SHERIDAN COUNTY

2014

Comprehensive Plan

Appendix 7:
Energy & Environment

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Geographic Size and Location

Sheridan County is the fourth largest county in Nebraska with a total area of 2,470 square miles. It is located in Northwest Nebraska along the South Dakota border approximately 65 miles east of Wyoming.

The most significant factor regarding the county's location is that it is very isolated in many respects. It is not located within commuting range of a metropolitan or micropolitan city, it is not located near an interstate highway and it is a long distance from its state capitol.

All of the nearest metro cities and micropolitan cities are outside a reasonable commuting range. Rapid City, 133 miles northwest of Rushville, is the nearest metropolitan city. Denver is the nearest large city and it is over 300 miles to the south-southwest. The nearest metropolitan city to the west is Casper, 217 miles distant while the nearest metro city to the east is Sioux City, IA which is 341 miles away. Scottsbluff is the nearest micropolitan town, but it is 110 miles from Rushville and 68 miles from Ellsworth.

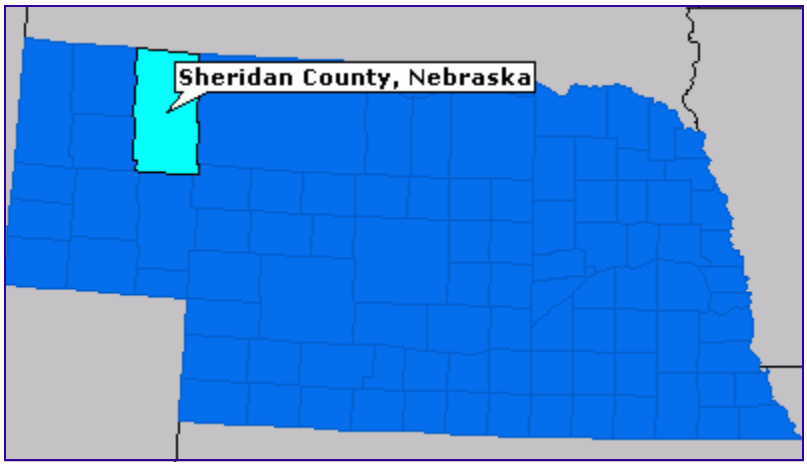
There are two smaller employment centers that are within commuting range from the county. Alliance is just 15 miles from Ellsworth and 45 miles from Hay Springs. Chadron is just 20 miles from Hay Springs and 31 miles from Rushville.

Commuting opportunities from Gordon are more limited as Chadron is 48 miles west, Alliance is 73 miles southwest. Valentine is 92 miles east, and there are not any towns larger than Gordon to the north. However, the long distance to other retail centers provides an advantage to Gordon in that many persons from northwest Sheridan, western Cherry and southern Shannon counties shop for basic goods and services in Gordon rather than driving to the other distant trade centers.

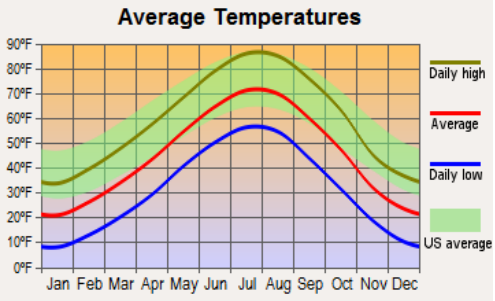
The counties northern towns, especially Gordon, Rushville and unincorporated Whiteclay, benefit from their proximity to the Pine Ridge Indian Reservation. Due to a small number of private businesses and health care facilities on the South Dakota side of the border, many residents of the reservation come to Sheridan County for commercial and health care activities.

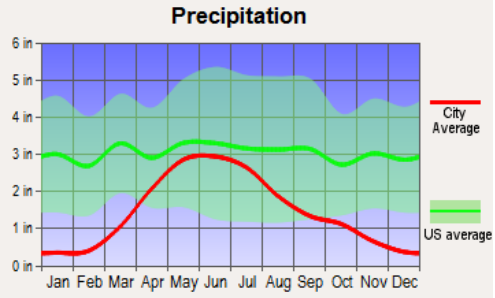
The long distance to interstate highways along commercial highways provides a major impediment to many economic opportunities. Because there are not any reliable commercial highways either straight north or south of the county, the closest access to an Interchange from Rushville is 121 miles to I-90 in Kadoka, but SD Highway 73 is not a commercial highway. Interstate 90 at Murdo, on US Highway 83 is 163 miles away while the closest access via commercial highways is Rapid City 133 miles to the northwest. The closest interstate access in Nebraska is at Sidney 135 miles southwest and 170 miles southeast in Ogallala, although that is not along commercial highways. I-25 is the closest interstate to the west, 157 miles distance while the nearest interstate to the east is Interstate 29 is 341 miles away.

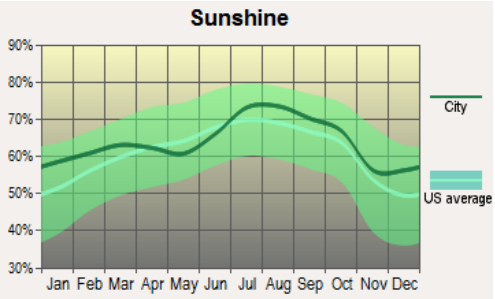
Location of Sheridan County

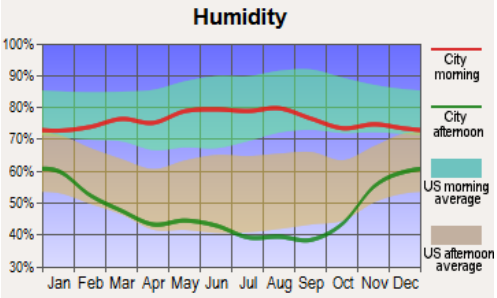


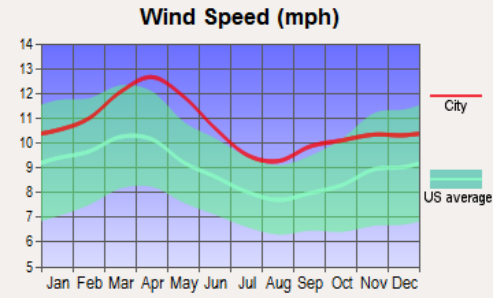
The State capital in Lincoln is approximately 410 miles away from the county seat. The county is actually much closer to the state capitals of South Dakota, Colorado and Wyoming as Pierre, SD is just 215 miles from Rushville, Cheyenne WY is 200 miles away and Denver, CO is 306 miles away. The capital of North Dakota is only 17 miles further away than the Nebraska capital.











Climate

Sheridan County has an attractive semi-arid climate that is highlighted by low humidity and many sunny days.

The county has a semiarid climate as a result of its relatively close proximity to the Rocky Mountains which affect climatic conditions by blocking and redirecting wind patterns and/or precipitation. Over the past 30 years, annual precipitation levels in Rushville have averaged just 18.6 inches a year.

Most of the county's precipitation falls in the form of rain between April and September. June is the wettest month with 2.86 inches of rain, while January is the driest month with just 0.41 inches of precipitation.

The heaviest one day rainfall occurred on June 20, 1965 when 4.15 inches of rain fell. Droughts, though, are more common to the area.

On average, 20 days of the year have at least one inch of snow on the ground, although this varies widely from year to year. The average seasonal snowfall is 57 inches, which also has a high variance.

Due to the county's location near the center of a large continent, extreme variances in temperatures are experienced during the year. In winter, periods of moderately cold temperatures are interrupted by spells of bitterly cold temperatures that can last up to a week or longer. The average high temperature in January is 38 degrees F while the average low temperature in January is 12 degrees F. The lowest temperature ever recorded in Rushville occurred in 1990 when the thermometer dipped to -34 degrees F.

Summers, conversely, are warm with periods of very hot weather. The relatively low humidity, which averages 50% at midafternoon, makes the periods of hot weather more comfortable than in the eastern part of the state. The average high temperature in July is 86 degrees F while the average July low is 58 degrees F. The highest temperature ever recorded in Rushville occurred in 1973 when the thermometer rose to 110 degrees F.

Average wind speeds in Sheridan County are higher than the national average as they typically average 1 to 3 mph higher than the US monthly average. Wind speeds range from an average of 9 mph in August to 13 mph in April.

A majority of the days in the county are sunny. In summer the sun shines more than 70% of the time possible while in the winter the sun shines nearly 60% of the time.

Severe thunderstorms occasionally occur during the spring and summer. Some of these storms are accompanied by hail which can damage or destroy homes, vehicles, and crops. On a scarce

Surface Water Features

The Niobrara River and its tributaries drains the entire county except for a small part of the northwestern part of the county.

Hay Springs Creek, Rush Creek and Antelope Creek drain the northern tablelands into the Niobrara River. All of these steams have flows that are intermittent and slow. Artificial dams create small lakes such as Walgreen Lake.

Box Butte Creek drains the loamy soils west of the sandhills into the Niobrara River. Underground seepage helps to maintain a continuous flow.

There are some small streams in the sandhills that drain into the Niobrara River. The sandhills also has many lakes and ponds that have formed in lowland areas. The soils in areas around the lakes with no outflow are alkaline. Some sandhills lakes, such as Smith Lake, have outlets and inflows that keep their water fresh.

The White River drains part of the northwest corner of the county. White Clay Creek, Beaver Creek, and Wounded Knee Creek all drain into the White River. These creeks have steeper gradients that provide faster flows of water than other parts of the county.

Floodplains

Sheridan County is mapped for flood plains. Many of the county's rivers, streams, and lakes have floodplains beyond their typical water surface. Most of the flood plain areas are very narrow in scope, though.

There are a few flood prone areas in the county where extensive property damage could occur. Most of these areas are nearby the incorporated communities.

Antelope Creek through Gordon is naturally in a 100-year floodplain. Webster Dam, just to the northwest of Gordon, has greatly reduced the potential for severe flooding in Gordon, though.

Only small parts of Rushville and Hay Springs are highly susceptible to flooding. Rush Creek to the west of Rushville is flood prone as is Hay Springs Creek to the south of Hay Springs. There is a very small area in the 100 year floodplain on the very south side of Clinton.

