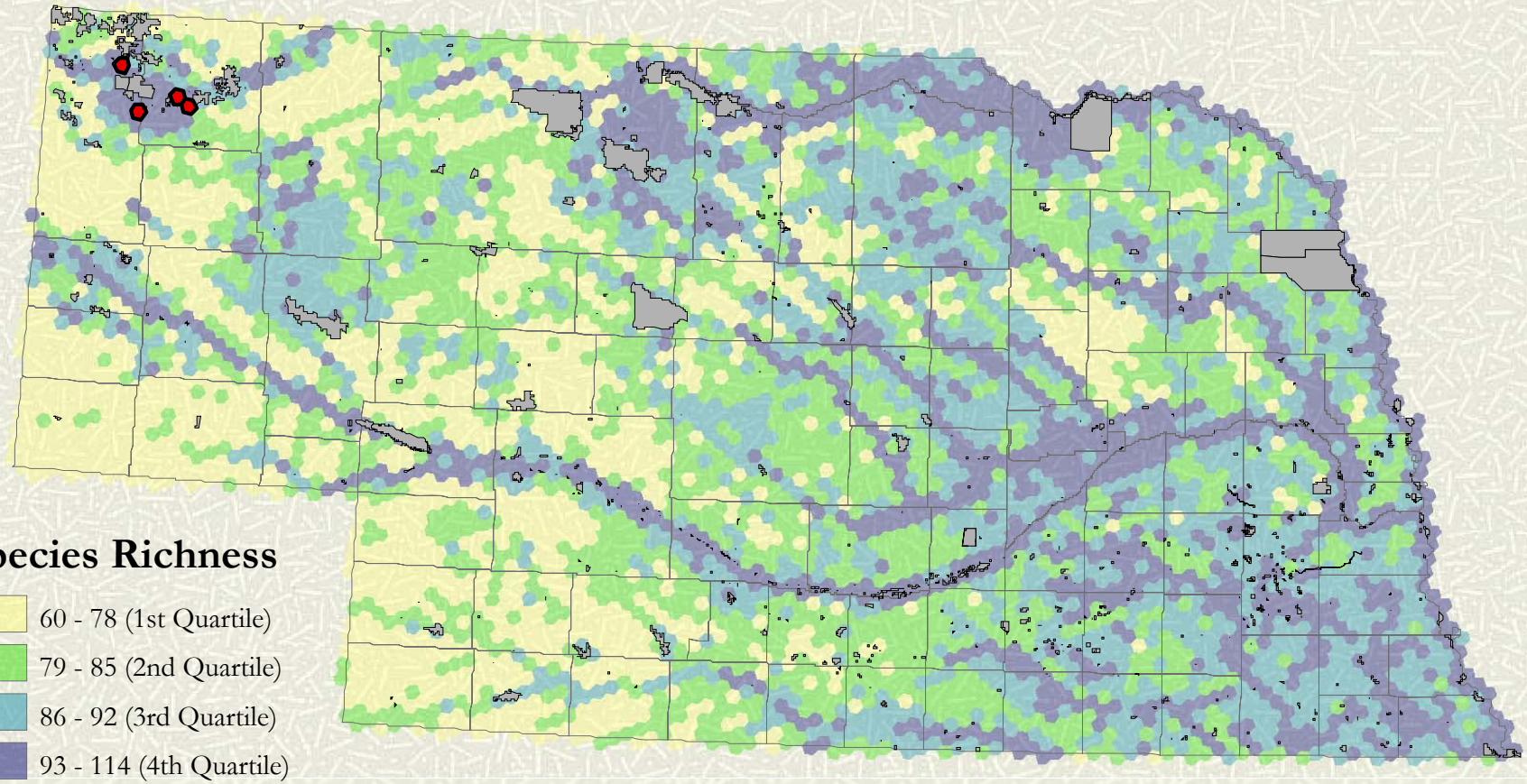


Mgmt Status 1,2 x Richness Quartile 4

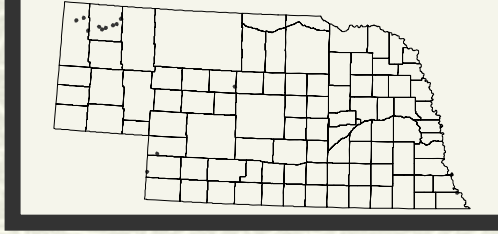


Gap Analysis of Birds

Woodland Mask

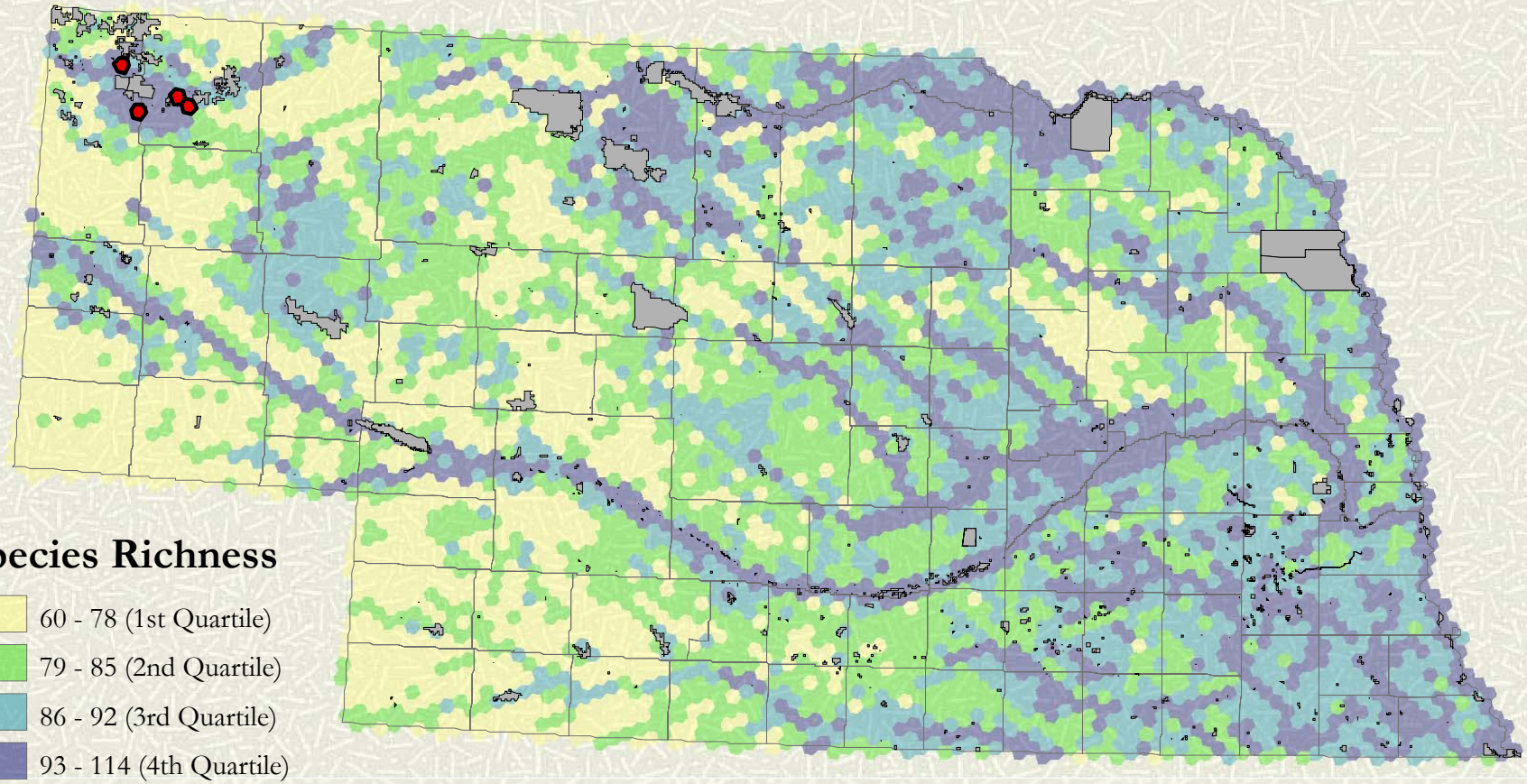


Mgmt Status 1,2,3 x Richness Quartile 4



Gap Analysis of Birds

Woodland Mask



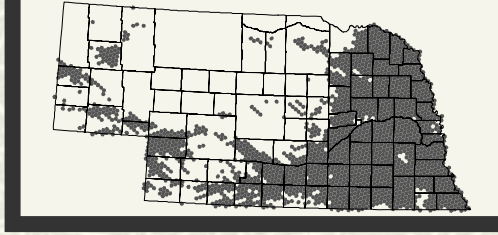
Mgmt Status 1-4 x Richness Quartile 4

Nebraska GAP Analysis

Appendix L

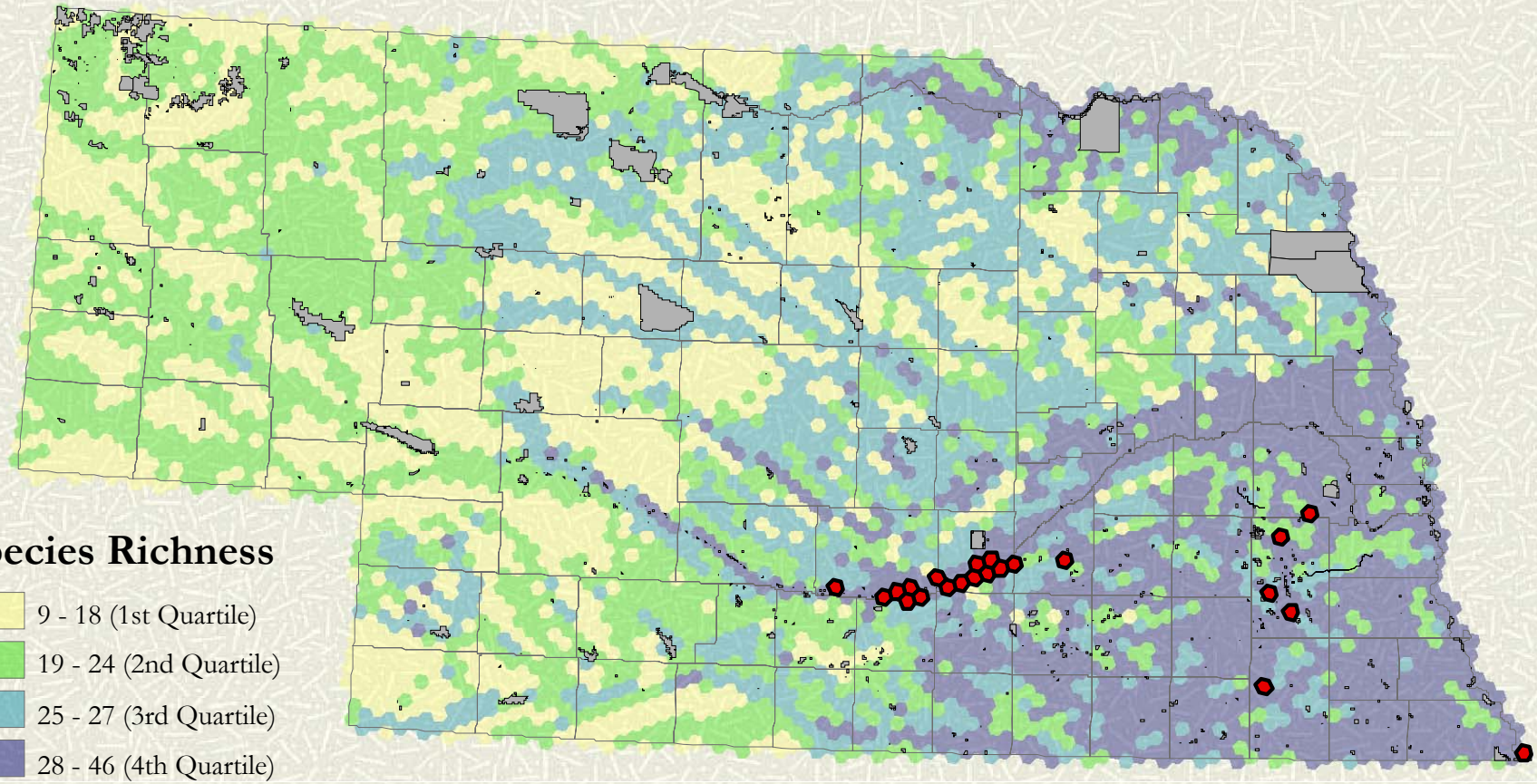
Part 2:

Pervasiveness Analysis for Species Richness of Reptiles & Amphibians and Mammals

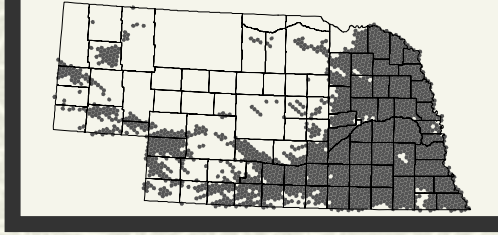


Gap Analysis of Amphibians and Reptiles

Anthropogenic Mask

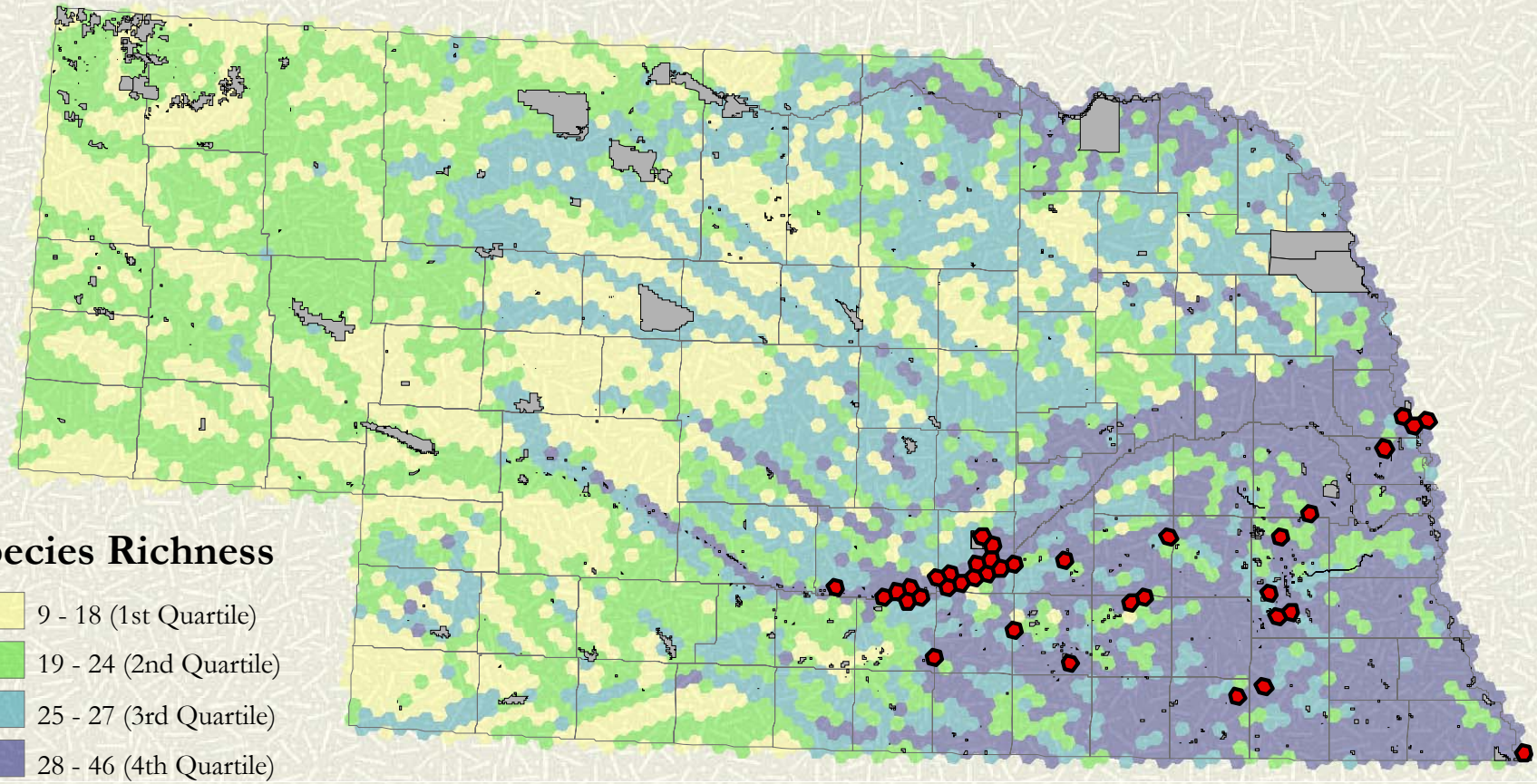


Mgmt Status 1 x Richness Quartile 4

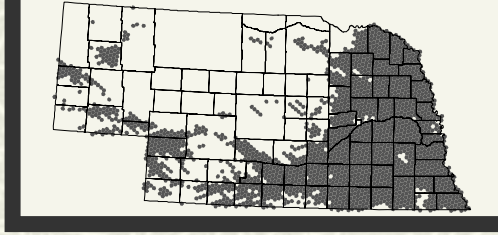


Gap Analysis of Amphibians and Reptiles

Anthropogenic Mask

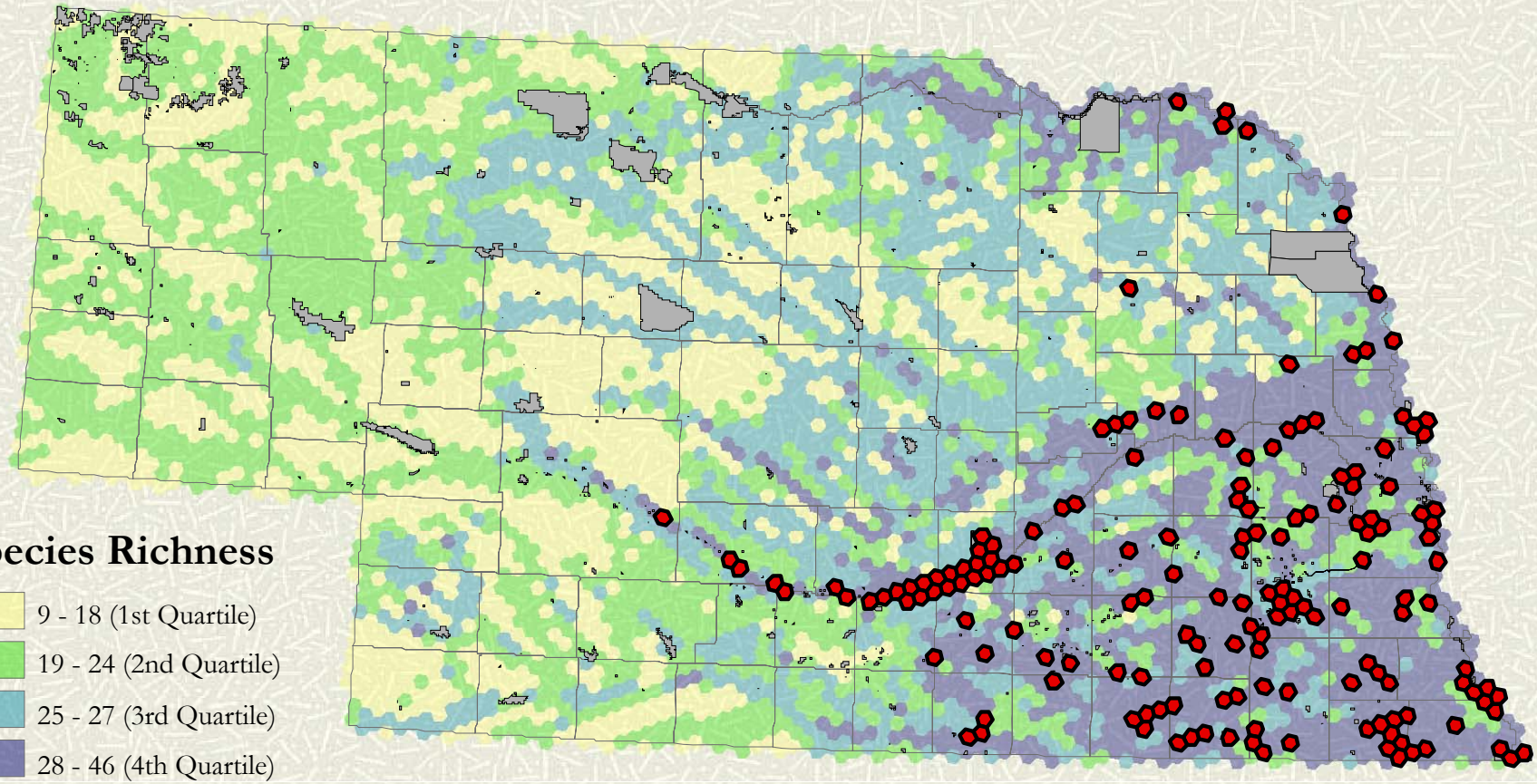


Mgmt Status 1,2 x Richness Quartile 4

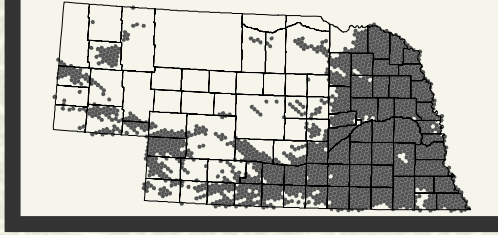


Gap Analysis of Amphibians and Reptiles

Anthropogenic Mask

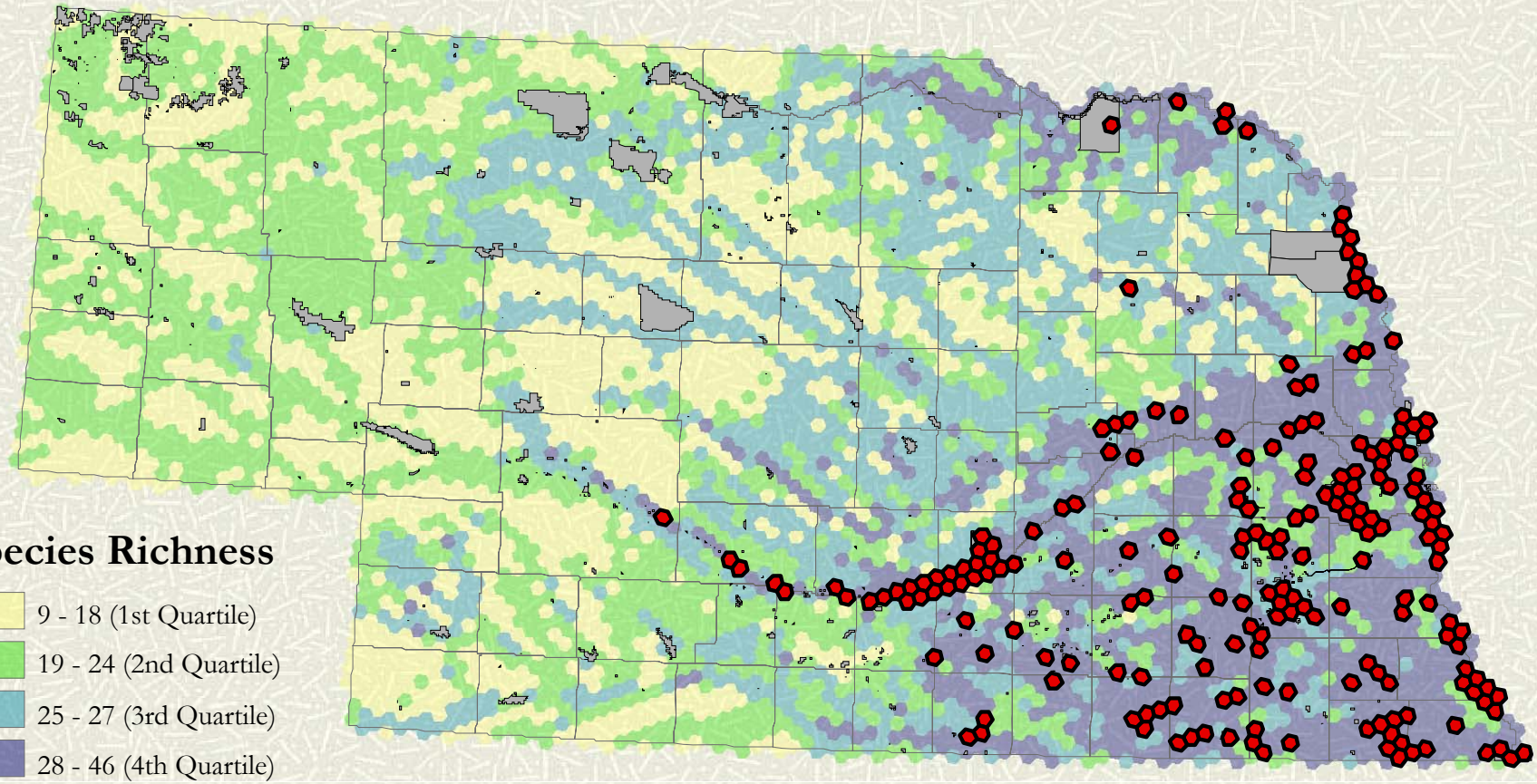


Mgmt Status 1,2,3 x Richness Quartile 4

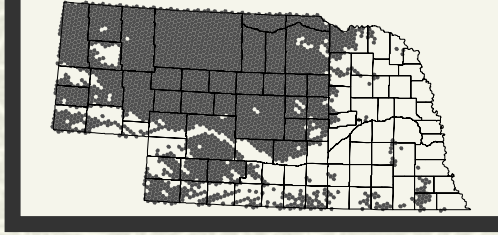


Gap Analysis of Amphibians and Reptiles

Anthropogenic Mask

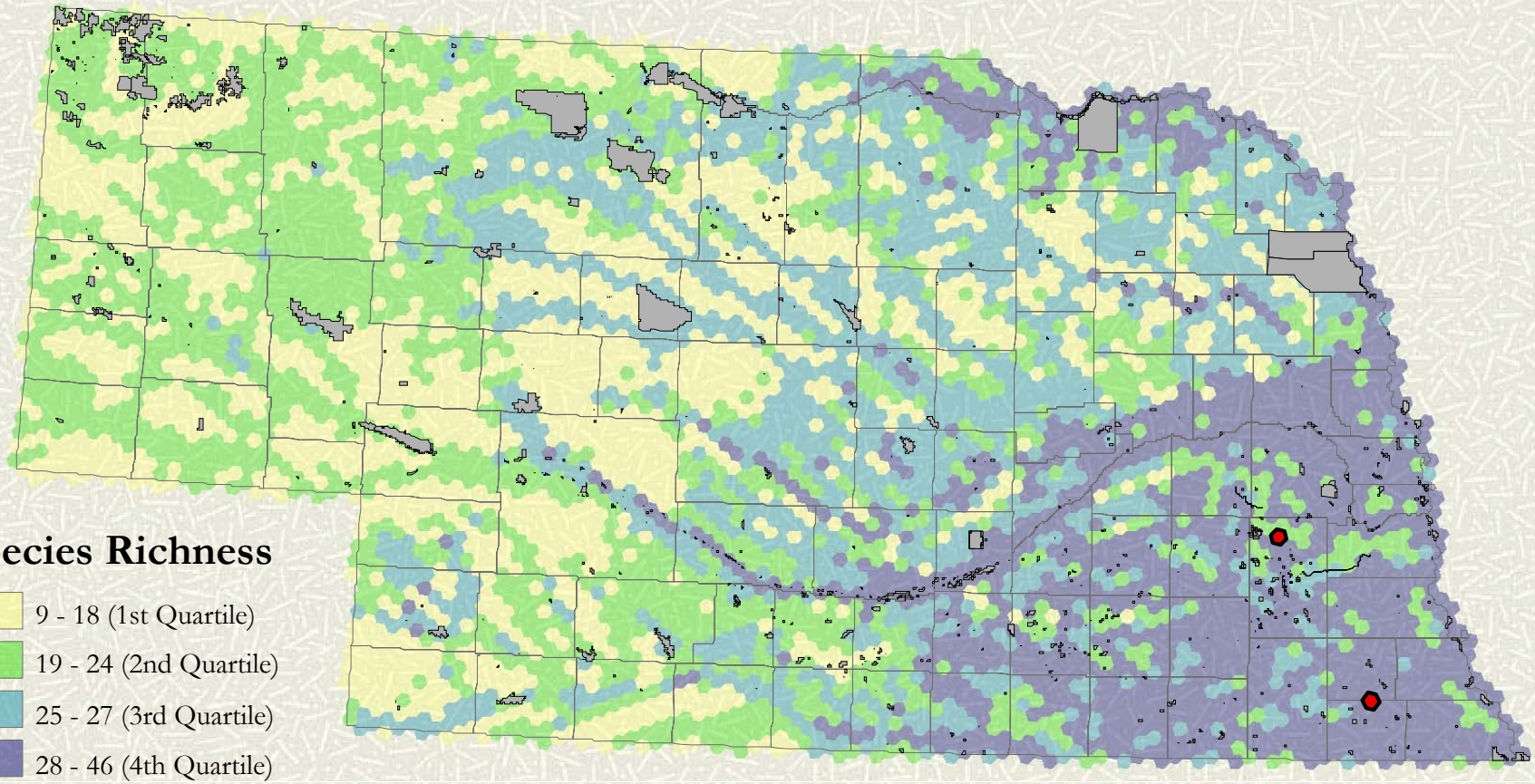


Mgmt Status 1-4 x Richness Quartile 4