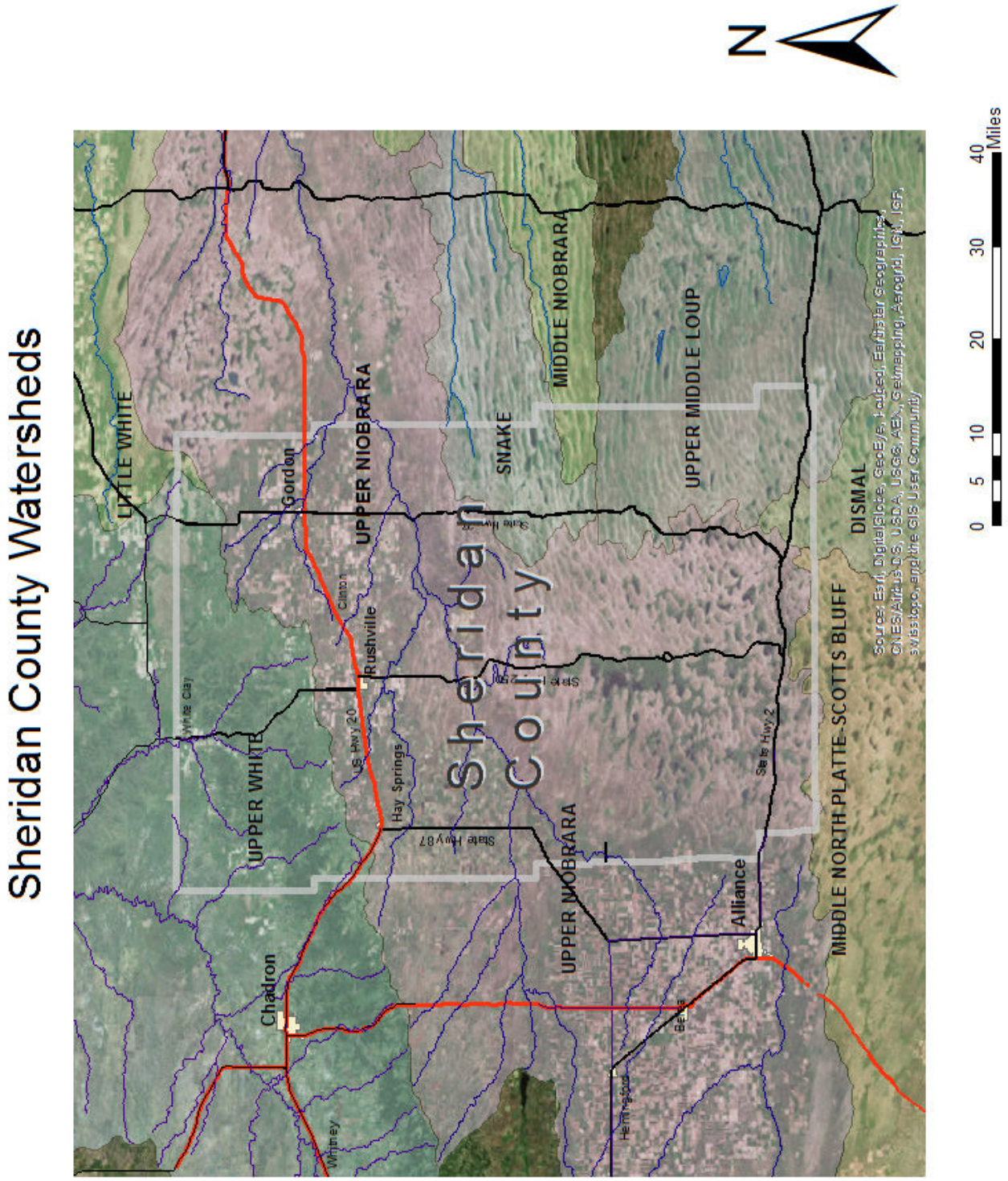
White Clay Creek just to the west of Whiteclay does pose a flooding threat, although Whiteclay itself is just outside the 100-year floodplain.

Most of the lakes in the southern part of the county are not at high risk of flooding. Since there is minimal runoff in the sandhills, there are not many streams that are going to build large amount of runoff.

The most susceptible areas to flooding are naturally areas along streams and rivers where there is runoff that can build up in low lying areas. Most of these areas include the areas along and to the north of the Niobrara River and the Mirage Flats area.

Some of the broader floodplain areas in the county include the area around Walgren Lake, a few isolated areas along the Niobrara River

Unfortunately, to clearly show all flood prone areas in the county would require nearly one hundred 11x17 maps. To see flood prone areas is Sheridan County, one can visit: https://msc.fema.gov/webapp/wcs/stores/servlet/CategoryDisplay


Sheridan County Watersheds
N
0 5 10 20 30 40 Miles
LITTLE WHITE
UPPER NIOBRARA
SNAKE
MIDDLE NIOBRARA
UPPER MIDDLE LOUP
DISMAL
MIDDLE NORTH PLATTE-SCOTTS BLUFF
UPPER WHITE
UPPER NIOBRARA
Sheridan County
Gordon
Rushville
Hay Springs
Chadron
Alliance
Whitney
Hemingford
Bayard
Crawford
Clinton
White Clay
State Hwy 87
State Hwy 2
US Hwy 20
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Groundwater, Surface Water, and Upper Niobrara White Natural Resource District

Groundwater within the Upper Niobrara White NRD is regulated by two mechanisms; the first is the Groundwater Management Area Rules and Regulations that have been developed based on the District's Groundwater Management Plan. These rules and regulations apply to the entire NRD. The other mechanism for ground – and surface water management is the Integrated Management Plan that has been jointly developed by the Nebraska Department of Natural Resources (NDNR). The IMP only applies to that portion of the district that has been declared fully appropriated.

Surface water management is the responsibility of the NDNR. Where ground and surface water are hydrologically connected, the Department and the NRD work together for management of both, which includes the development of a water computer model. The model will be a tool that the entities can use to evaluate various different scenarios and provide information for future decision making. The model is currently being finalized and will be used in the near future. Once in-hand, the public will be engaged to gather input on scenario development. It is also important to note that in the fully appropriated areas, the NDNR has a moratorium on any new surface water uses.

Development of groundwater irrigation has impacted the resource in some areas significantly, thus an increase in management and regulations by both the UNWNRD and NDNR. Areas of concern include the two sub-areas with allocations – sub area 4; Box Butte County and 6; Mirage Flats. The UNWNRD is working with the NDNR on the impacts of groundwater irrigation and surface water supply.

The NRD could require an entity to submit a study or monitoring if there is a potential request that will be made to the board. For example, if a landowner would like to transfer water or certified irrigated acres beyond what is currently allowed, the board may ask for an evaluation prior to considering a variance.

The NRD highly values the role education and voluntary conservation play in management of the resources. Each year the budget includes information and education funds to advance these efforts. A primary driver in seeking voluntary implementation of management practices is that regulations are expensive in terms of staff time to monitor and enforce what has been put into place.

The NRD utilizes several outlets to get the information to the producers, including web sites, news releases, public education sessions, radio announcements and one on one contact.

Unfortunately, and as described previously there are areas that require regulation to ensure the life of the aquifer is extended to the greatest extent possible.

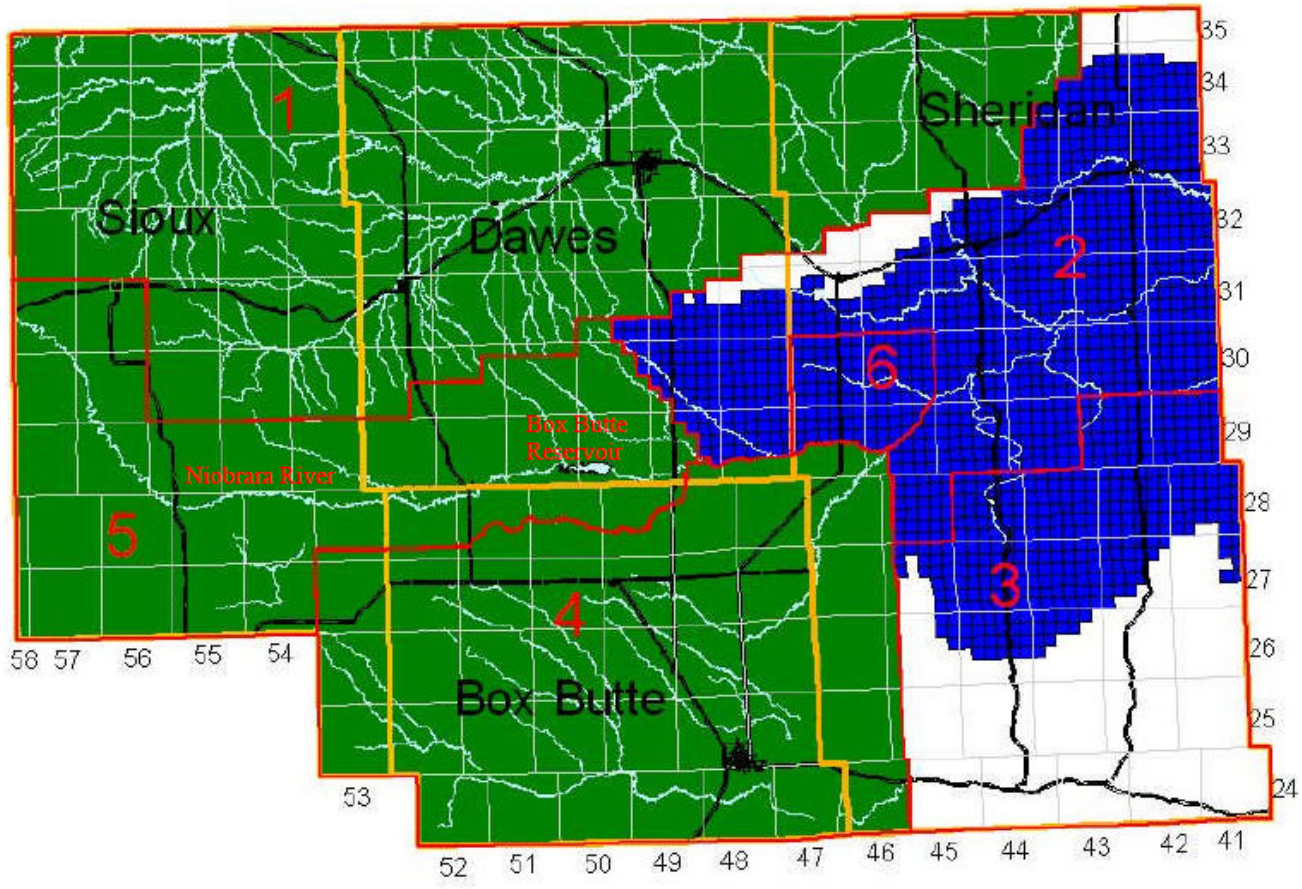
The NRD participates in the Panhandle No-Till Partnership which includes the North Platte NRD, South Platte NRD and USDA – Natural Resources Conservation Service, the partnership promotes no-till crop production throughout the area as a means of reducing erosion, reducing water use and improving soil health.

Another area the district takes a lead role in is the Sediment and Erosion Control program. The NRD is responsible for investigation of complaints and ensuring any problems are addressed.

This page is taken from interview responses from current UNWNRD director Patrick O'Brien, November 2014.

Upper Niobrara White Natural Resource District with Sub areas

Map 1. Dark Green Shaded Area Designated as Fully Appropriated November 3, 2004
Blue Shaded Area Designated as Fully Appropriated January 25, 2008
Red Lines Delineate Sub-area Management Boundaries



Map provided by UNWNRD; Integrated Water Management Plan

Triggered regulations by sub area in Sheridan County:

- **Entire UNWNRD**: Moratorium on new high capacity wells– those that are able to either alone or in combination pump 50 gallons or more a minute.
- **Sub Area 2:** Phase II of groundwater management rules. No new irrigated acres allowed.
- **Sub Areas 4 and 6:** Phase III of groundwater management rules. No new wells and no new irrigated acres. Groundwater allocations in place: 65 inches per acre from 2015-2019.

Ground Water Specifics

Ground water Is the primary source of water for all uses in Sheridan County. In the northern part of the county, rocks are the primary water bearing formations. The White River Group is a relatively poor source of water. Locally its Chadron formation contains small amounts of water in sandstone and gravel beds, but water quality is often poor. The Brule Formation also is an undependable source of water, although some joints, fractures, or faults in the fine-grained siltstone, as well as some sandstone beds, yield enough water for livestock and domestic uses.

The Arikaree and Ogallala Groups form the major aquifers in northern Sheridan County. At the base of the Arikaree Group, the Gering Formation contains permeable sand and sandstone that provide water for nearly any use. The thicker Monroe Creek and Harrison formations above the Gering Formation are formed by the less permeable silty, fine-grained sandstone and sandy siltstone that generally supply water only for livestock or domestic uses. The Arikaree Group contains a large amount of water because it has a saturated thickness of as much as 450 feet. This Group is a complex system of paleovalley deposits with a considerable thickness of fine-grained rocks; therefore, it yields a large amount of water only if a thick interval of the saturated upper formation is penetrated or if the interval includes a thickness of the basal sandstone.

The Ogallala Group contains the most permeable rocks in northern Sheridan County and, in places, is a major source of water. The grain size, sorting, fabric, cementation of the rocks, and complex interbedding can influence efficiency and usefulness of the Ogallala Group as an aquifer.

The complex structure geology of northern Sheridan County affects the occurrence of groundwater in the bedrock. Because of tilted beds and faults, the continuity of deposits is interrupted, thus influencing the occurrence, direction, and rate of movement of groundwater in permeable rocks. However, joints and fractures enhance storage and movement of water in otherwise relatively impermeable masses of rock.

The unconsolidated Quaternary alluvium forms the stream terraces and floodplains in the Niobrara River valley and the smaller stream valleys in northern Sheridan County. It provides aquifers that yields small quantities of water for livestock and domestic uses, especially in areas of coarse-grained alluvium.

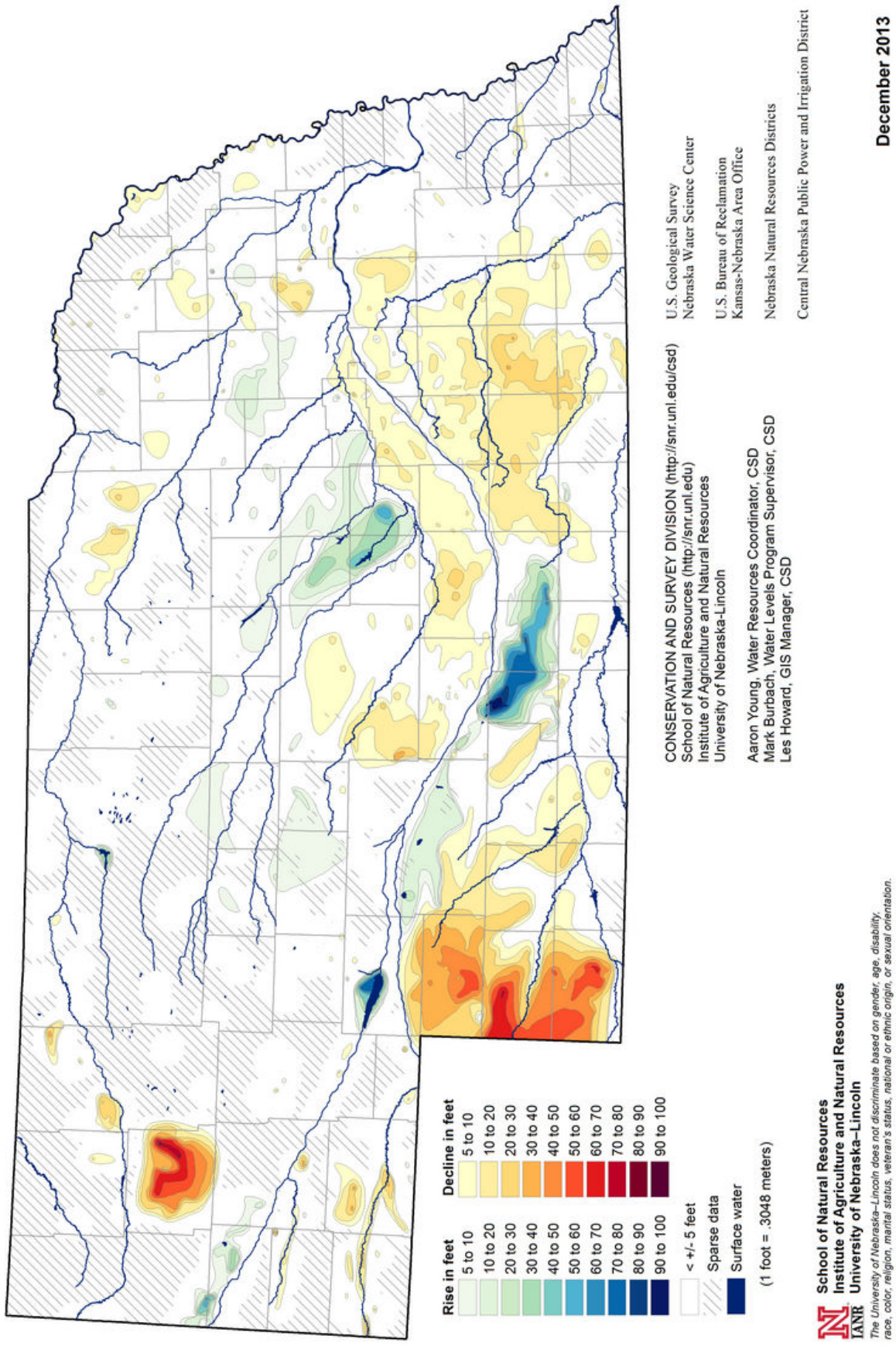
The configuration of the water table in northern Sheridan County is affected by topography. The Pine Ridge separates two distinctly different gradients and shapes in the water table. In the northwestern part of the county north of the Pine Ridge, the gradient is apparently steep and generally north-northwest, reflecting the relatively steep topography and low permeable rocks. The general configuration has local variations because of the topographically high outlines from the Pine Ridge. South of the Pine Ridge, the gradient is less steep and is an easterly direction reflecting a more subdued topography and the presence of more permeable rocks, such as the Ogallala Group. In the northeastern part of the county, where the Pine Ridge is subdued, the ground water divide is also less prominent and trends east-southeast. The actual shape of the groundwater table throughout the northern part of the county is quite complicated because of the many extremes in topography, geologic structure, stratigraphy, tilt of the beds and hydraulic conductivity. The source of groundwater in the area is local precipitation. Discharge to the north of the Pine Ridge is mainly through the stream systems. South of the Pine Ridge, discharges to stream systems, ponds, and the Niobrara River, which is a principal area of groundwater discharge.

The occurrence of groundwater south of the Niobrara river differs from that in the northern part of the county. The main aquifers are the Ogallala group and the unconsolidated Pliocene through Quaternary alluvial sediments. The Ogallala Group is the oldest and thickest aquifer and ranges from about 300 to more than 700 feet thick. The dune sand that mantels southern Sheridan County is extremely important in the total hydrology of the area but does not yield large quantities of water.

Southern Sheridan County is underlain by a shallow groundwater mound that extends into parts of Cherry, Grant, Garden, and Morrill Counties. Ground water flows outward from the mound in all directions. The source of the ground water is precipitation that is rapidly absorbed by the sand or flows as runoff to the numerous lakes and valleys in the sandhills. Little, if any, surface water normally flows out of southern Sheridan County The interaction among precipitation, the hydrology of the lakes and wetlands, and groundwater is complicated and not completely understood. The hydraulic connection between the lakes and groundwater apparently varies from lake to lake

Conditions of the aquifer and groundwater throughout Sheridan County are complex, but the quantity and quality of the water is good for most uses.