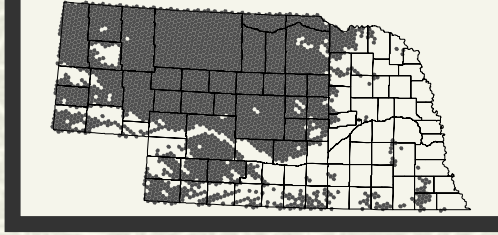


Gap Analysis of Amphibians and Reptiles

Grassland Mask

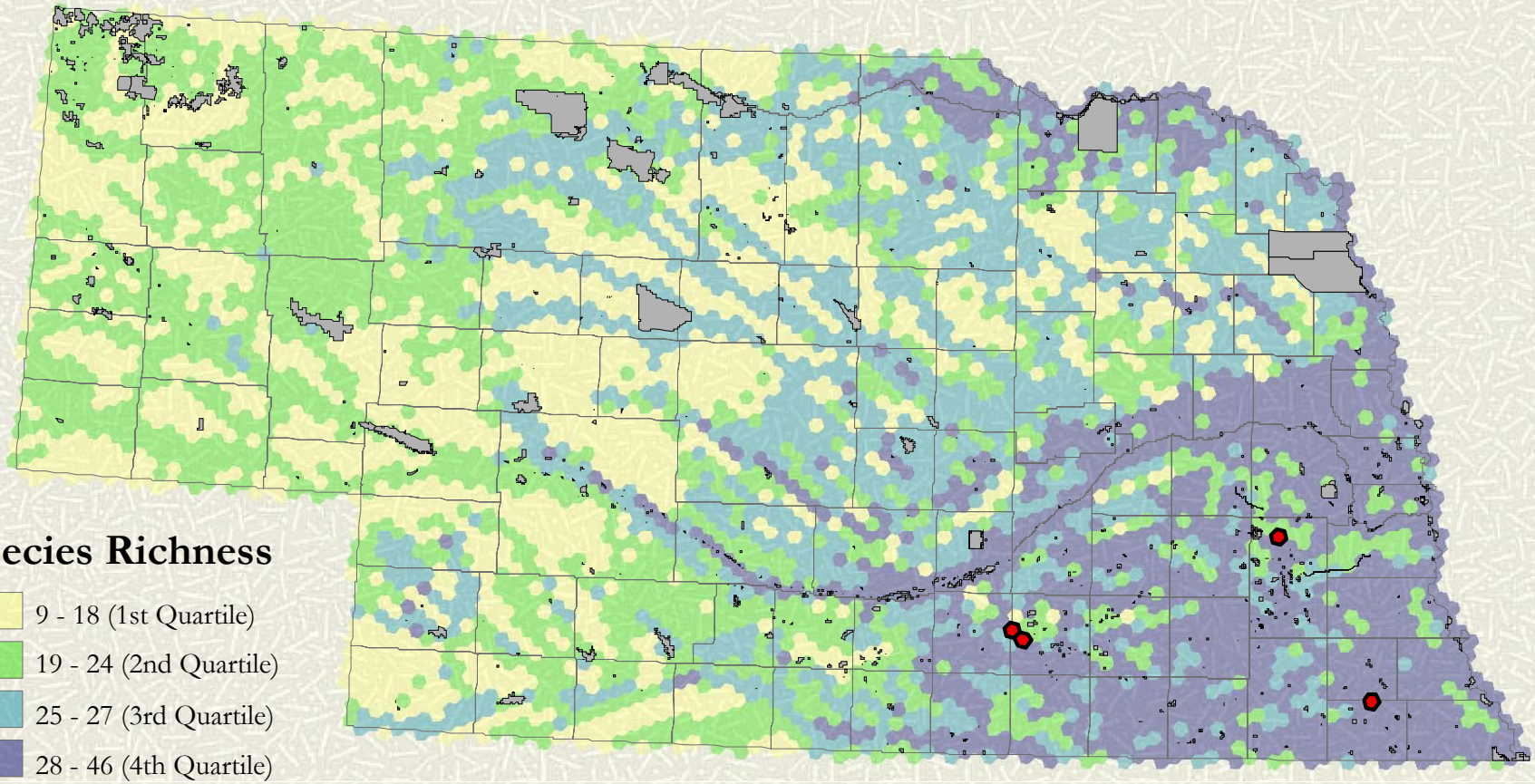


Mgmt Status 1 x Richness Quartile 4

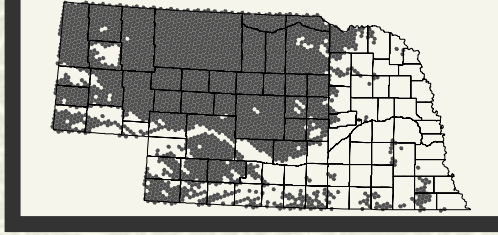


Gap Analysis of Amphibians and Reptiles

Grassland Mask

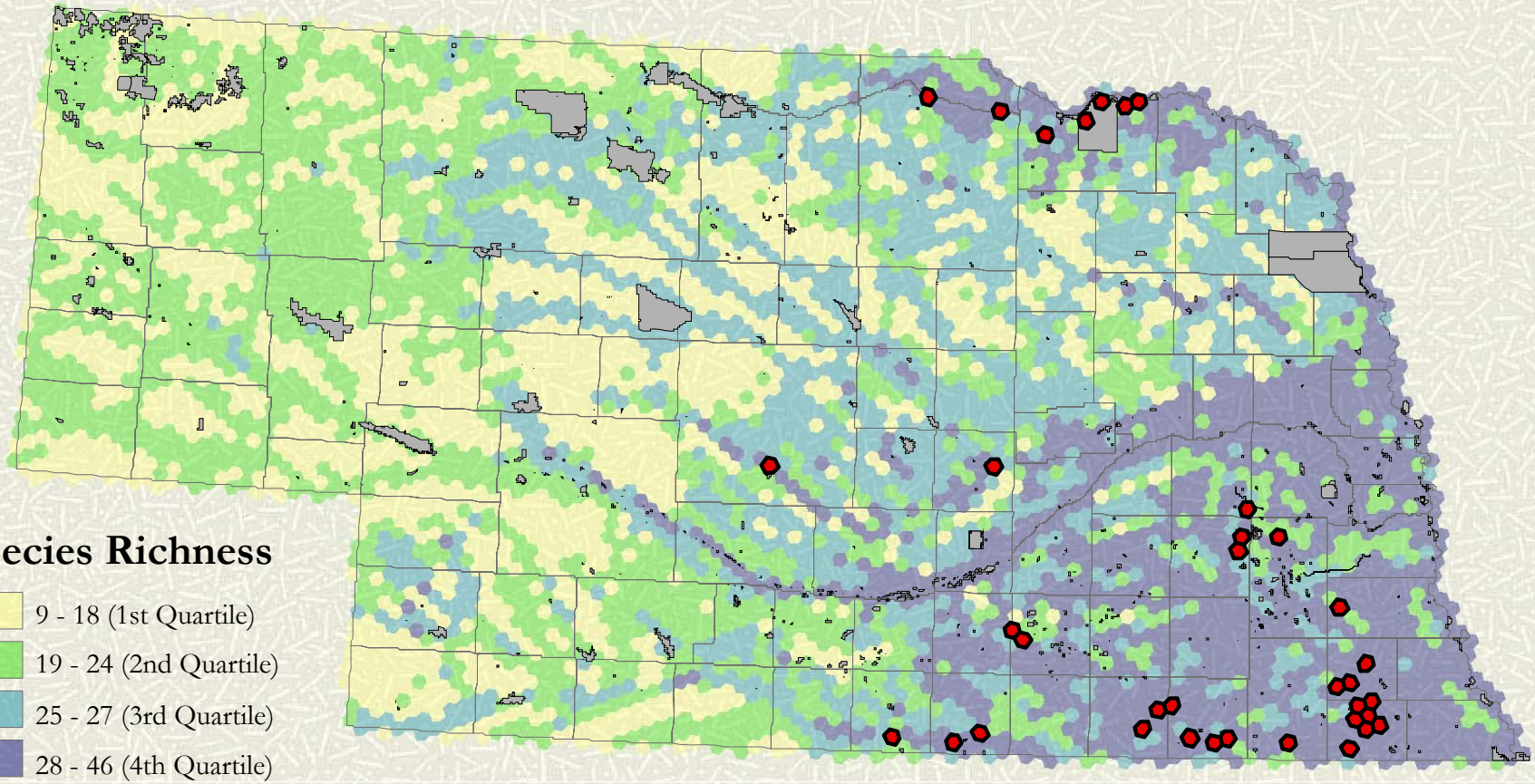


Mgmt Status 1,2 x Richness Quartile 4

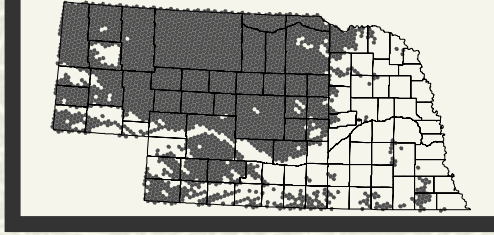


Gap Analysis of Amphibians and Reptiles

Grassland Mask

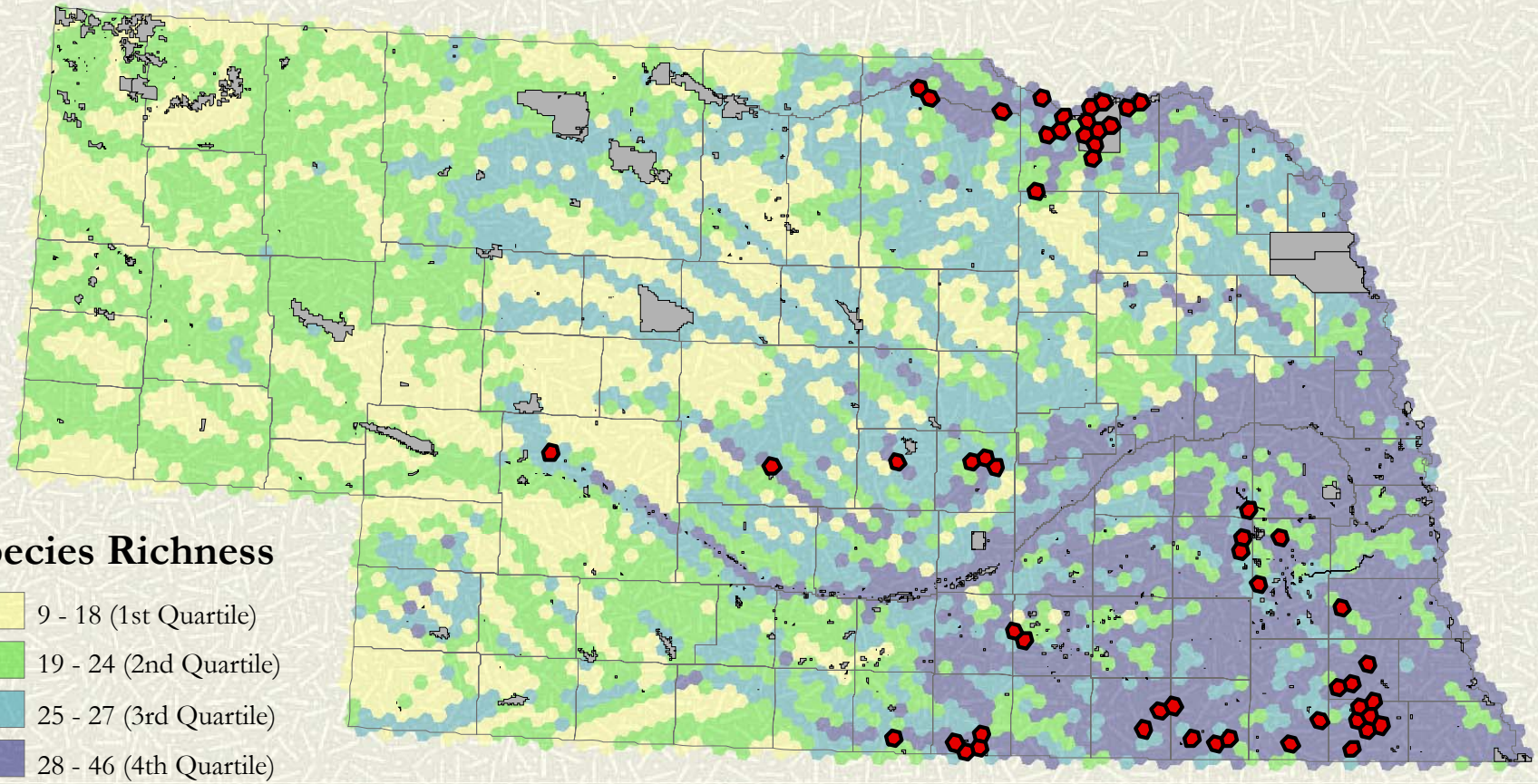


Mgmt Status 1,2,3 x Richness Quartile 4

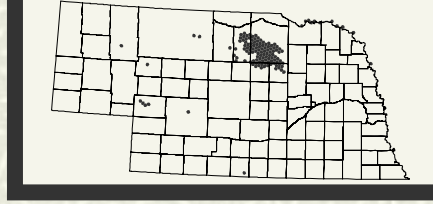


Gap Analysis of Amphibians and Reptiles

Grassland Mask

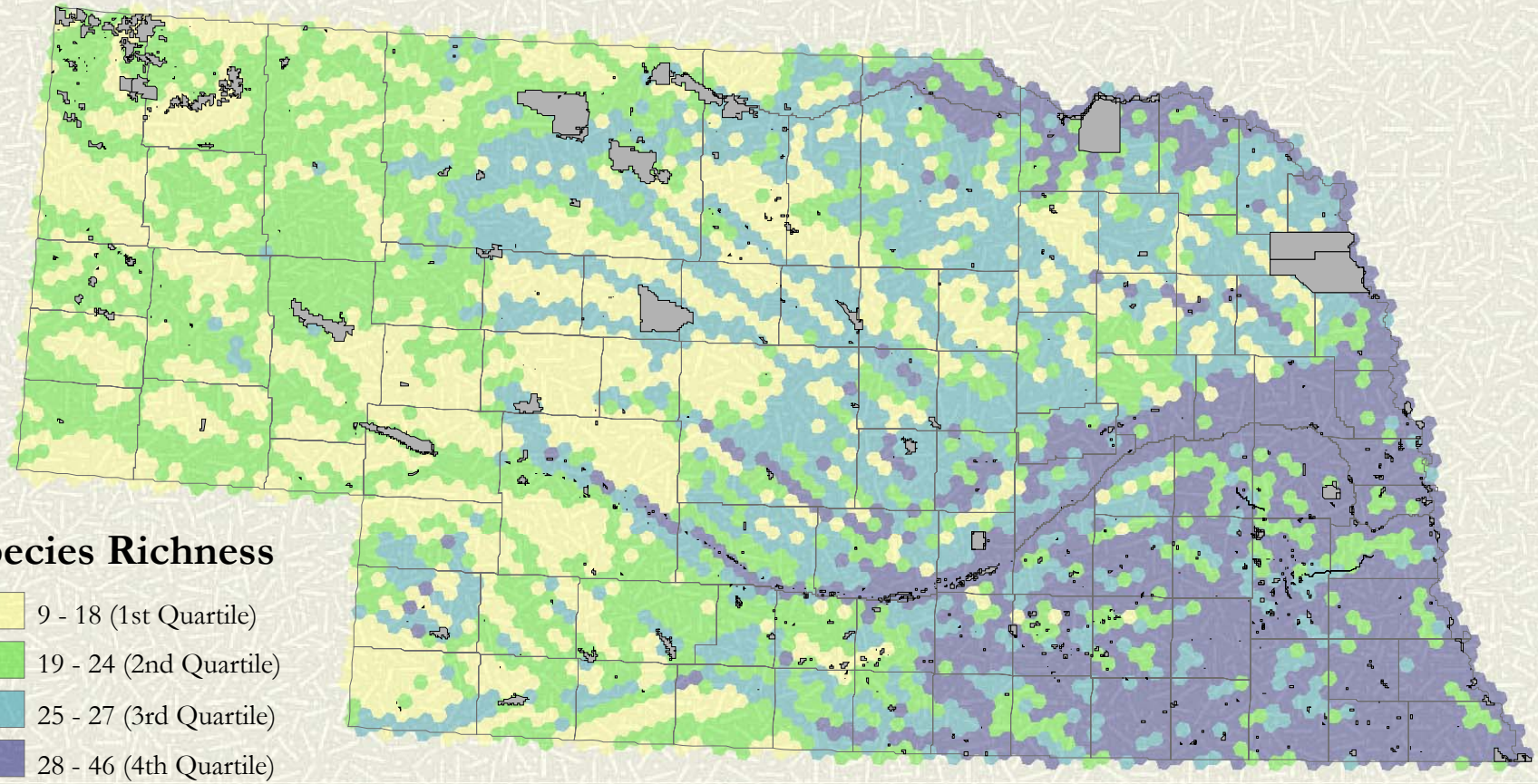


Mgmt Status 1-4 x Richness Quartile 4

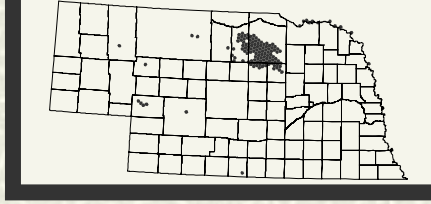


Gap Analysis of Amphibians and Reptiles

Wetland Mask