-source: Sheridan County Soil Survey


Groundwater-level Changes in Nebraska - Predevelopment to Spring 2013
Rise in feet
5 to 10
10 to 20
20 to 30
30 to 40
40 to 50
50 to 60
60 to 70
70 to 80
80 to 90
90 to 100
Decline in feet
5 to 10
10 to 20
20 to 30
30 to 40
40 to 50
50 to 60
60 to 70
70 to 80
80 to 90
90 to 100
< +/- 5 feet
Sparse data
Surface water
(1 foot = .3048 meters)
CONSERVATION AND SURVEY DIVISION (http://snr.unl.edu/csd)
School of Natural Resources (http://snr.unl.edu)
Institute of Agriculture and Natural Resources
University of Nebraska-Lincoln
Aaron Young, Water Resources Coordinator, CSD
Mark Burbach, Water Levels Program Supervisor, CSD
Les Howard, GIS Manager, CSD
U.S. Geological Survey
Nebraska Water Science Center
U.S. Bureau of Reclamation
Kansas-Nebraska Area Office
Nebraska Natural Resources Districts
Central Nebraska Public Power and Irrigation District
December 2013
School of Natural Resources
Institute of Agriculture and Natural Resources
University of Nebraska–Lincoln
IANR
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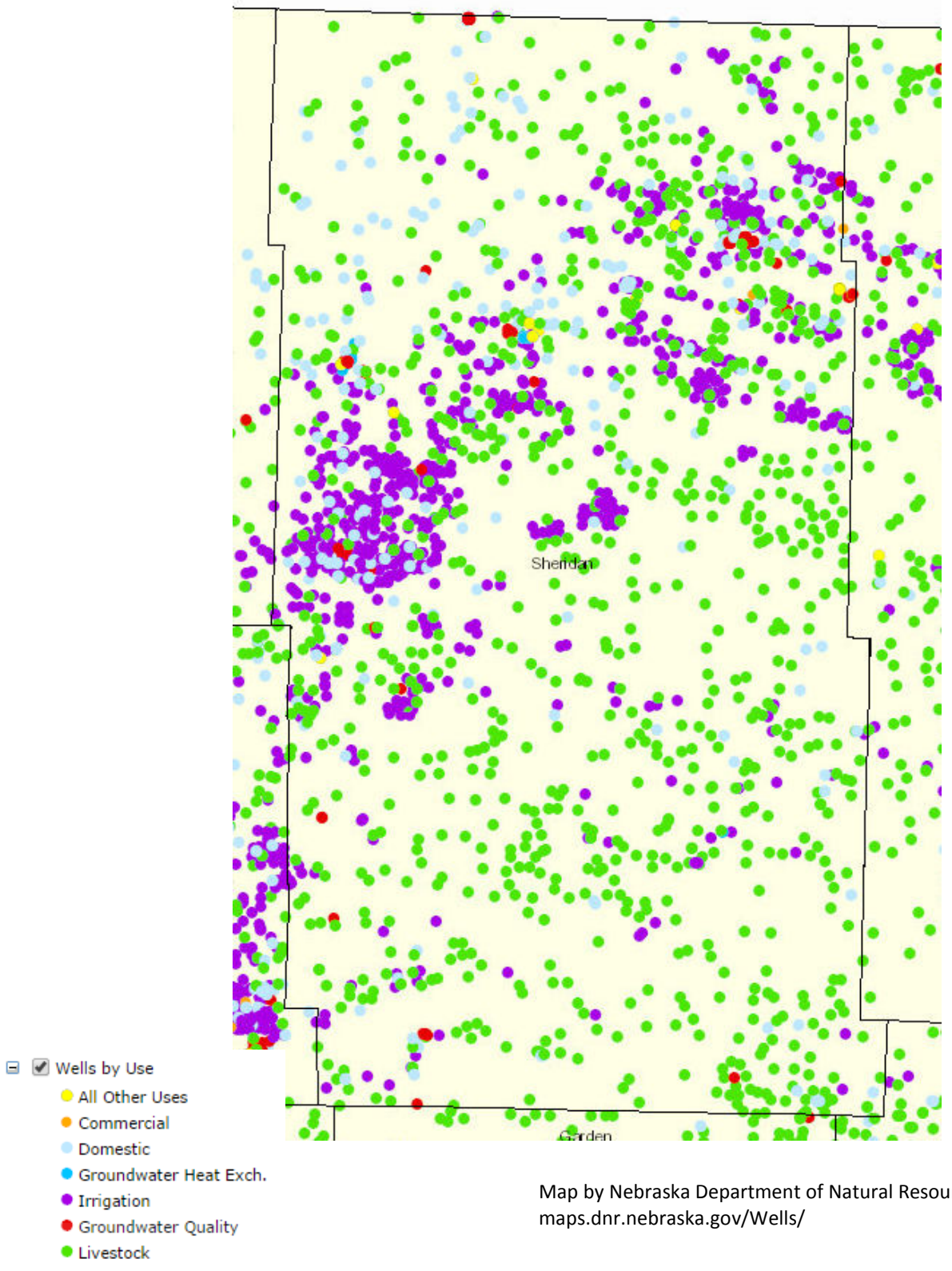
Registered Wells in Sheridan County



Map by Nebraska Department of Natural Resources
maps.dnr.nebraska.gov/Wells/

Physiography/Elevation

Sheridan County is located in the High Plains region of the Great Plains. The county can be subdivided into four major landform groups. The part of the county south of the Niobrara River, or about 60 percent of the total area of the county, is part of the sandhills. About a third of the county north of the Niobrara River to the Pine Ridge escarpment is a tableland that dips to the southeast. This tableland makes up the highest and most nearly level land in the county. It is a remnant of the High Plains and is a transitional area between the Sandhills area and the Pine ridge escarpment on its northwestern edge. In the extreme northwest corner of the county is the Chadron Dome, which exposes the oldest geological materials.

The elevation of the county ranges from around 4,000 feet north of Hay Springs to 3,500 feet where the Niobrara River exits the county. Some of the sandhills have elevations that top 4,000 feet in elevation, including Big Hill on the eastern border tops out at 4,144 feet.

Geology

The oldest exposed rock unit in Sheridan County are the Carlile Shale, the Niobrara Formation, and the Pierre Shall of the Cretaceous period. These units are in a small area of about 25 miles in the extreme northwest corner of the county. The Niobrara Formation, which consists of chalk, calcareous shale, and limestone, is the most extensive of the units.

In other areas of the county, from oldest to youngest, Tertiary rocks of the White River group; the Chadron and Brule formations; the Gering, Monroe Creek, and Harrison Formations of the Arikaree Group; and the Ogallala Group form the bedrock. The Brule and the formations of Arikaree Group crop out or are near the surface throughout much of the northern fourth the county.

Topographically, this area is the steeply eroded, northwest facing slope of the Pine Ridge. The Brule Formation is pinkish to brownish and sandy siltstone containing occasional sandstone beds. It is believed to have formed mainly from wind-deposited silt made up mainly of shards and fragments of volcanic glass. The Gering Formation is mainly buried valley and small channel deposits of grayish, very fine to medium grained sandstones. The overlying beds of the Monroe Creek and Harrison Formations are pale brownish, very fine and fine, silty sandstone and sandy siltstone containing calcareous nodules and concretions. Much of the material in these beds may have been deposited by the wind.

The Ogallala group of Miocene age forms the bedrock in the extreme northeastern corner in the southern and the southern three-quarters of the county. It extends south of a line roughly about 12 miles north of, and parallel to, the Niobrara river. Originating from an ancient flood plane and from stream deposits of quartz, feldspar, and rock fragments from mountains to the west, the rocks in the Ogallala group have lithologies varying among silty and silty clay sandstones, sandy and clayey siltstones, caliche limestones, and sand and gravel. Cementation is by carbonates, compaction of the silt and clay matrix, and clay weathered from feldspars and other mineral fragments. The colors of the rocks include gray, greenish-gray, brown and white. The thickness of the Ogallala Group is more than 350 feet in the area where it fills in east-west trending paleovalley across central Sheridan County.

Deformation associated with the uplifts of the mountains to the west and the Black Hills to the north has profoundly influenced the geology in Sheridan County. The Chadron Arch, which crosses the subsurface from southeast to northwest near the center of the county, forms the eastern edge of the Denver-Julesburg structural basin to the southwest. Folding and faulting has influenced the positioning of the bedrock units, the erosion exposing them, and the drainage features in the county.

Unconsolidated Quaternary deposits are generally less than 50 feet thick in the northern part of the county north and west of the sandhills that mainly border the Niobrara River. In parts of the Niobrara River valley these deposits are more than 100 feet thick. These sediments occupy a limited area on the uplands and are formed by wind-deposited silt and sand along the slope wash. In the stream valleys sandy and silty alluvial deposits from relatively flat floodplain terraces.

In extreme northeastern corner of the county and southward from near the Niobrara River, the Quaternary deposits include bedded sequences of the locally silty sand and gravel, silty and clayey sands, silt and clayey silt that are predominantly fluvial origin. These deposits are overlain by young dune sand that is predominantly fine sand in a variety of sand dune, interdune, and sand sheet configurations that are more than 200 feet thick.

-source: Sheridan County Soil Survey

Soils

The following pages highlight the major soils in Sheridan County and their development-related characteristics. A map of local soils and more detailed information can be found in the Sheridan County soil survey.

Areas of soils formed in material weathered from interbedded chalk and shale or from siltstone and areas of rock outcrop

1. Enning-Rock Outcrop-Minnequa association

This association is in the northwestern corner of the county, which is known locally as the Chadron Dome. It consists of gently sloping to very steep side slopes and ridges and broad, gently sloping foot slopes. Rough, broken side slopes and escarpments along some of the deeply entrenched drainageways. Runoff flows toward the White River.

This association makes up about 19,840 acres or about 1% of the county.

This association has areas of rock outcrop and shallow and moderately deep, gently sloping to very steep, well-drained, silty soils; on upland.

Nearly all of this association supports native grasses and is used for grazing. Nearly all of the acreage is used for feeder calf operations. A small area of the gently sloping soils is cultivated, and dryland wheat and alfalfa are the main crops.

An inadequate supply of water for livestock limits grazing. Precipitation that accumulates in stock water ponds is the only source of water for livestock except in areas served by pipelines. Wells yield low quantities of water that has a high mineral content. Some of this water is not suitable for domestic use.

Water erosion and soil blowing are hazards affecting cultivated areas. The soils are low in natural fertility.

Very few ranch headquarters are in this association. Trails supplement the one unimproved dirt road that crosses part of the area.

2. Thirtynine-Kadoka-Epping association

This association is between the Pine Ridge and the Chadron Dome. It consists mainly of nearly level to very steep ridgetops, steep slopes, and breaks along creeks and intermittent drainageways. The creeks originate mainly in the Pine Ridge area and flow north toward the White River.

This association makes up about 30,720 acres, or about 2% of the county.

The soils are very deep, moderately deep, and shallow, nearly level to very steep, well-drained, silty and loamy soils; on uplands.

Farms in this association are diversified. Most of the farms are cash-grain and livestock enterprises. Most of the acreage of the soils in this association supports native grasses and is used for grazing or hay. The main livestock enterprise is a production of beef cattle. About 40 percent of this association is cultivated. Dryland wheat, millet, and alfalfa are the principal crops.

Areas of soils formed in material weathered from calcareous sandstone and areas of rock outcrop; in the Pine Ridge area

3. Tassel-Pondrosa-Rock outcrop association

This association is in the northern part of the county and is known locally as the Pine Ridge. It consists mainly of steep and very steep side slopes, ridges, and breaks that are covered with Ponderosa Pine. Many areas of rock outcrop, canyon walls, and escarpments are in this area. The rest of the area is strongly sloping to steep.

This association makes up about 137,600 acres or about 9% of the county

These soils have areas of rock outcrop and shallow and very deep, strongly sloping to very steep, well-drained, loamy soils; on uplands.

Nearly all of this Association supports native grasses and woodland and is primarily used for grazing. Most of the areas are generally too steep for cultivation. Some of the more gently sloping soils on some broad ridgetops and foot slopes are cultivated. Dryland wheat and alfalfa are the main crops and are used mainly as winter feed for livestock.

The steep and very steep topography, the areas of rock outcrop, and the shallow soils limit the use of most areas of this association to range, woodland, recreational areas, and wildlife habitat. This area provides good recreational sites and excellent habitat for deer, turkey and other upland wildlife. It has good potential for further development of wildlife habitat and recreational sites. Most of the association supports ponderosa pine and has good potential for commercial timber production.

Water erosion and soil blowing are the main hazards affecting cultivated areas. A system of conservation tillage that keeps protective amounts of crop residue on the surface and the use of cover crops help control erosion. Proper grazing years, timely deferment of grazing, and a planned grazing system help to maintain or improve the range condition. Proper woodland management that improves forest stands is a concern.

Soils formed in loess and material weathered from calcareous sandstone

4. Oglala-Alliance-Canyon association

This association consists of nearly level to steep side slopes, ridge tops, and shoulders of uplands. It is on some of the highest elevations in the county and make up the drainage divide between the White River to the north and the Niobrara River to the south.

This association makes up about 133,760 acres, or about 8% of the county.

This area has deep and shallow, nearly level to steep, well-drained, loamy soils; on uplands..

Farms in this association are diversified, mainly a combination of cash-grain and livestock enterprises. The nearly level to strongly sloping areas generally are cultivated. The steep areas and some of the strongly sloping areas generally support native grasses and are used for grazing. The shallow canyon soils limit root development. The main drying crops are wheat, alfalfa, oats, and millet. A few areas are irrigated corn, and alfalfa are the main crops.

Water erosion and soil blowing are the main hazards affecting cultivated areas. A system of conservation tillage that leaves crop residue on the surface and the use of cover crops help to control erosion and conserve moisture.

5. Santana-Canyon-Busher association

This association consists mainly of soils on side slopes, shoulders, and ridgetops. Many areas are dissected by drainageways. Slope range from 0 to 30 percent.

This association makes up about 71,040 acres, or about 4% of the county.

This area has very deep, deep, and shallow, nearly level to steep, well-drained, loamy soils; on uplands.

Farms in this association are diversified, with winter wheat and cattle as the main enterprises In areas that are irrigated by a sprinkler or a gravity system, dry, edible beans; corn; and alfalfa are grown. The shallow canyon soils limit root development for cultivated crops. Cattle and grain are marketed locally or in adjacent counties. A system of conservation tillage that keeps protective amounts of crop residue on the surface and the use of cover crops help to control erosion. Proper grazing use, timely deferment from grazing, and a planned grazing system help improve or maintain the range condition.

6. Tuthill-Keya association

This association consists of soils on uplands and in upland swales. Slopes range from 0 to 11 percent.

This association makes up 126,080 acres, or about 8% of the county.

This area has very deep, nearly level to strongly sloping, well-drained, loamy and sandy soils on uplands.

Farms in this association are diversified grain and livestock enterprises. Winter wheat and alfalfa are the main crops. Some cultivated areas are planted to sunflowers and millet. Some areas support native grasses and are used as range. Grain and cattle are marketed locally or in adjacent counties. Alfalfa is used as winter feed for cattle.

Erosion is the main hazard in cultivated areas. A system of conservation tillage that keeps protective amounts of crop residue on the surface and the use of cover crops help to control erosion and conserve moisture. Proper grazing use, timely deferment of grazing, and a planned grazing system help improve or maintain the range condition.

7. Busher-Tassel association

This association consists mainly of soils on ridgetops, shoulders, side slopes, and breaks on uplands. Slopes range from 0 to 30 percent.

This association makes up about 10,880 acres, or less than 1% of the county.

This area has deep and shallow, nearly level to steep, well-drained, loamy soils; on uplands.

The soils in this association support native grasses and are used as range. They are not suitable for cultivation because of the slope, the shallow root zone, and the hazard of erosion. The use of the soils as range helps to control erosion. Proper grazing use, timely deferment of grazing, and a planned grazing system help improve or maintain the range condition. Livestock are sold locally or in adjacent counties.

8. Busher-Valent-Tassel association

This association is on breaks, dunes, and ridges on the uplands and on side slopes adjacent to upland drainageways. Most of the intermittent drainage ways are tributaries of the Niobrara River.

This association makes up about 3,520 acres or less than 1% of the county.

This area has very deep, deep, and shallow, nearly level to very steep, well-drained and excessively drained, loamy and sandy soils; on uplands.

Water erosion is a principal hazard affecting areas used for range, and soil blowing is the principal hazard affecting cultivated areas. Insufficient rainfall in summer generally limits the growth of grasses and cultivated crops. A restrictive layer in some of the soils limits root growth and the available water capacity for the production of grasses and crops. Regulating the timing and intensity of grazing and improving the range condition are the principal management concerns affecting range. Controlling soil blowing and improving fertility are the management concerns affecting cultivated areas.

Farms and ranches in this association average about 2,000 acres. Many of the owners or operators live outside this association. Wells provides sufficient water for livestock and domestic use. Cattle is the main livestock enterprise, and most cattle are marketed outside the county at sale barns or at larger terminal markets. Some of the yearling calves are sold directly to feeder buyers. Cash-grain crops are marketed locally. Very few improved roads are in this association. Trails provide access to most areas.

Areas of Soils formed in mixed loess and alluvium and areas of rock outcrop

9. Keith, gravelly substratum-Bridget-Johnstown association

This association consists mainly of soil on uplands adjacent to the Niobrara River. Slopes range from 0 to 6 percent.

This association makes up about 24,960 acres, or about 2% of the county.

This area has very deep, nearly level to gently sloping, well-drained, loamy soils; on uplands, foot slopes, and alluvial fans.

Farms in this association produce winter wheat. In irrigated areas corn and dry, edible beans are the main crops.

Water erosion and soil blowing of the main hazards. A system of conservation tillage and the use of cover crops to help to control erosion and conserve moisture. Farm produce is marketed mainly within the county or in adjacent counties

10. Beckton-Lute assocation

This association consists of soils in alluvial fans and low stream terraces that have a high content of sodium. Slopes range from 0 to 2 percent.

This association is about 24,320 acres, or about 2% of the county.

This area has very deep, nearly level, moderately well-drained and somewhat poorly drained, loamy soils; on alluvial fans and low stream terraces.

Nearly all of this association supports native grasses used as a range or hayland Some areas are used as cropland.

Farms in this association or diversified cattle and grain enterprises. Winter wheat is the main cultivated crop and is grown mainly in the areas that are least affected by sodium. Some alfalfa is also grown.

The use of the soils in this association as range or hayland is effective in controlling soil erosion. In cultivated areas a system of conservation tillage that keeps protective amounts of crop residue on the surface and the use of cover crops to help to control water erosion and soil blowing and conserve moisture.

11. Orpha-Calamus-Rock outcrop association

This association consists mainly of the valley sides in the valley floor along the Niobrara River. Slopes range from 0 to 60 percent.

This association makes up about 62,080 acre or about 4% of the county.

This area has areas of a rock outcrop and very deep, nearly level to very steep, excessively drained and moderately well-drained, sandy soil; on uplands, foot slopes, and bottomland.

The soils in this association mainly support native grasses and are used as range. The Orpha soils are generally too steep for cultivation. The Calamus soils are subject to rare flooding and the hazard of soil blowing. Some areas of the Calamus soils are used for native hay, but in a few areas alfalfa is grown for use as winter feed. Cattle are marketed locally or in adjacent counties

Soils Formed in Sandy Eolian Material and Sandy Alluvium

12. Valent-Dailey association

This association is in the sandhills and consists of hummocks and smooth side slopes.

This association makes up about 92,160 acre, or 6% of the county.

This area has very deep, nearly level to rolling, excessively drained and somewhat excessively drained, sandy soils; in the sand hills.

Farms and ranches in this association mainly support native grasses and are used as range. The less sloping areas are cultivated. Corn and alfalfa are grown in irrigated areas. Winter wheat is the main dryland crop.

Soil blowing is the principal hazard in cultivated areas or in overgrazed areas that are unprotected by plant cover.

Cattle and cash-grain crops are marketed locally or in adjacent counties. Alfalfa is used as winter feed.

13. Valient association

This association consists of sandhills. The rolling and hilly dunes are interspersed with gently undulating and undulating dunes. Catsteps are common on the steepest slopes.

This association makes up about 413,229 acres, or about 26% of the county.

This area has very deep, rolling and hilly, excessively drained, sandy soils; in the sand hills.

Nearly all of this association supports native grasses and is used for range and hayland. The rolling and hilly areas are used for range, and the nearly level and gently undulating areas are used for range and as hayland. A small acreage of the nearly level to gently sloping areas is cultivated. Corn, mixed grasses, and alfalfa are grown. Nearly all the cultivated areas are irrigated by center pivot or other sprinkler systems.

Ranching is well adapted to the soils in this association. Management that includes proper grazing use, timely deferment of grazing or haying, and a grazing system in which the order of grazing and rest periods are changed each year helps to maintain or improve the range condition. Erosion is the main hazard affecting cultivated areas. A system of conservation tillage that leaves crop residue on the surface helps to control erosion. In irrigated areas, timely application of irrigated water and improvement of fertility are the main management concerns.

Cattle and cash-grain crops are marketed locally or in adjacent counties. Alfalfa is used as winter feed.

14. Valient-Wildhorse association

This association consists of sandhills interspersed with valleys. The dunes range as much as 300 feet above the valley floors. The dunes on the north side of the valley are generally very steep and have catsteps, and those on the south side of the valleys are generally rounded and smoother. The valleys are nearly level and very gently sloping. They have numerous lakes and wet areas that are surrounded by better drained soils.

This association makes up about 238,720 acres, or about 15% of the county.

This area has very deep, nearly level to hilly, excessively drained and somewhat poorly drained, sandy soils; in the sandhills..

Nearly all of this association supports native grasses and is used for range and hayland. The rolling and hilly areas are used for range, and the larger, wet valleys are used mainly for the production of native hay. In a few cultivated areas sprinkler irrigation systems are used. Alfalfa and mixed grasses are grown.