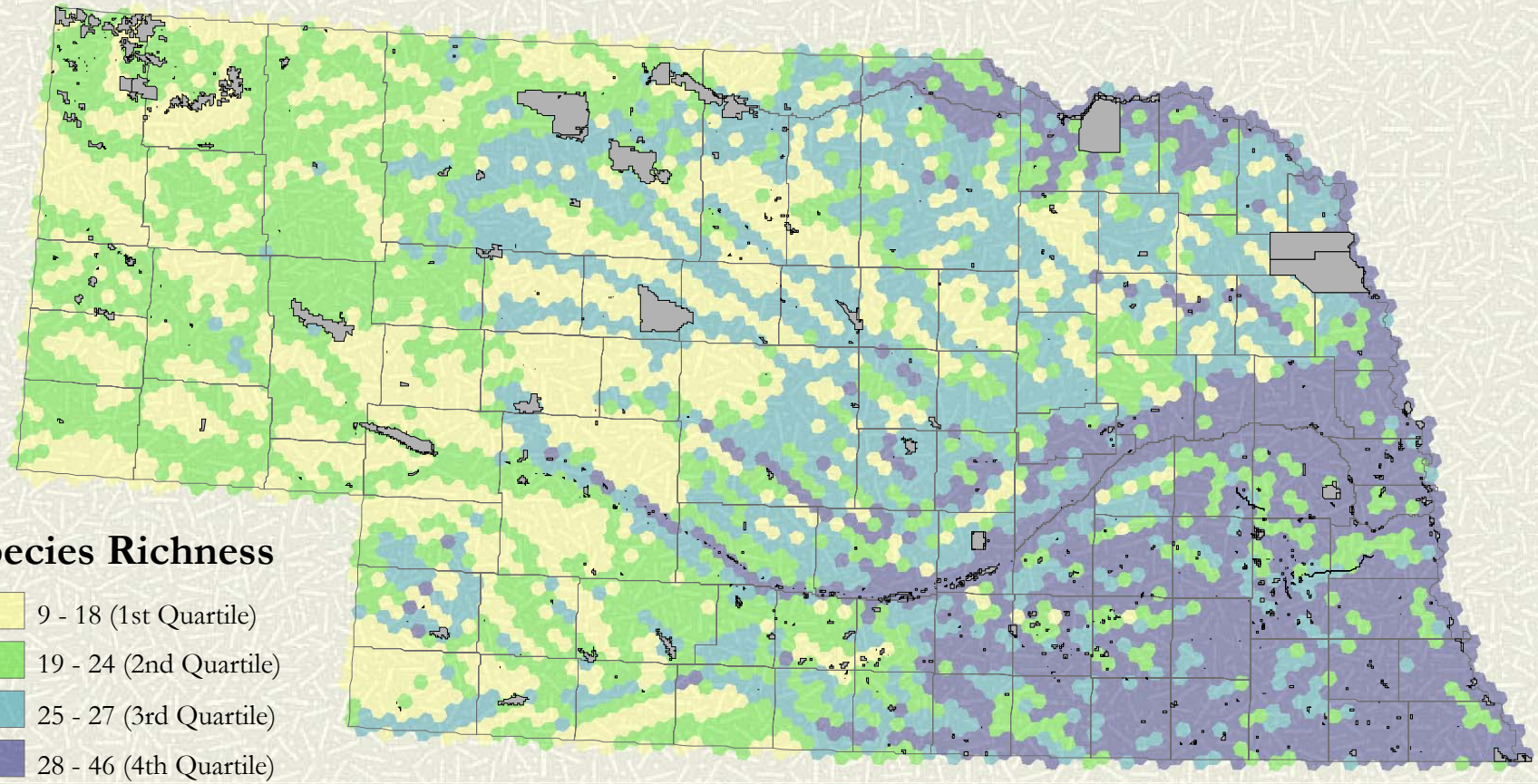


Mgmt Status 1 x Richness Quartile 4

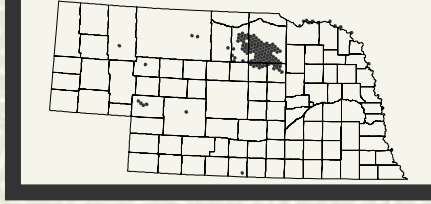


Gap Analysis of Amphibians and Reptiles

Wetland Mask

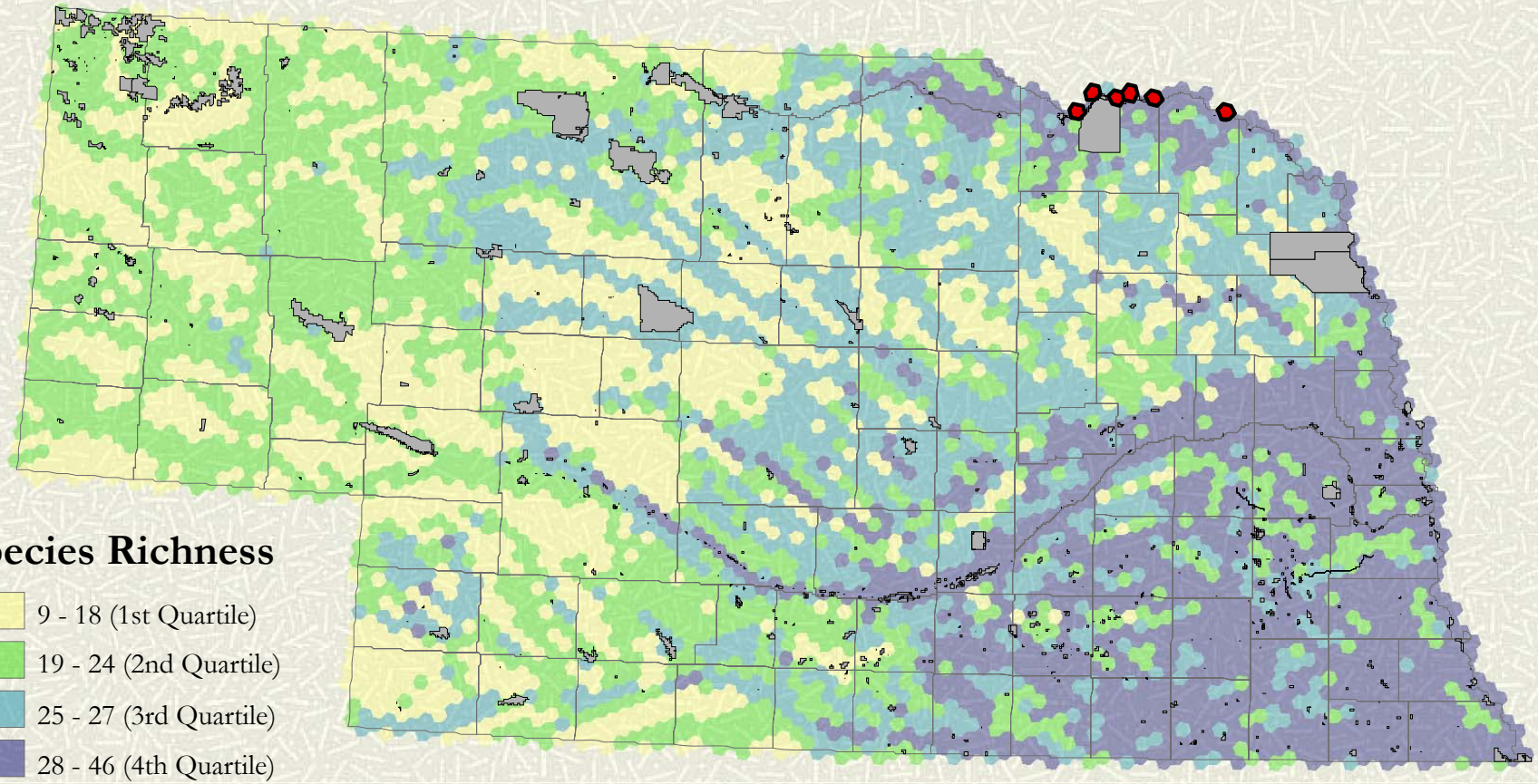


Mgmt Status 1,2 x Richness Quartile 4

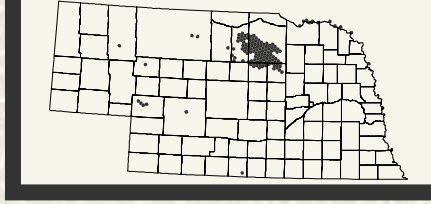


Gap Analysis of Amphibians and Reptiles

Wetland Mask

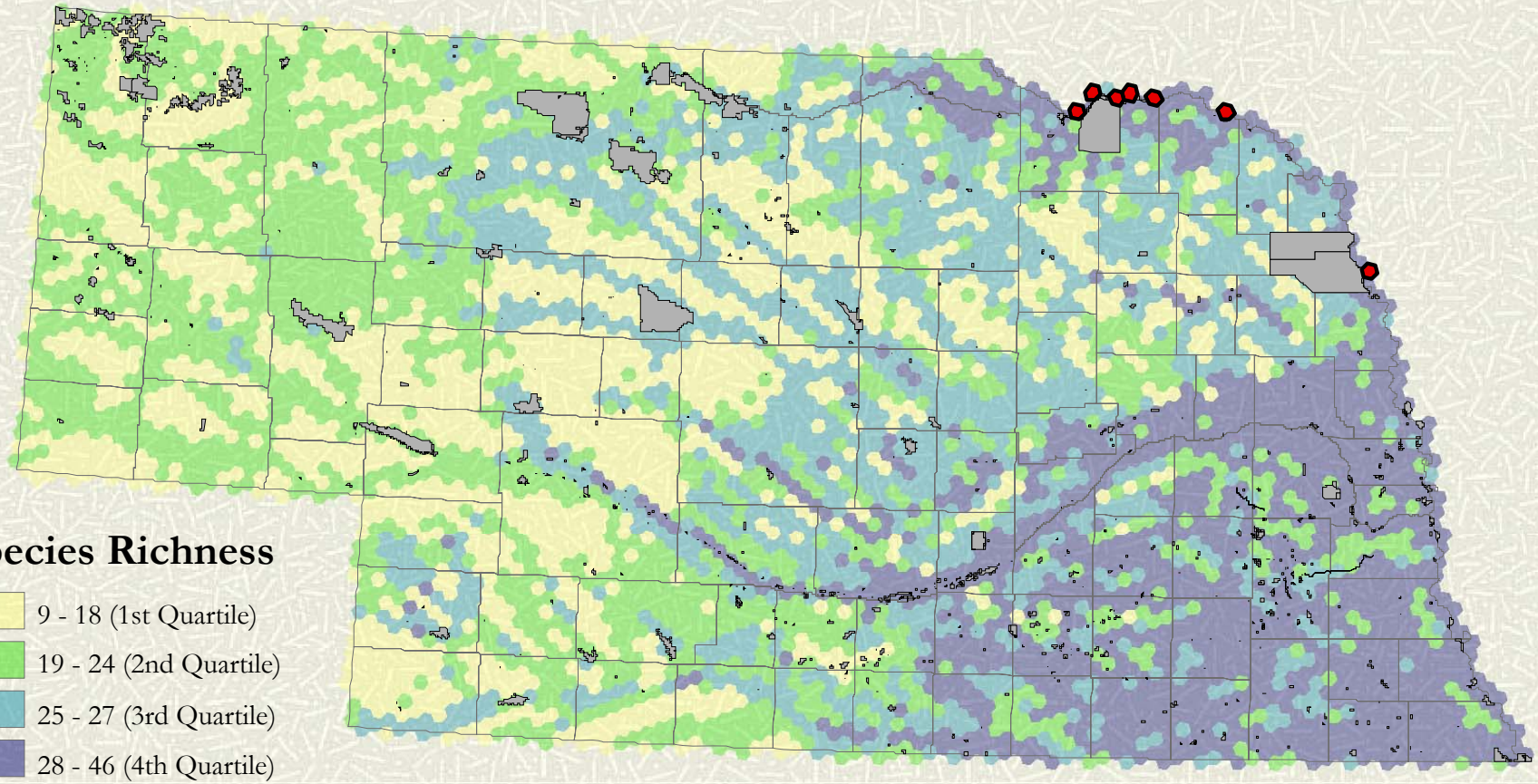


Mgmt Status 1,2,3 x Richness Quartile 4

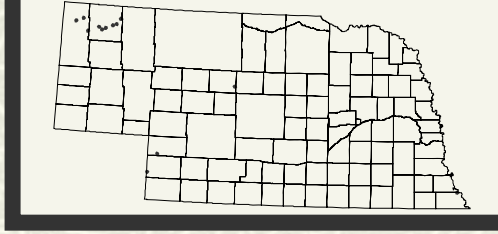


Gap Analysis of Amphibians and Reptiles

Wetland Mask

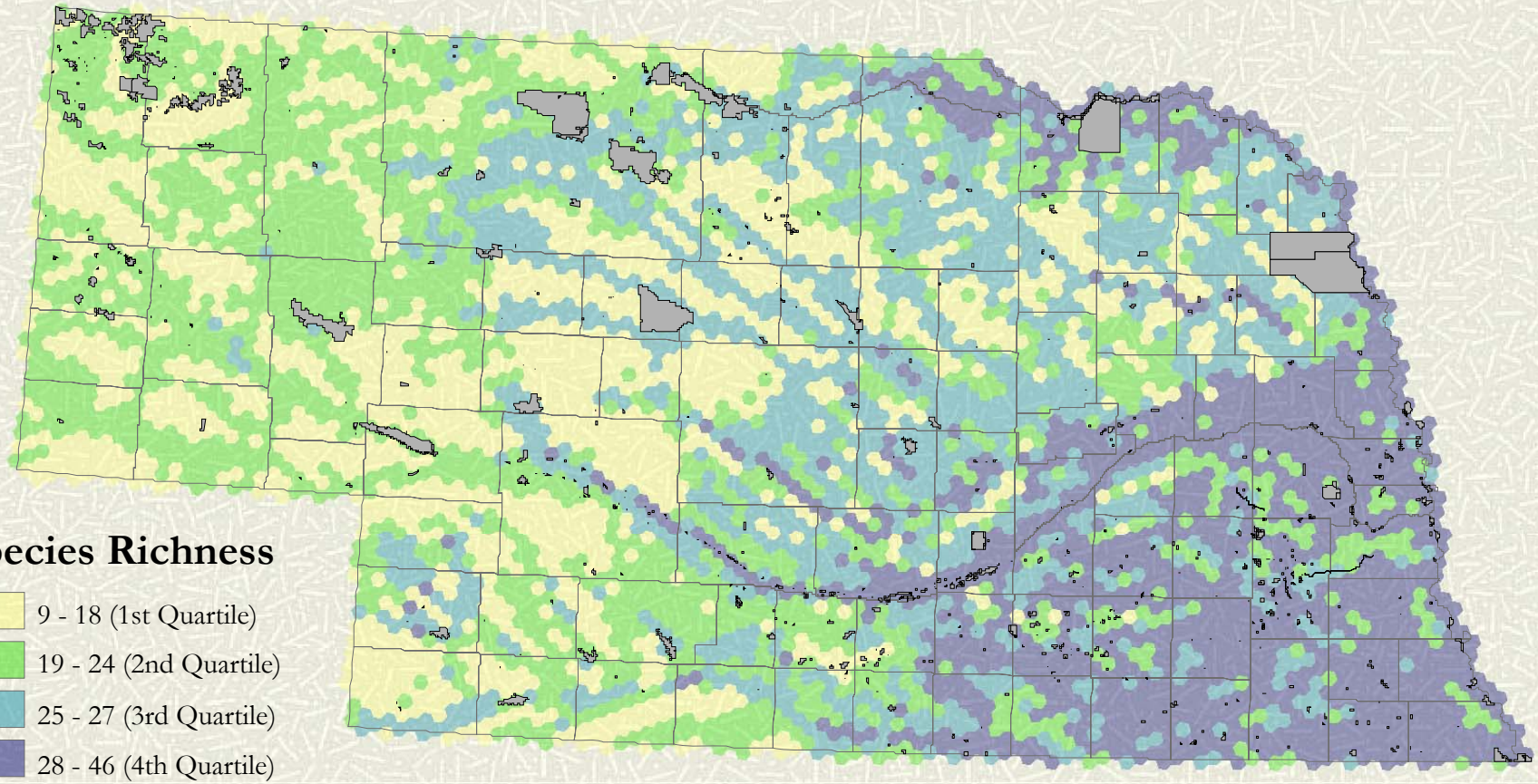


Mgmt Status 1-4 x Richness Quartile 4

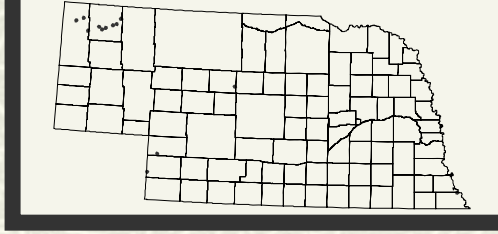


Gap Analysis of Amphibians and Reptiles

Woodland Mask

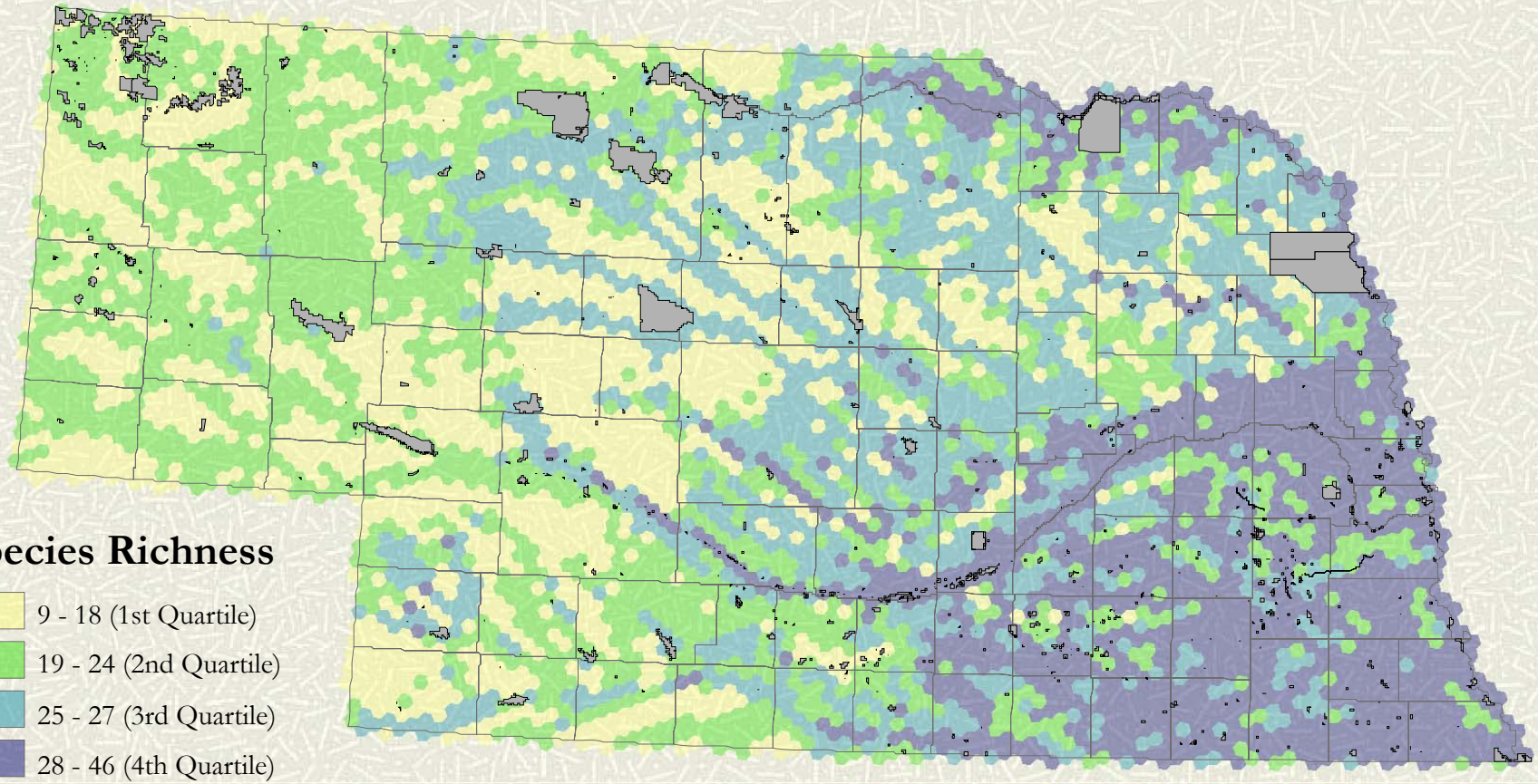


Mgmt Status 1 x Richness Quartile 4

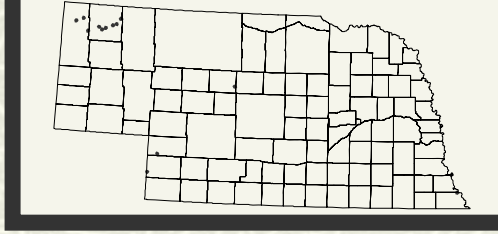