Ranching is well adapted to the soils of this association. Management that includes proper grazing use, timely deferment of grazing or haying, and a grazing system in which the order of the grazing and rest periods are changed each year helps to maintain or improve the range condition. In cultivated areas control of soil blowing, timely application of irrigation water, and improvement of fertility of the main management concerns.

Cattle are marketed in local sales barns, sold directly to feeder operations, or hauled by truck to large terminal markets.

15. Valent-Els, calcareous-Hoffland association

This association consists of sandhills and wet valleys. The hills are as much as 400 feet above the valley floors and are generally steep and very steep on the north side of the valleys. Catsteps are common on the steep slopes. The valleys are nearly level and very gently sloping and are interspersed with lakes.

This association makes up about 117,120 acres, or about 7% of the county.

This area has very deep, nearly level to hilly, excessively drained, somewhat poorly drained, poorly drained, and very poorly drained, sandy and loamy soils; in the sand hills.

Nearly all of this association supports native grasses and is used for range and hayland. The rolling and hilly areas are used for range, and the wet valleys are used mainly for the production of native hay. In a few small cultivated areas sprinkler irrigation systems are used. Alfalfa is the principal crop.

Ranching is well adapted to the soils in this association. Maintaining desirable grasses through a grazing system in which the order of the grazing and rest periods are changed every year and establishing adequate and proper placement of water facilities are the main management concerns. In cultivated areas timely application of irrigation water, control of soil blowing, and improvement of fertility are the main management concerns.

Cattle are marketed in local sales barns, sold directly to feeder operations, or hauled by truck to large terminal markets.

16. Valentine-Tryon-Ipage association

This association consists hummocky sandhills with intervening wet valleys. Slopes range from 0 to 60 percent. The soils in this association formed in eolian sand and alluvium.

This association makes up 76,160 acres, or about 5% of the county.

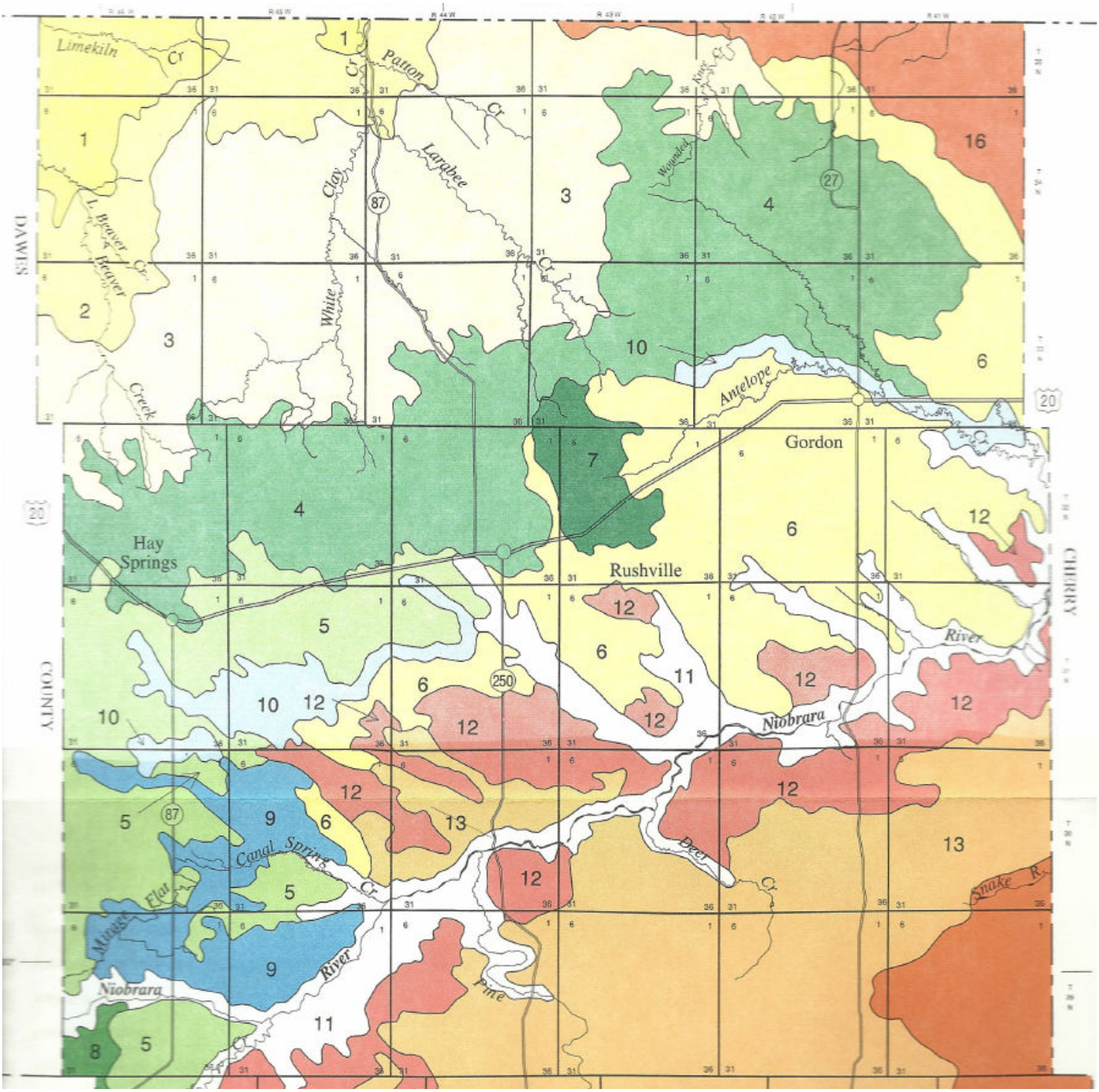
This area has very deep, nearly level to hilly, excessively drained, moderately well drained, poorly drained, and very poorly drained, sandy and loamy soils; in the sandhills.

Nearly all of this association supports native grasses used for range and hayland. The sub irrigated valleys are used as hayland. Most of this association is unsuited to cultivated crops because of the slopes and the wetness of the valleys. Ranches in this association are predominantly cow-calf livestock enterprises. Wells provide good quality water for livestock.

Overgrazing can reduce the protective cover and result in deterioration of the native plants.

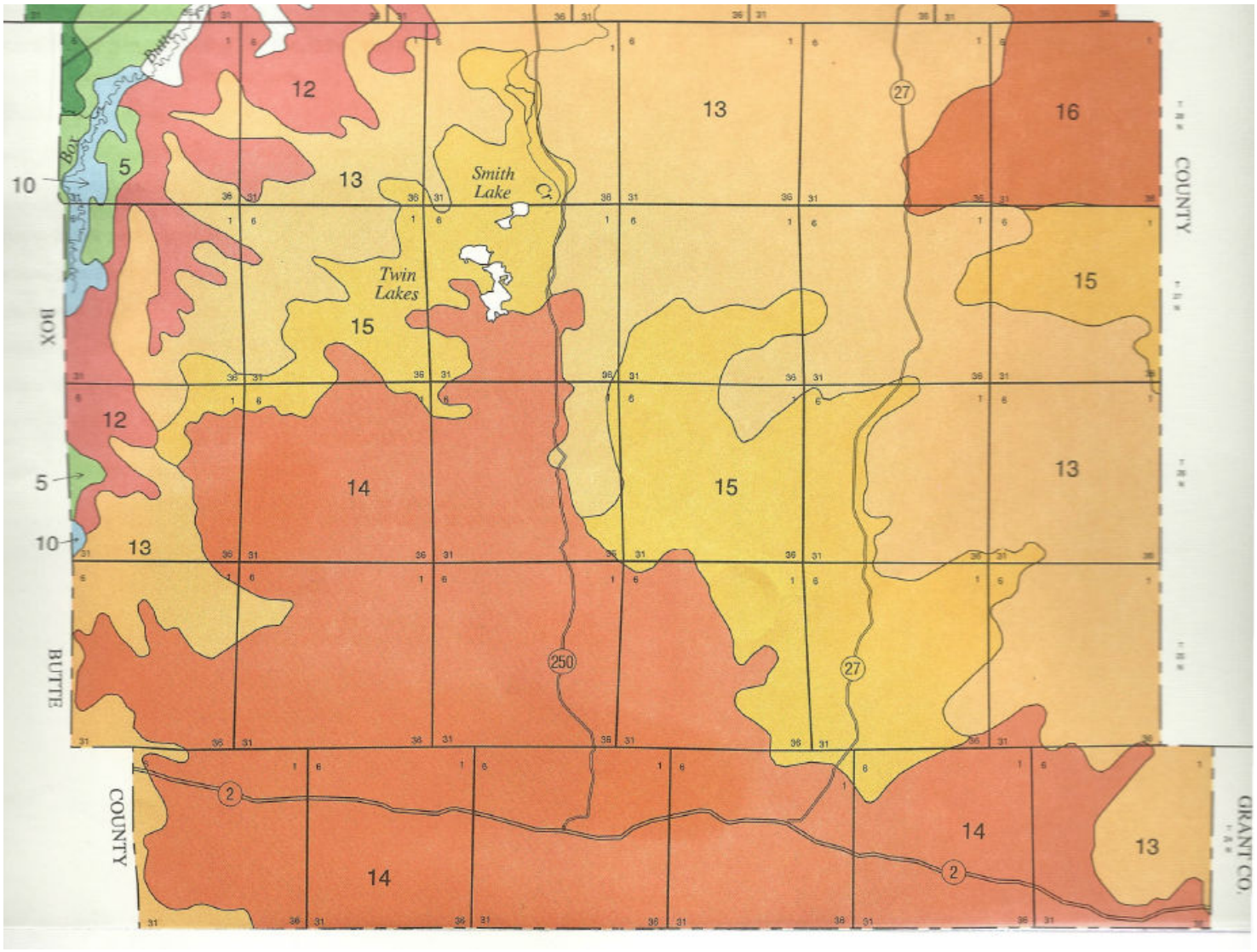
Management that includes proper grazing use, timely deferment of grazing and haying, and restricted use during very wet periods helps to maintain the range condition. The seasonal high water table benefits grasses during dry periods that hinders haying during wet periods. Soil blowing can be controlled by an adequate plant cover.