Gap Analysis of Amphibians and Reptiles

Woodland Mask

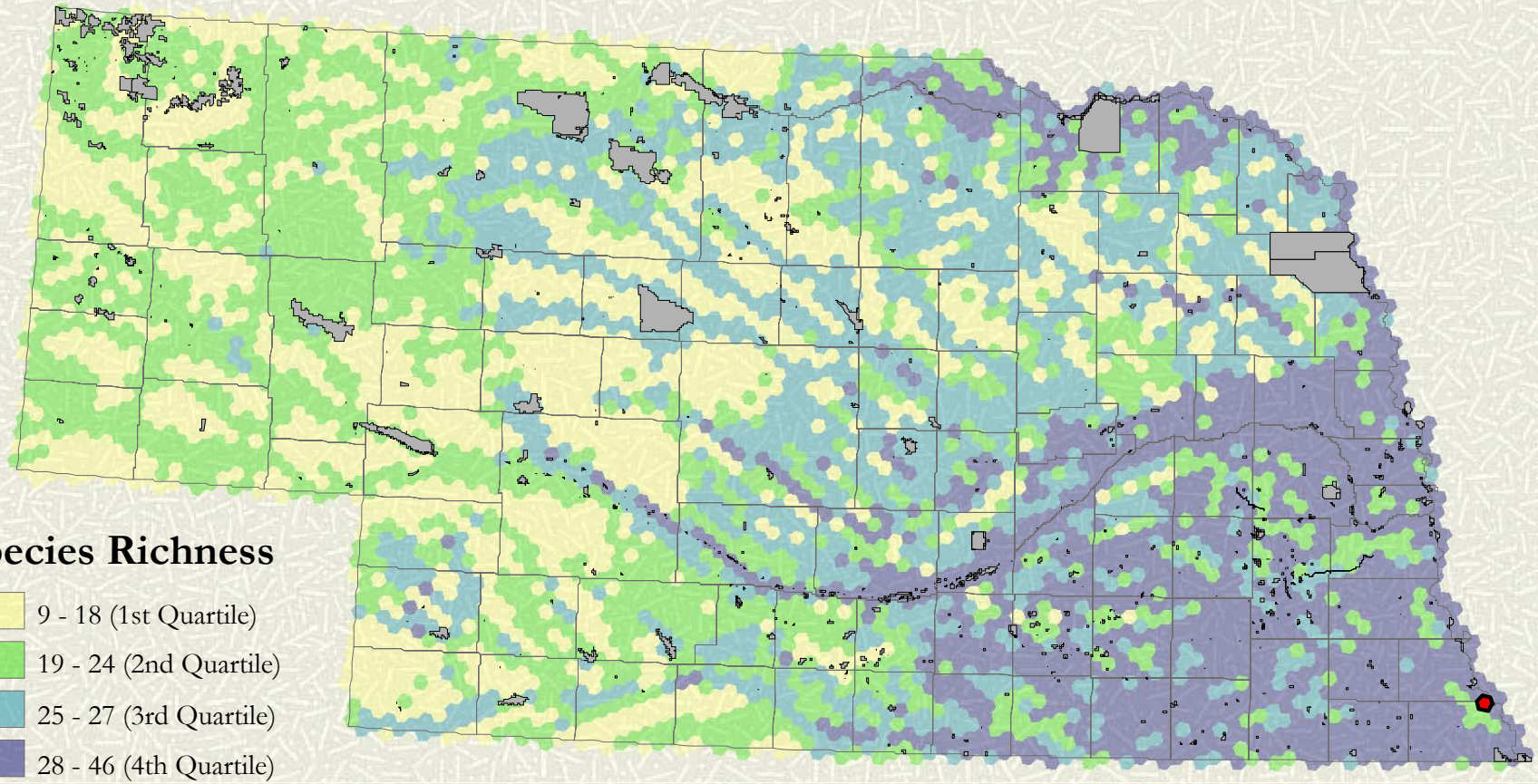


Mgmt Status 1,2 x Richness Quartile 4

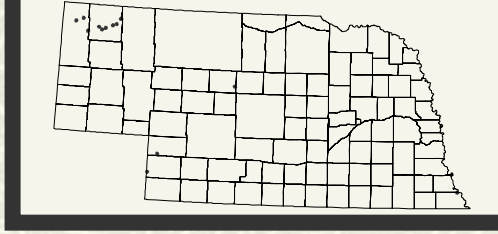


Gap Analysis of Amphibians and Reptiles

Woodland Mask

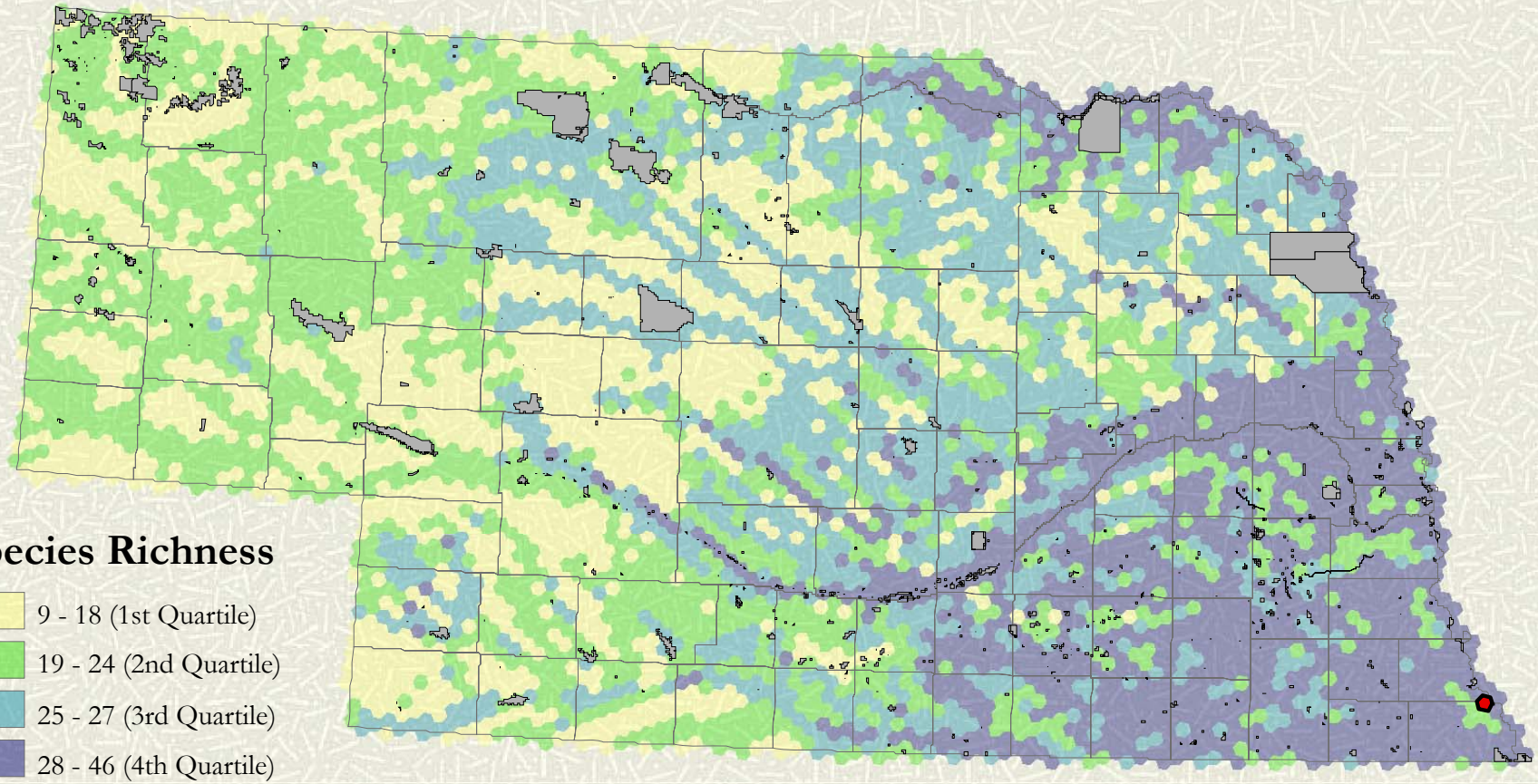


Mgmt Status 1,2,3 x Richness Quartile 4

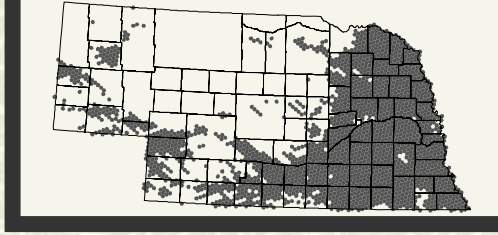


Gap Analysis of Amphibians and Reptiles

Woodland Mask

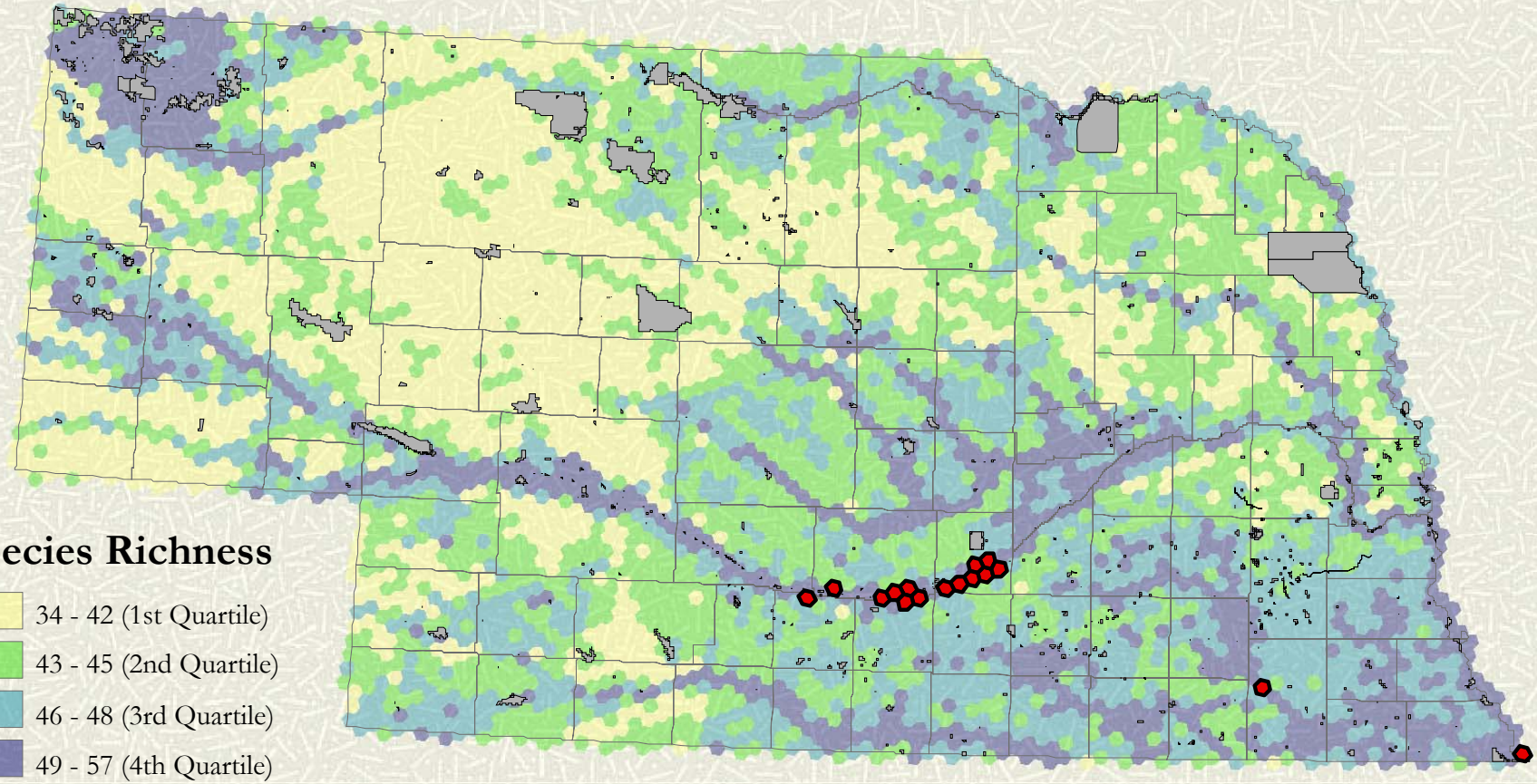


Mgmt Status 1-4 x Richness Quartile 4

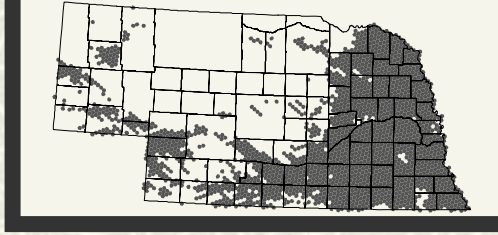


Gap Analysis of Mammals

Anthropogenic Mask

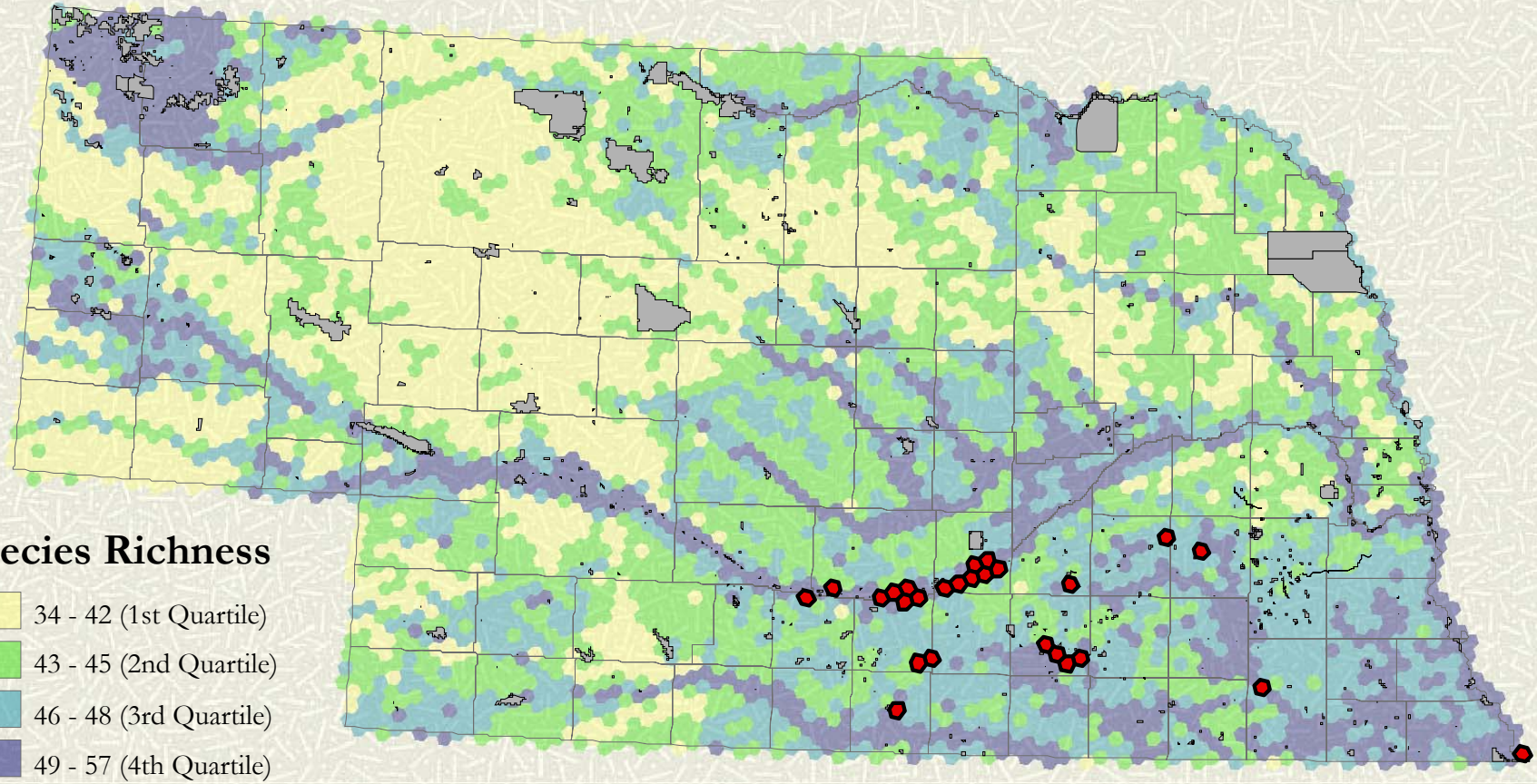


Mgmt Status 1 x Richness Quartile 4

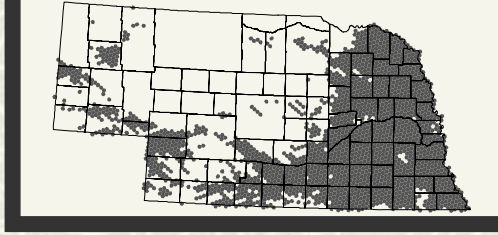


Gap Analysis of Mammals

Anthropogenic Mask

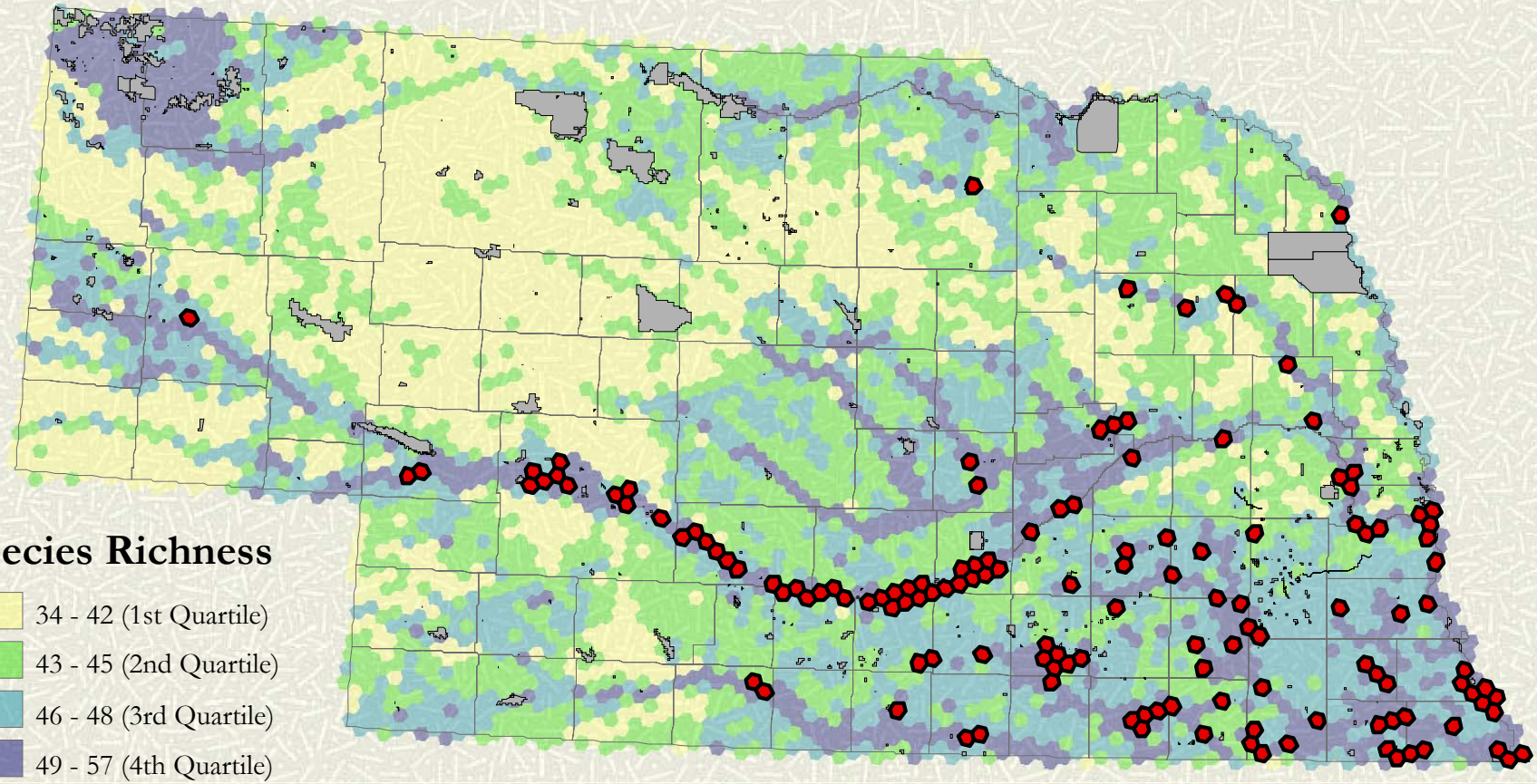


Mgmt Status 1,2 x Richness Quartile 4

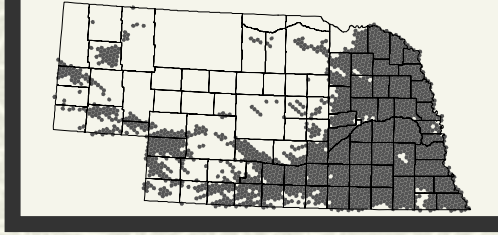


Gap Analysis of Mammals

Anthropogenic Mask

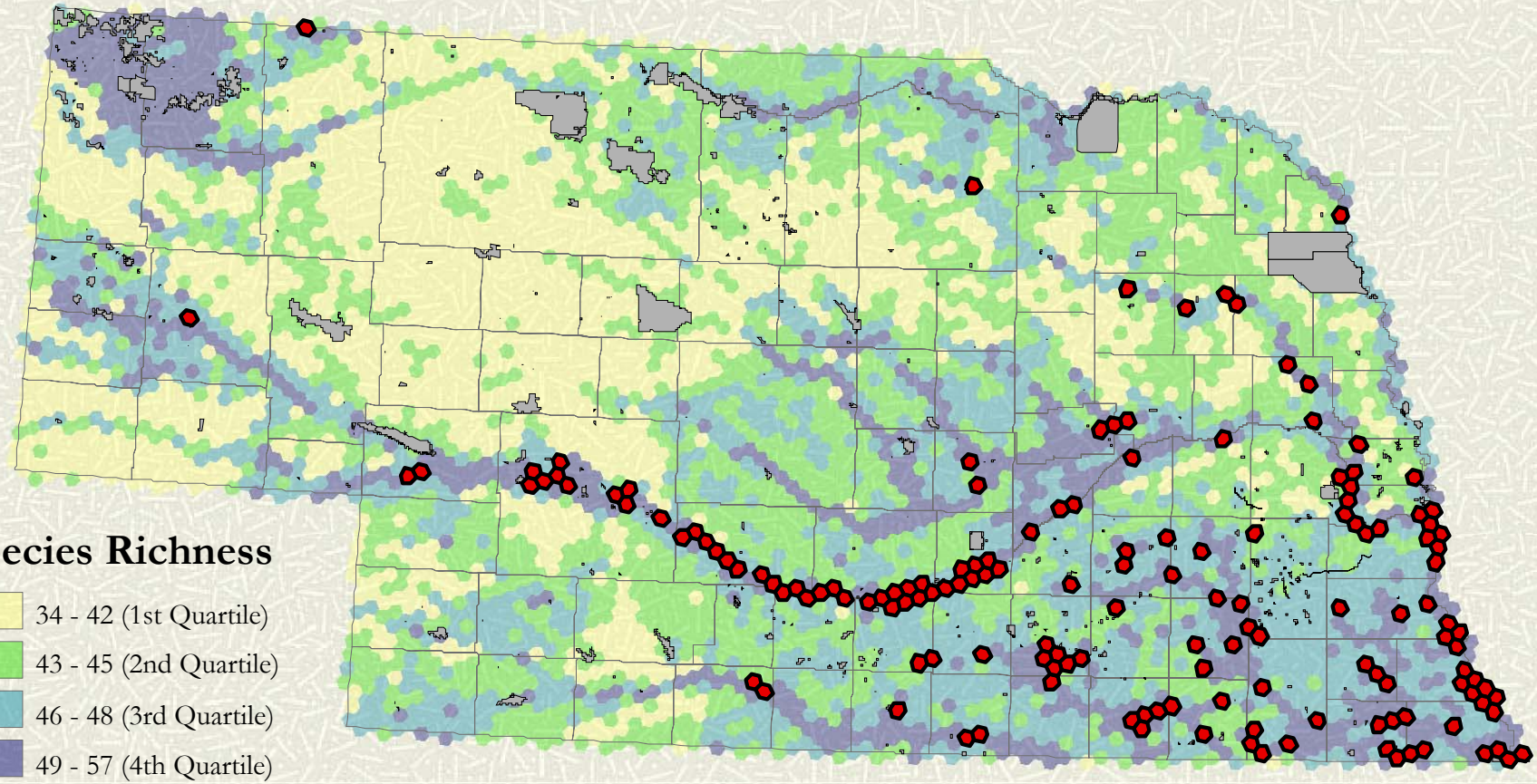


Mgmt Status 1,2,3 x Richness Quartile 4



Gap Analysis of Mammals

Anthropogenic Mask



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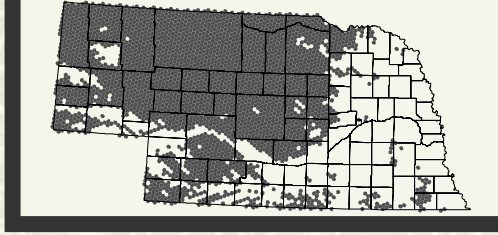
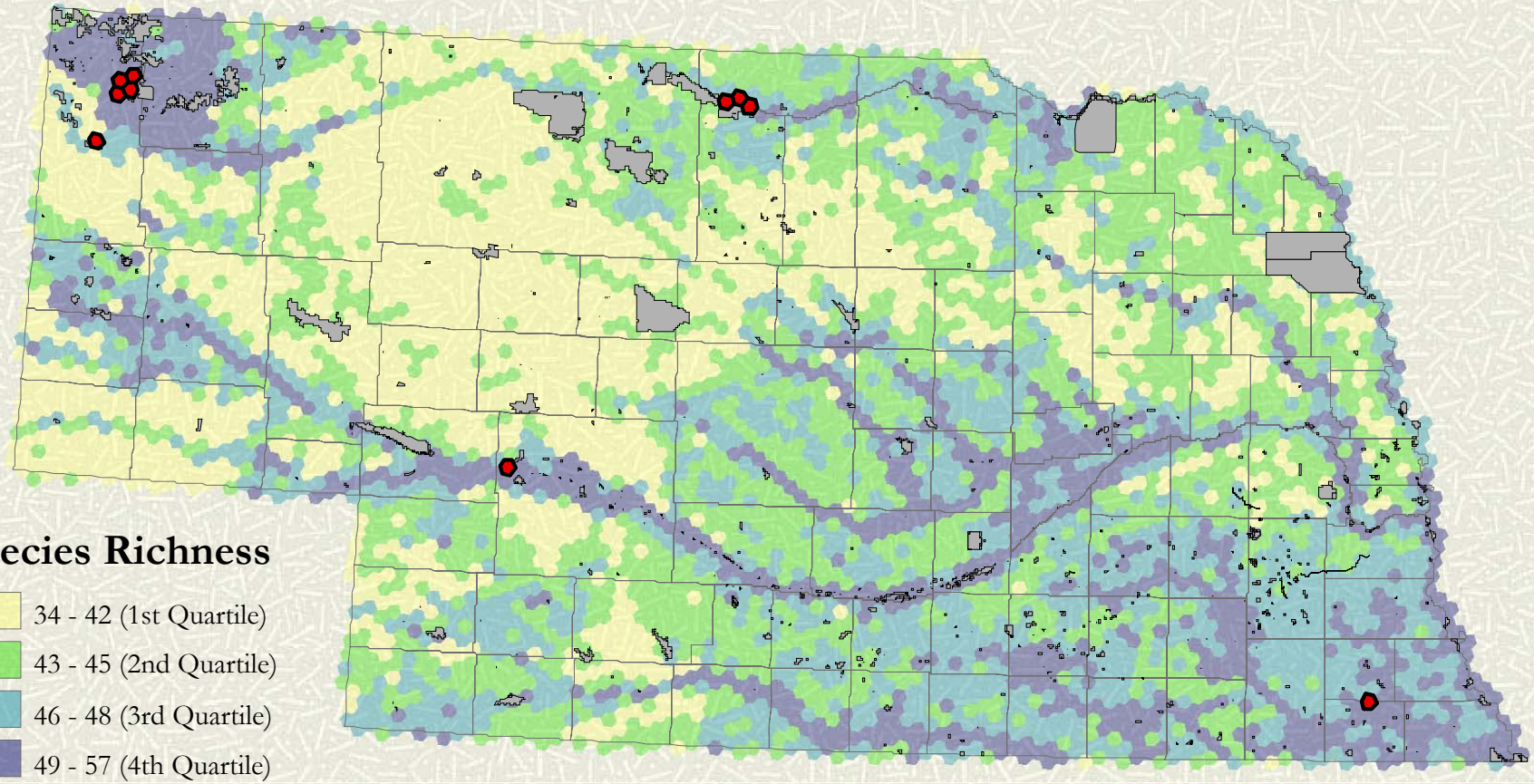
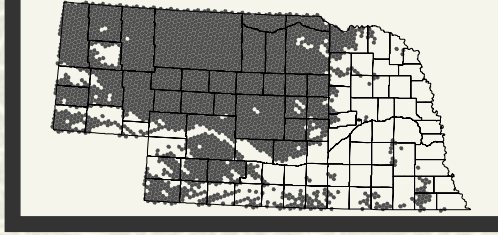


Gap Analysis of Mammals

Grassland Mask

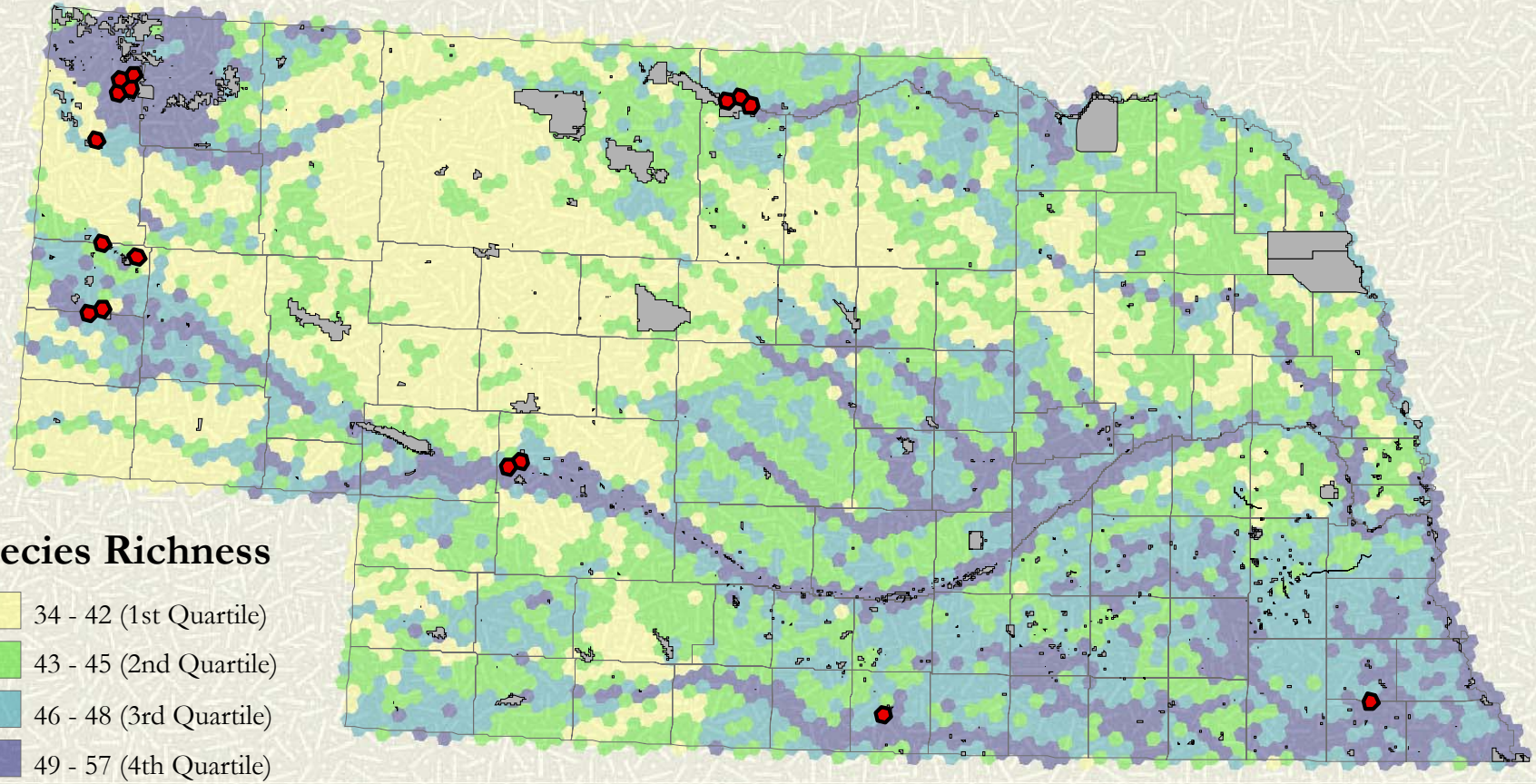


Mgmt Status 1 x Richness Quartile 4



Gap Analysis of Mammals

Grassland Mask



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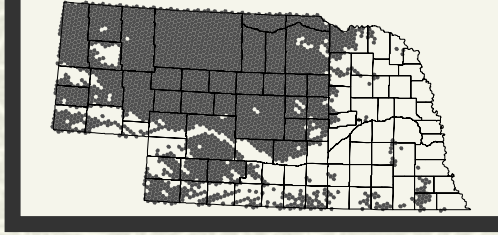

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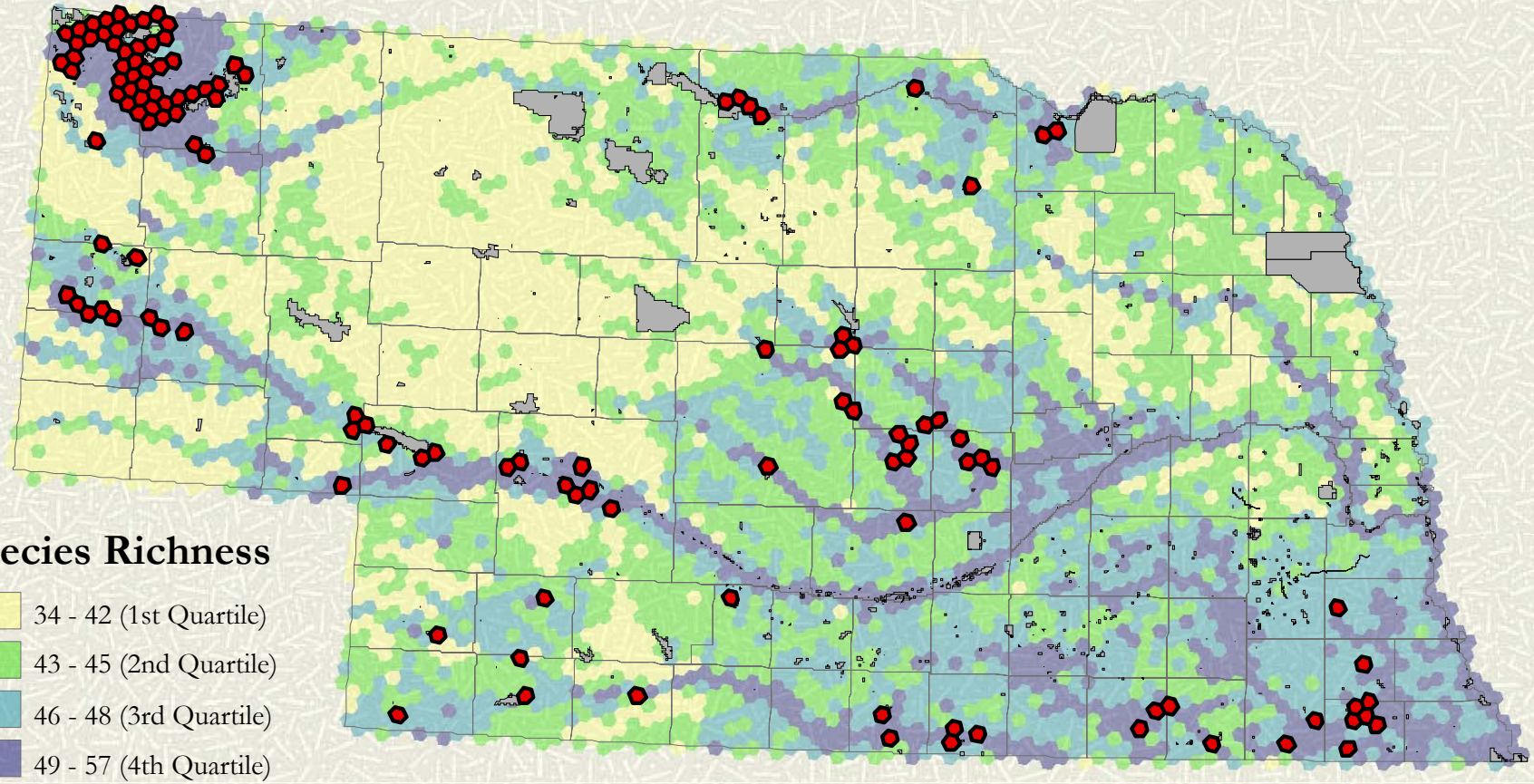
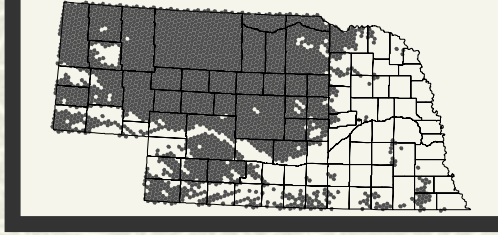