Soils in Northern Sheridan County



1. Enning-Rock Outcrop-Minnequa association; 2. Thirtynine-Kadoka-Epping association; 3. Tassel-Pondrosa-Rock outcrop association; 4. Oglala-Alliance-Canyon association; 5. Santana-Canyon-Busher association; 6. Tuthill-Keya association; 7. Busher-Tassel association; 8. Busher-Valent-Tassel association; 9. Keith, gravelly substratum-Bridget-Johnstown association; 10. Beckton-Lute association; 11. Orpha-Calamus-Rock outcrop association; 12. Valent-Dailey association; 13. Valient association; 14. Valient-Wildhorse association; 15. Valent-Els, calcareous-Hoffland association; and, 16. Valentine-Tryon-Ipage association

Soils in southern Sheridan County



1. Enning-Rock Outcrop-Minnequa association; 2. Thirtynine-Kadoka-Epping association; 3. Tassel-Pondrosa-Rock outcrop association; 4. Oglala-Alliance-Canyon association; 5. Santana-Canyon-Busher association; 6. Tuthill-Keya association; 7. Busher-Tassel association; 8. Busher-Valent-Tassel association; 9. Keith, gravelly substratum-Bridget-Johnstown association; 10. Beckton-Lute association; 11. Orpha-Calamus-Rock outcrop association; 12. Valent-Dailey association; 13. Valient association; 14. Valient-Wildhorse association; 15. Valent-Els, calcareous-Hoffland association; and, 16. Valentine-Tryon-Ipage association

Required Energy Element

During the 2010 legislative session, LB 997 was enacted to require cities and counties to include an energy element in their comprehensive development plans that "Assesses energy infrastructure and energy use by sector, including residential, commercial, and industrial sectors; evaluates utilization of renewable energy sources; and promotes energy conservation measures that benefit the community."

Local Energy Resources

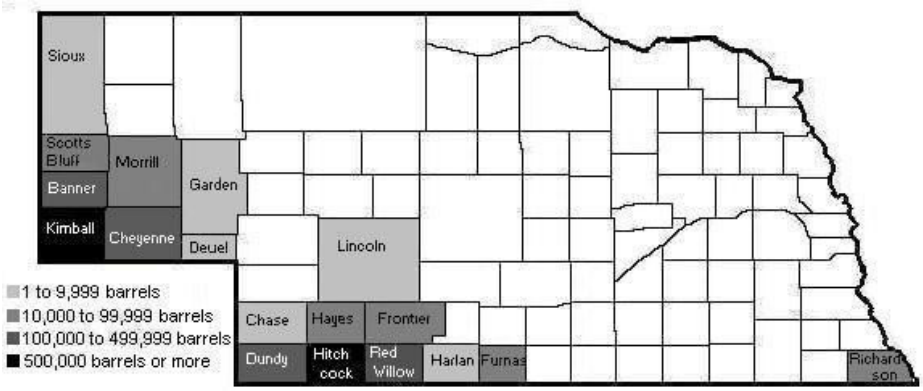
- Oil Resources and Production
- Natural Gas Resources and Production
- Wind Energy Resources
- Solar Energy Potential
- Geothermal Potential
- Biomass Potential

Oil Resources/Consumption

Sheridan County does not produce any oil.

It is estimated that Nebraska consumed 40,357,000 barrels of oil in 2009. This equates to 22.46 barrels per person (approx 943 gallons). Based on this ratio, it is estimated that Sheridan County uses 122,833 barrels of oil (5,159,017 gallons) annually. At $85/barrel (below current market rates), the county consumes $10,440,805 worth of oil annually, Given the county's agricultural base, the county likely uses more fuel per capita than the state average.

Crude Oil Production by County in Nebraska, 2010

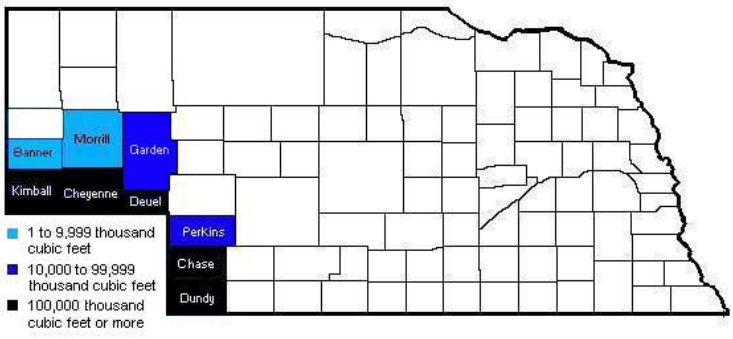


Natural Gas Resources/Consumption

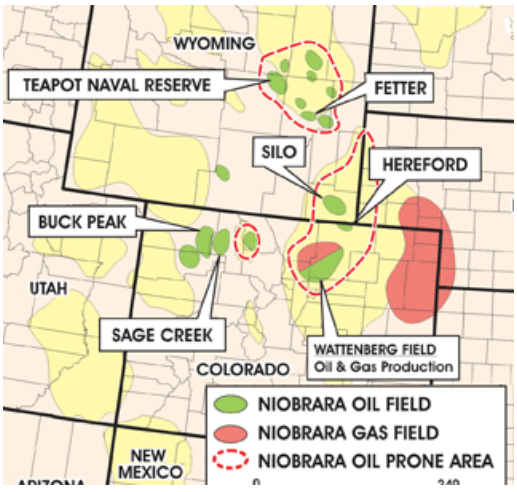
Sheridan County does not produce any natural gas.

It is estimated that Nebraska consumed 153.5 trillion BTUs of natural gas. This equates to 85.5 million BTUs per person. Based on this ratio, it is estimated that Sheridan County uses 467 billion BTUs annually. At $$7.05 per BTU, the county consumes $3,300,000 worth of natural gas annually.

Natural Gas Production by County, 1984 to 2009

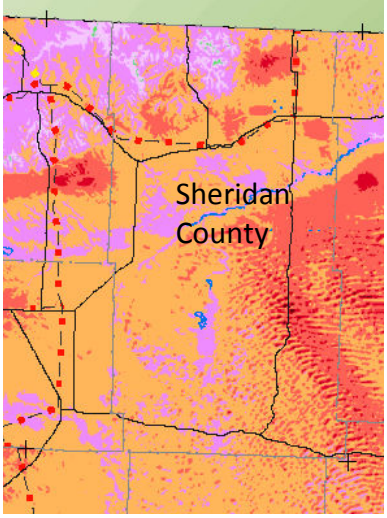


Niobrara Oil and Gas Basin



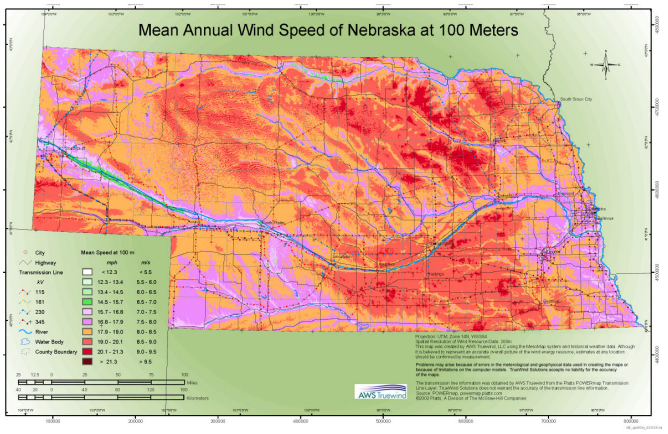
Wind Energy

Mean Annual Wind Speed at 100 meters



Sheridan County has both natural and physical assets which provide opportunities for wind energy development, especially in the northwest part of the county. These assets include above average wind speeds, proximity to major transmission lines (roughly along the Highway 20 corridor from Gordon to Chadron and near Highway 27 north of Gordon) and cheap land.

Despite having the basic assets the wind industry needs, neither Sheridan County nor any of its neighboring counties have a single commercial wind farm or manufacturing facility. The county's distance to a large population center certainly hinders its raw potential, as does state policy regarding wind energy. Together, these two obstacles do not provide much promise for near-term wind energy development in Sheridan County. Even though South Dakota has twice as much wind energy development as Nebraska, the wind industry is almost non-existent west of the Missouri River in that state. The one exception being a single turbine constructed by a Native American tribe in Todd County, SD.



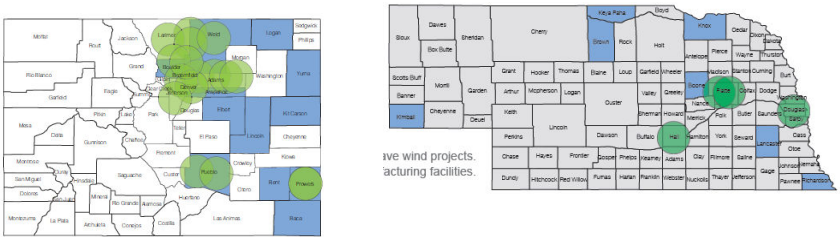
The wind energy industry is strong in Colorado, though, as they are a national wind energy leader generating the third highest percentage of power from wind of any state. Colorado has also attracted major manufacturing investment to their state, becoming the national hub for Vestas. There are 18 facilities in Colorado currently manufacturing for the wind industry.

The most notable state policy difference is that Colorado has a Renewable Portfolio Standard (RPS) of 30% by 2020 while Nebraska does not have an RPS. Even though the renewable energy mandate may provide a potential market in Colorado for a county development, developments to serve this market from Nebraska are at a disadvantage because Colorado provides 1.2 RPS credits for projects located in Colorado while Nebraska does not provide any meaningful incentives for wind energy development. Delivering electricity from wind power from the county to the large Colorado market is further complicated by the county being in the eastern power grid and Colorado being in the western power grid.

In Nebraska, the largest energy markets are in the east, which makes projects in the northeast and north central more efficient locations for development to serve eastern Nebraska. There are also many other issues such as the least cost mandate, transmission issues, and the presence of small public power districts that do not benefit from the federal production tax credit that hinder wind development in Sheridan County.