Mgmt Status 1,2,3 x Richness Quartile 4



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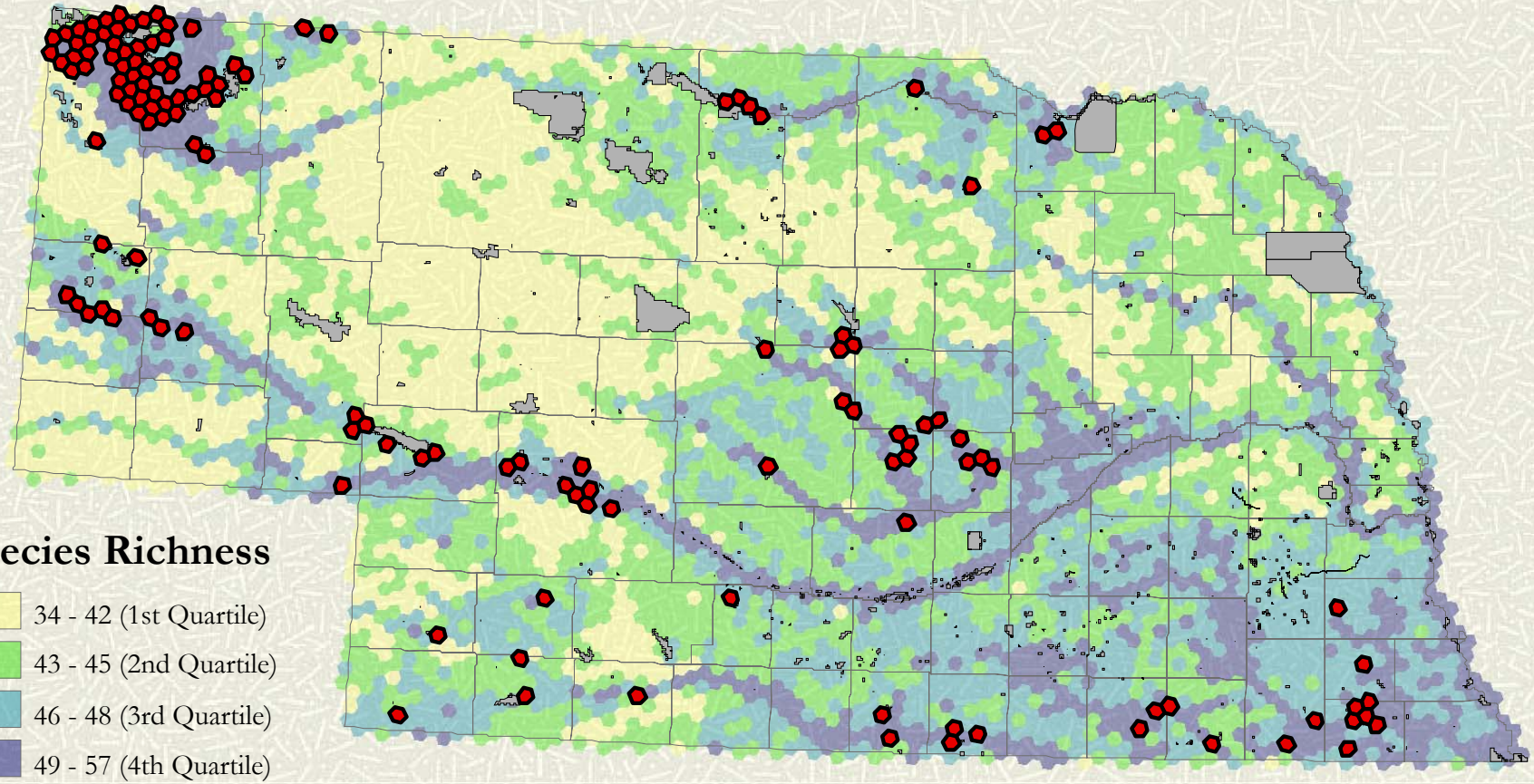

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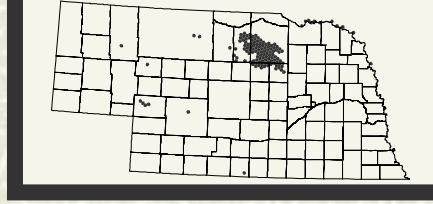
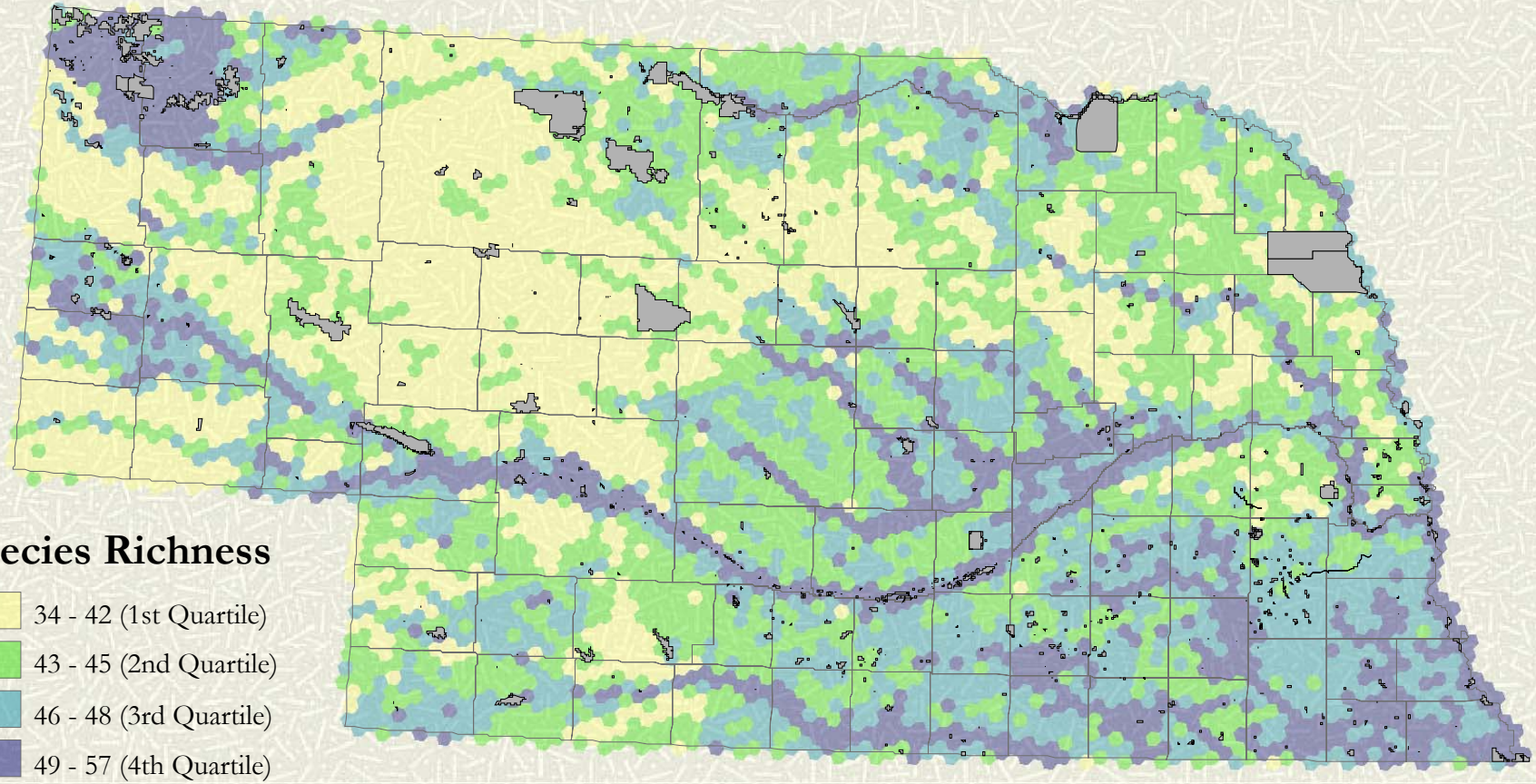
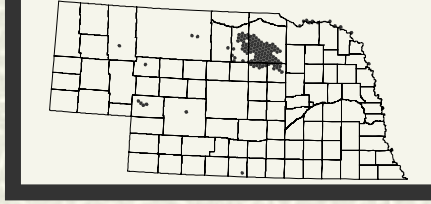


Gap Analysis of Mammals

Wetland Mask

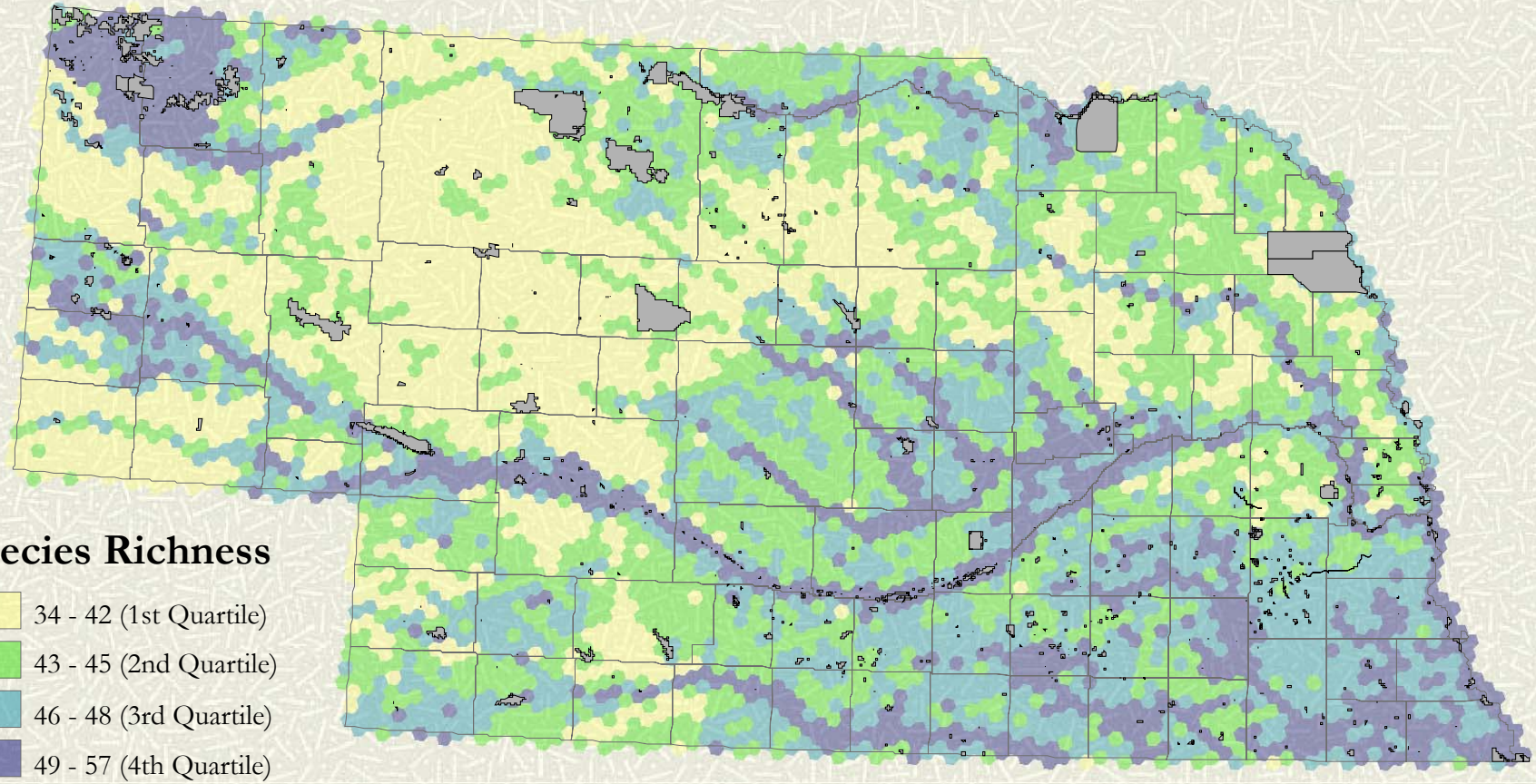


Mgmt Status 1 x Richness Quartile 4

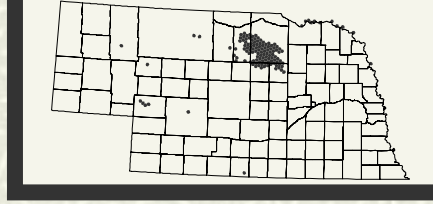


Gap Analysis of Mammals

Wetland Mask

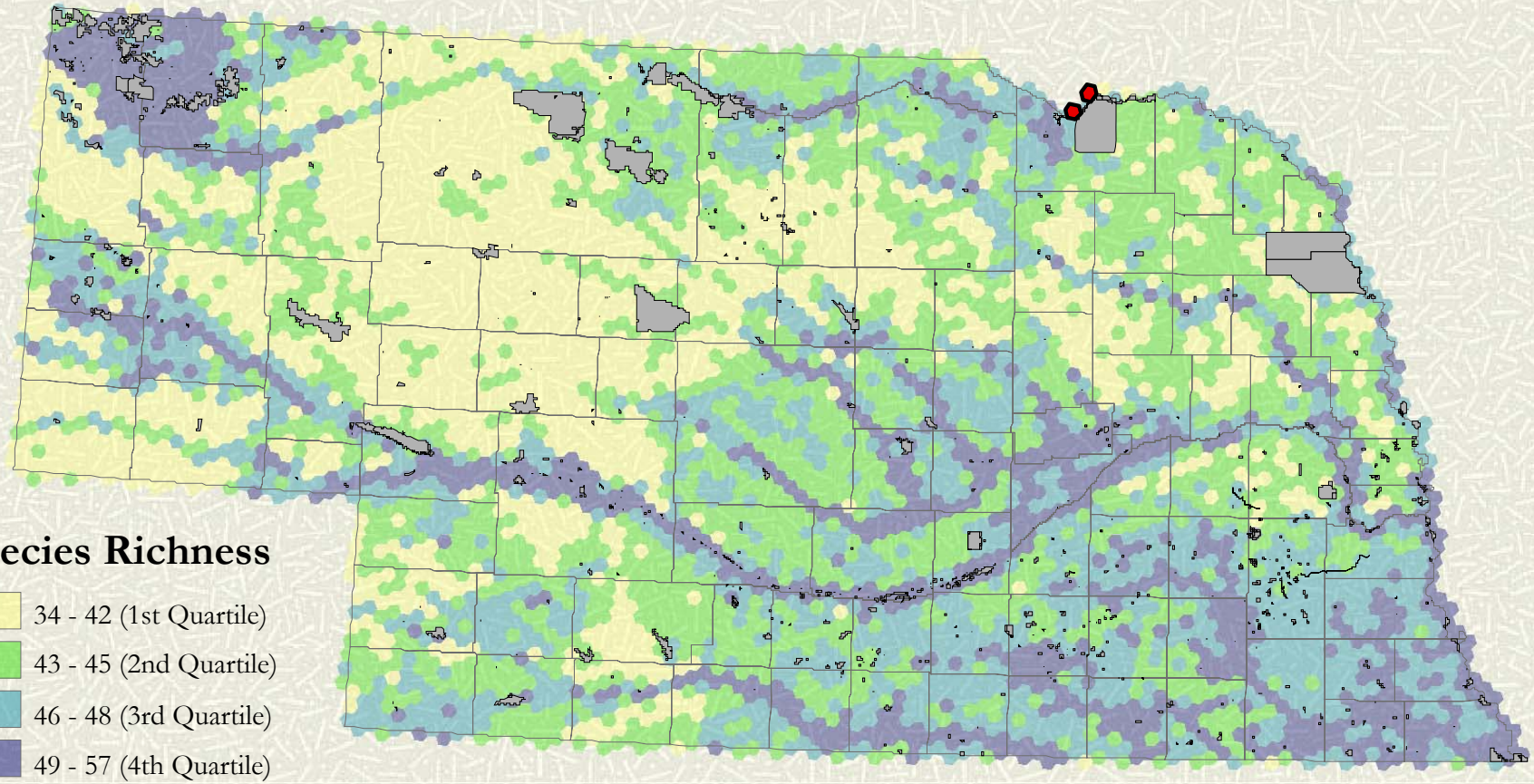


Mgmt Status 1,2 x Richness Quartile 4

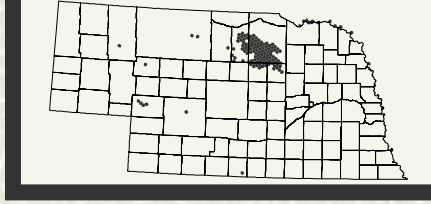


Gap Analysis of Mammals

Wetland Mask

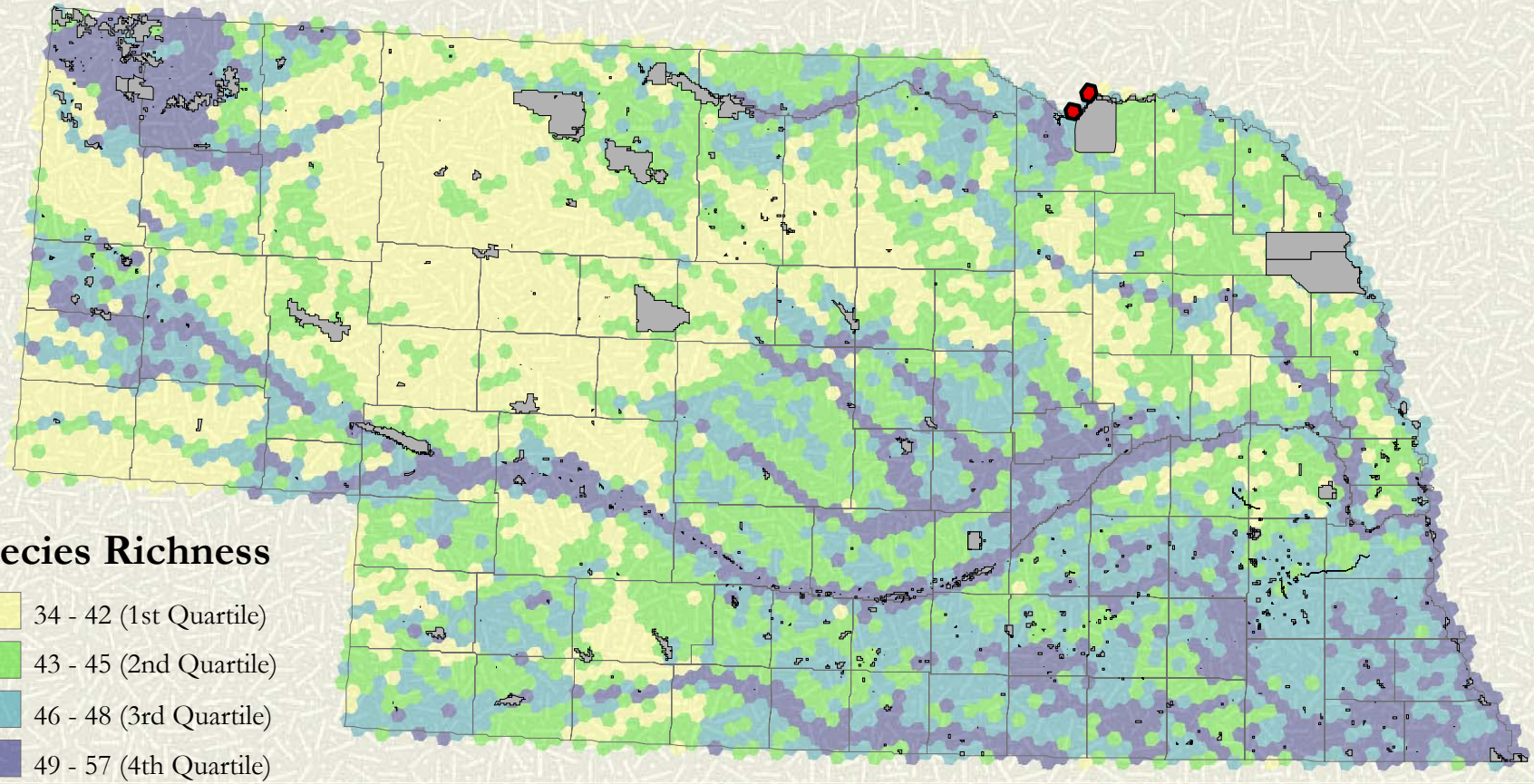


Mgmt Status 1,2,3 x Richness Quartile 4

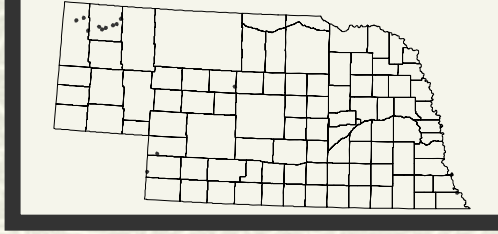


Gap Analysis of Mammals

Wetland Mask

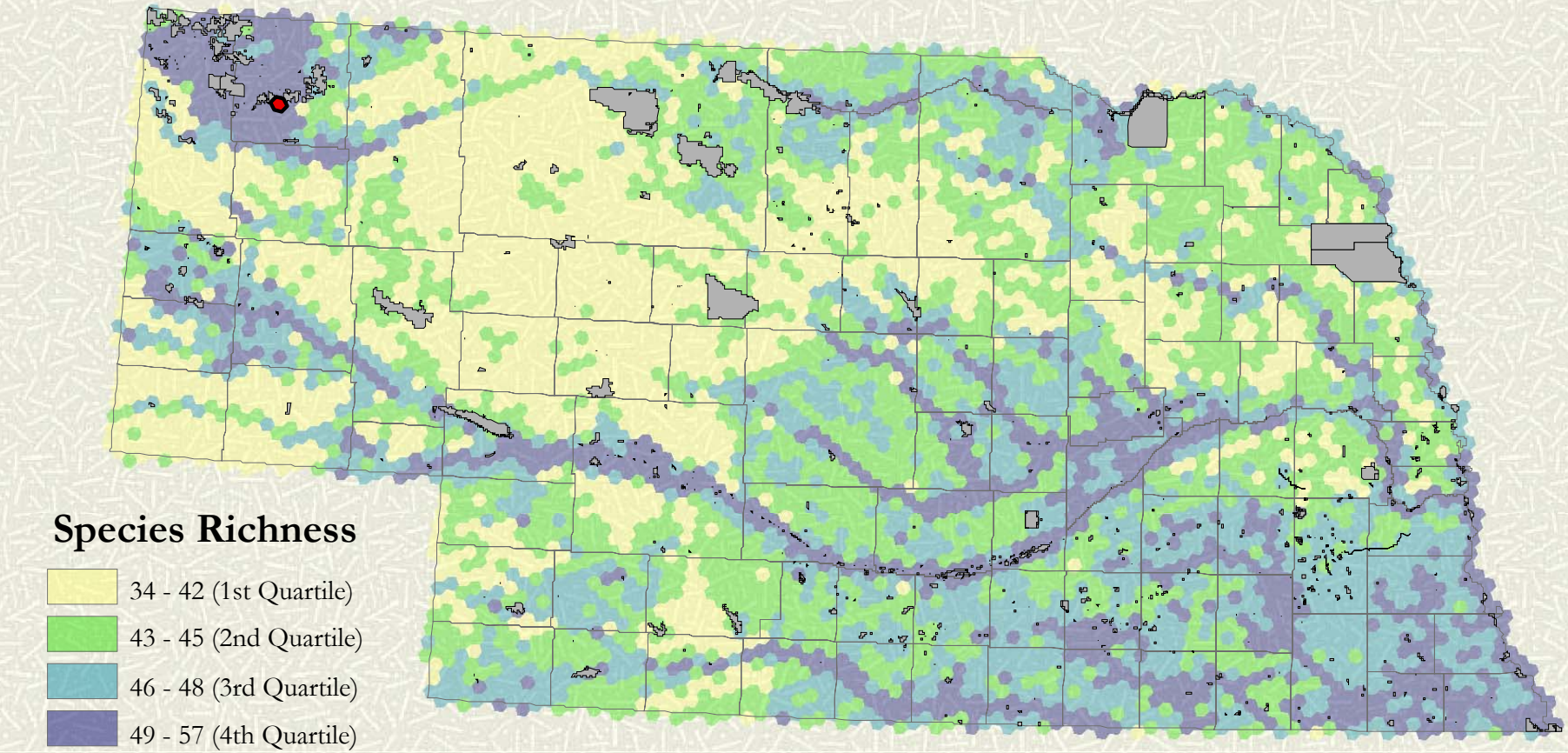


Mgmt Status 1-4 x Richness Quartile 4

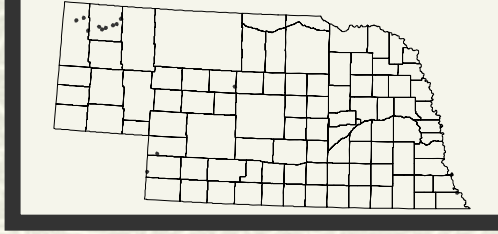


Gap Analysis of Mammals

Woodland Mask



Mgmt Status 1 x Richness Quartile 4



Gap Analysis of Mammals

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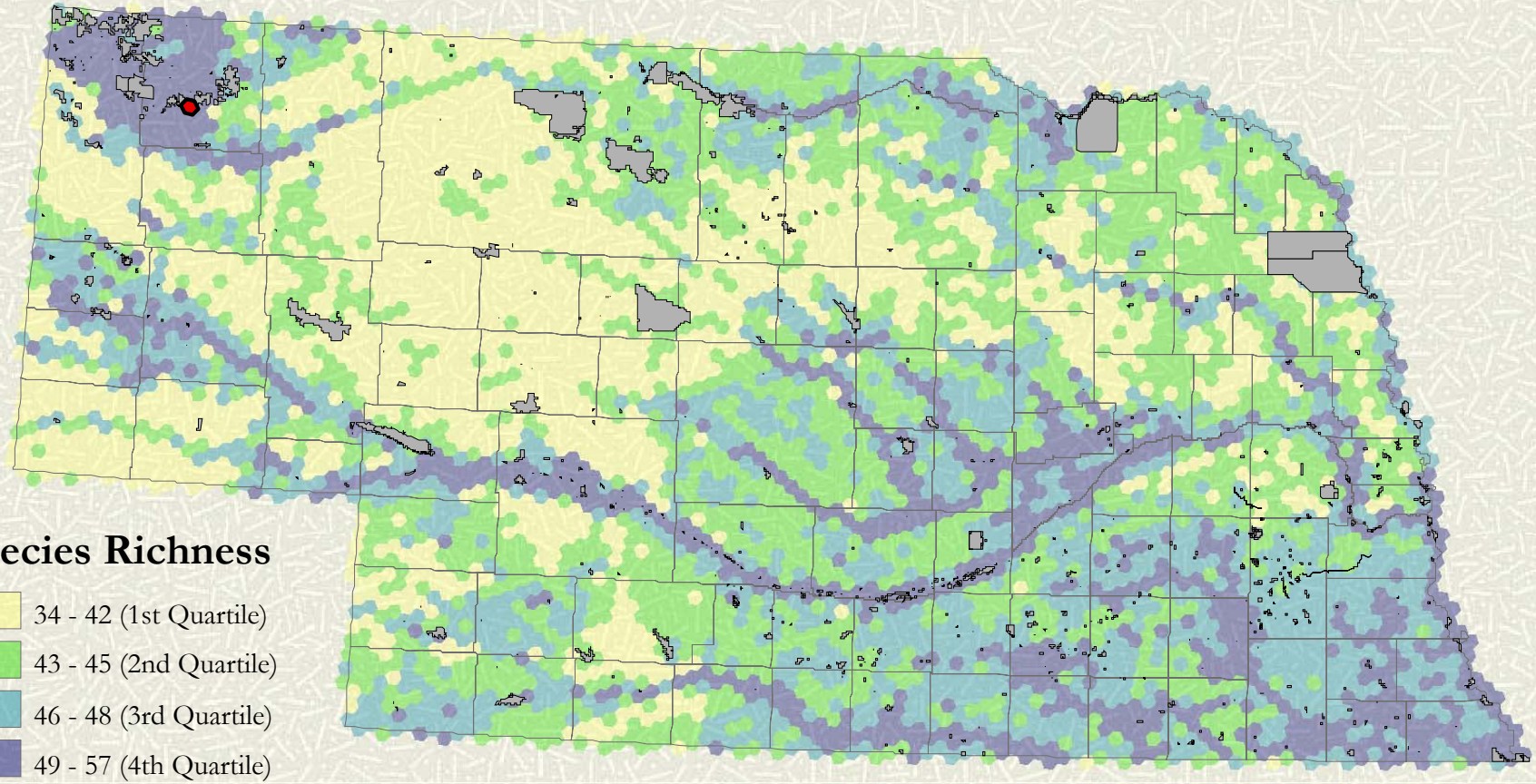
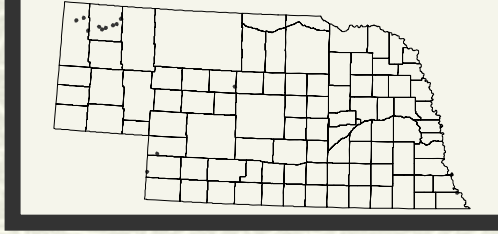


Mgmt Status 1,2 x Richness Quartile 4



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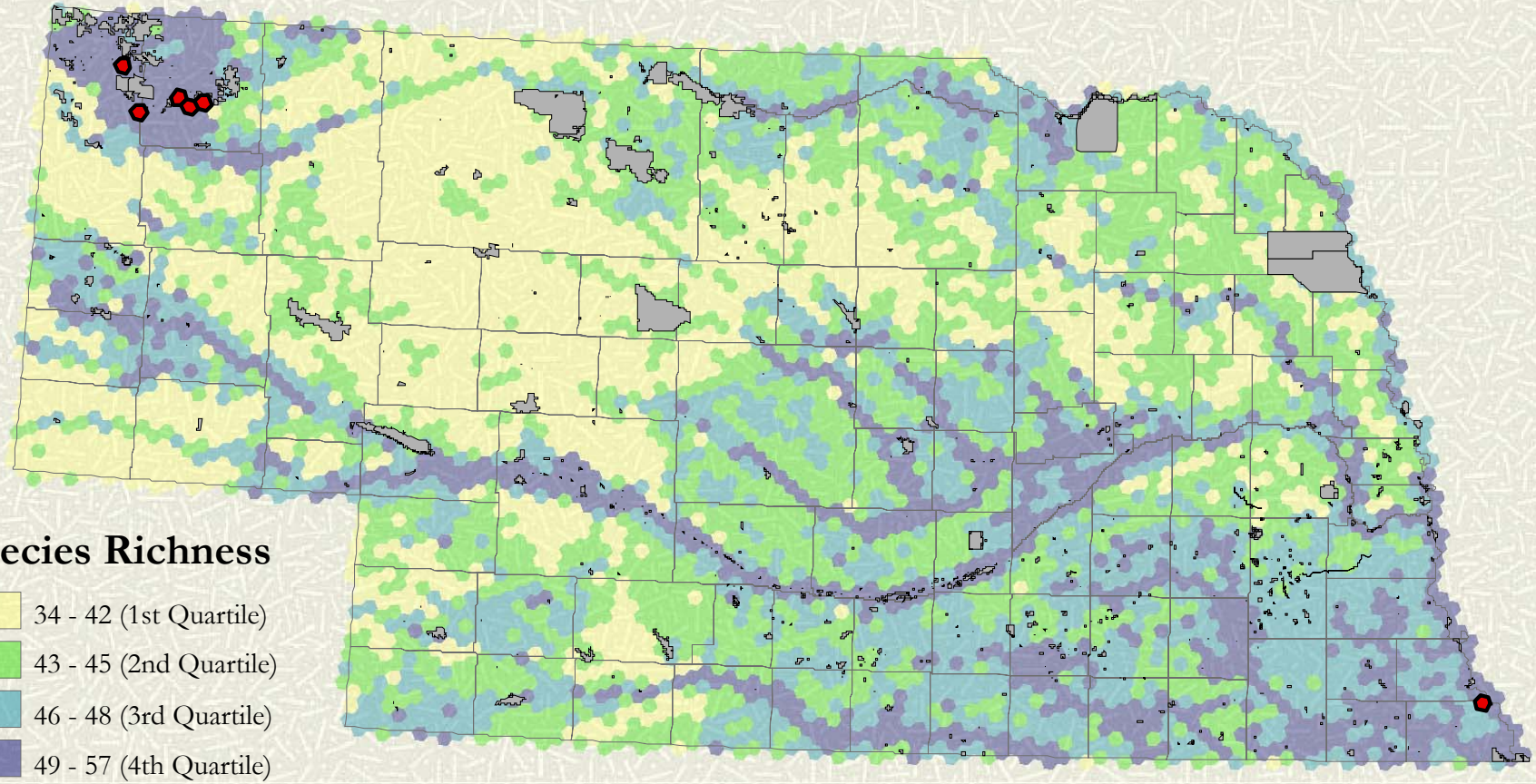
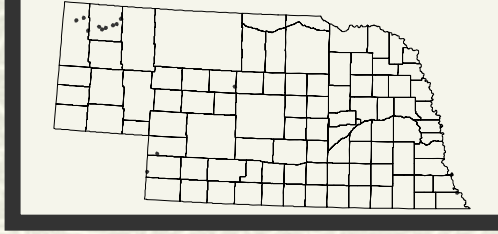
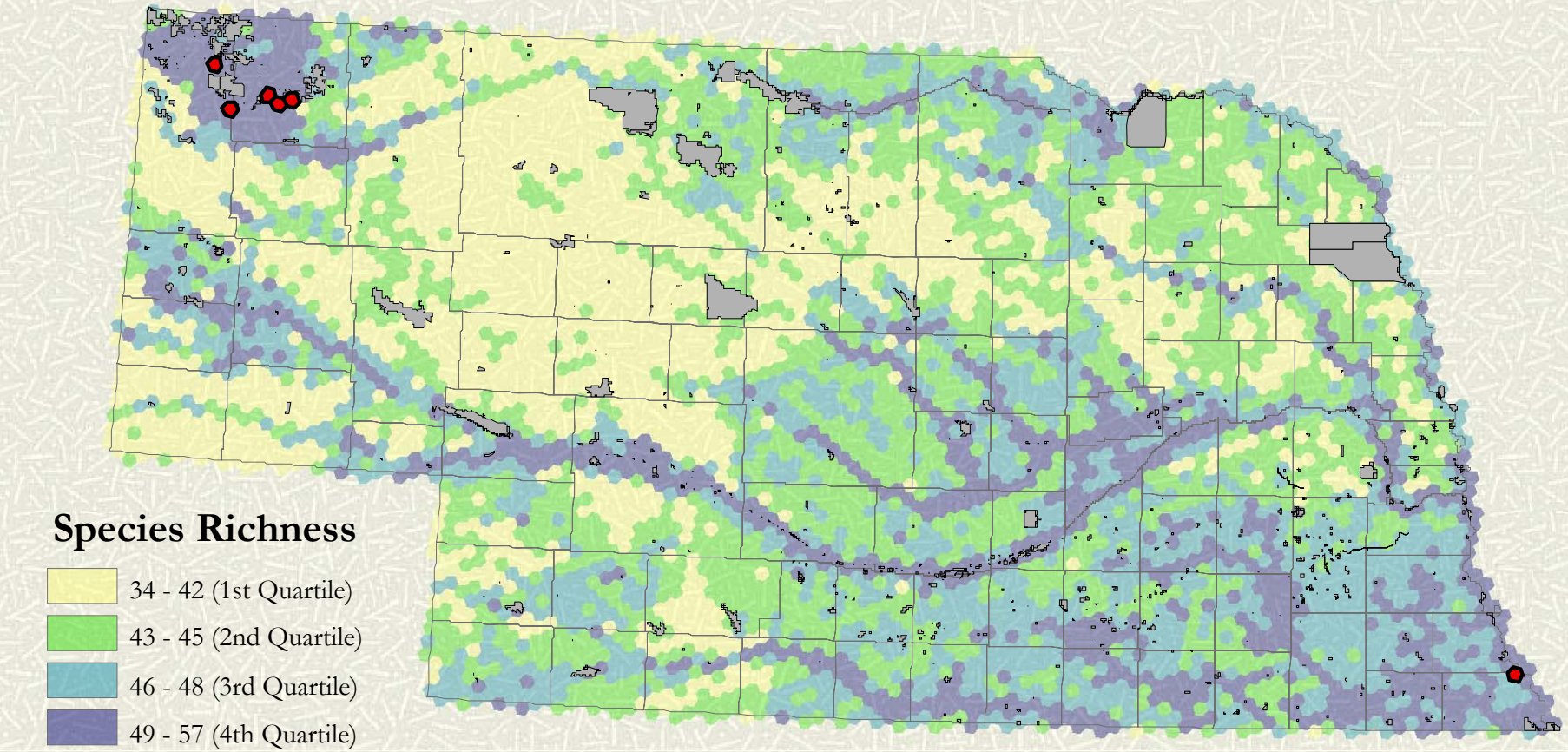


Mgmt Status 1,2,3 x Richness Quartile 4



Gap Analysis of Mammals

Woodland Mask



Mgmt Status 1-4 x Richness Quartile 4