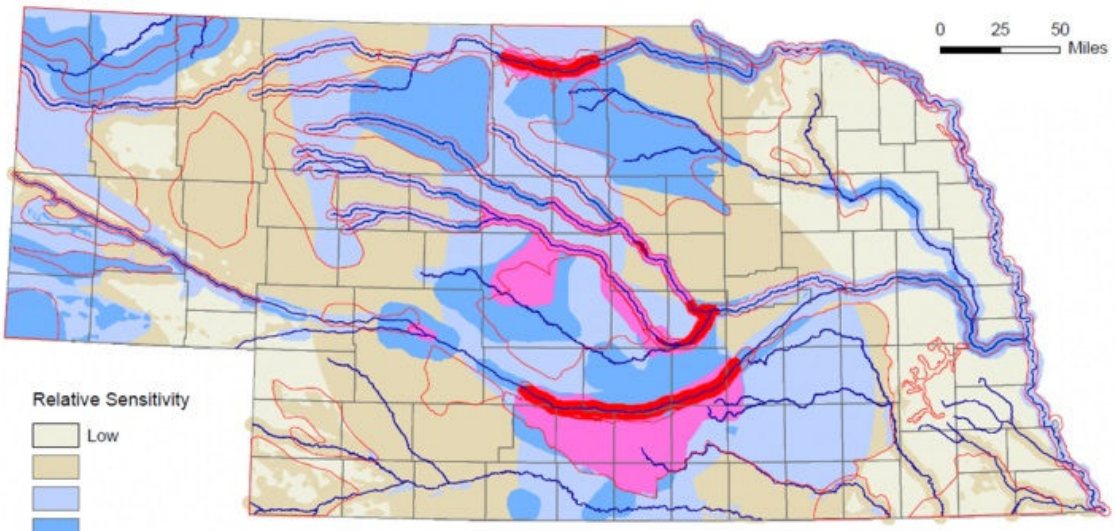
While South Dakota has a voluntary renewable objective to have 10% renewable by 2015, it is not a mandate. Furthermore, most of the population lies in the eastern part of the state making it an unlikely market.

Colorado, Nebraska, and South Dakota wind farms and wind manufacturing



Counties with commercial wind farms in blue; manufacturing plants green and planned yellow

Wind Energy and Nebraska's Wildlife:
An index of the sensitivity of wildlife habitats to wind energy development, based on selected at-risk species



Relative Sensitivity

Low

High

Biologically Unique Landscapes

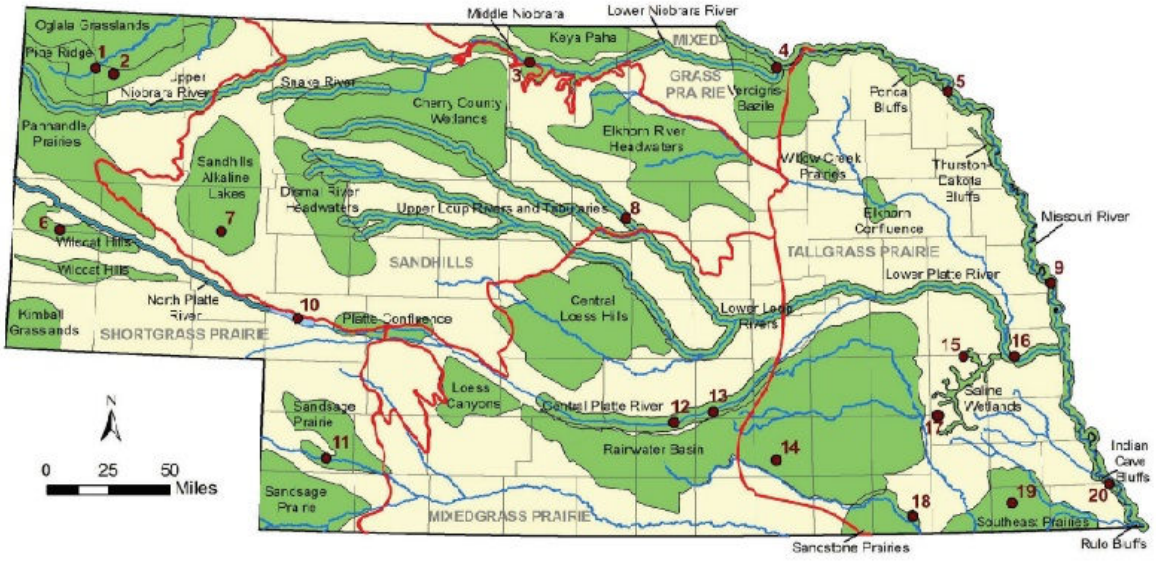
This map was designed to aid in planning for wind energy development by identifying areas that are considered relatively more sensitive or less sensitive to such development, with respect to species of concern. This map is not designed to evaluate wind farm siting at specific locations. Even in "low sensitivity" areas shown, there will be specific locations where siting of wind power infrastructure can negatively impact significant biological resources (e.g. remnant tallgrass prairie, listed plant species, etc.). Contact the Nebraska Game and Parks Commission and the U.S. Fish and Wildlife Service for potential site-specific impacts and potential conservation measures to avoid "take" under the state Nongame and Endangered Species Conservation Act and the federal Endangered Species Act.

See attached document for a description of the information used to develop this map.

Map version date: October 1, 2011

NEBRASKA GAME PARKS

Nebraska Natural Legacy Project:
Biologically Unique Landscapes and Demonstration Sites



Demonstration Site
River
County Boundary
Ecoregion Boundary
Biologically Unique Landscape

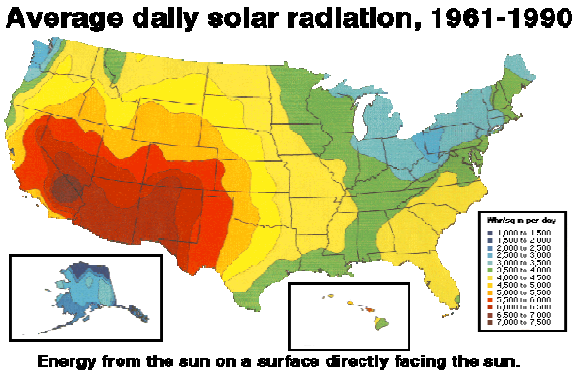
Nebraska Natural Legacy Project

Nebraska Environmental Trust

NEBRASKA GAME PARKS

Solar Potential

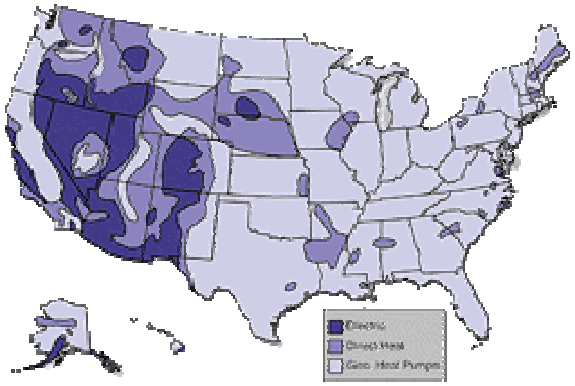
Solar energy is presently more expensive than more conventional sources of electricity. However, technological advancements are rapidly bringing down the cost of solar energy while the cost of fossil fuels are rapidly rising. Thus solar powered energy holds great promise as it may become a very feasible source of electricity production in the future.



If solar energy becomes an economically viable source of energy in the future, Sheridan County does have good potential for solar energy. However, in the near future, smaller personal solar systems for homes and businesses are much more likely to occur in the area while commercial size operations are more likely to locate in the Southwestern US.

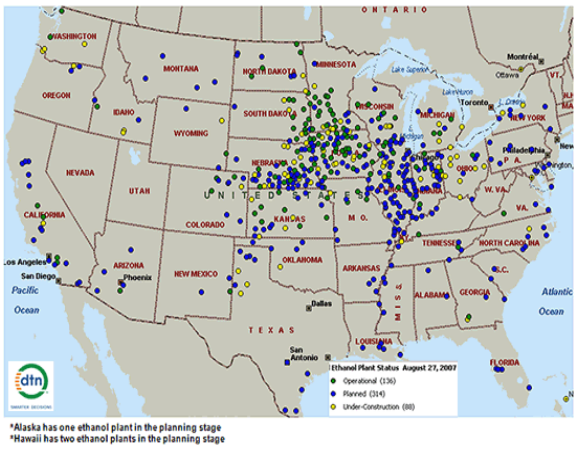
The greatest solar energy potential for Western Nebraska is more likely to exist in manufacturing components for solar plants as Colorado not only has very good solar energy potential, the wind energy manufacturing cluster in Colorado could easily grow into a renewable energy cluster providing satellite component manufacturing opportunities as Colorado has many smaller solar manufacturers for residential systems. However, given the county's small

Geothermal Energy



Sheridan County has good potential for geo-thermal energy. While Sheridan County's geothermal resources likely would not be a desirable location for commercial production, the use for individual homes, businesses, schools, and public buildings could utilize this resource.

Biomass



Sheridan County does not have any type of biomass production with the closest plants being an ethanol facility in Bridgeport.

With its rail access and large amount of agricultural land, Sheridan County could feasibly facilitate a biomass facility. However, the county is not the most ideal site for an ethanol production site as a large share of corn would need to be shipped in and the county does not have a large livestock feeding yard.

Cellulosic ethanol may be more suited for the county. However, it is not likely to be commercially viable in the foreseeable future while many other counties would have better transportation advantages due to the distance to markets.

Energy Consumption

- Commercial Energy Consumption
- Industrial Energy Consumption
- Residential Energy Consumption
- Renewable Energy Consumption

Energy Consumption in Nebraska's Commercial Sector

Energy consumption for the commercial sector in Sheridan County is not available so state figures are utilized.

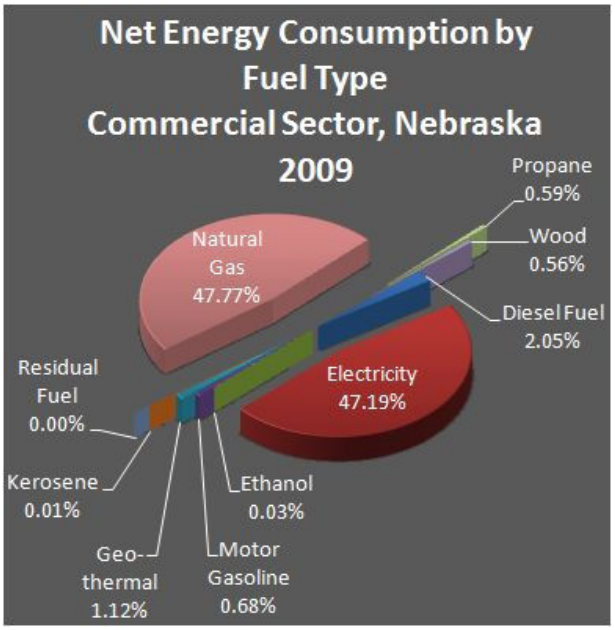
The commercial sector consists of nonmanufacturing business establishments. Included are hotels, motels, restaurants, wholesale businesses, retail stores, laundries, and other service enterprises; health, social, and educational institutions; and federal, state, and local governments. Streetlights, pumps, bridges, and public services are also included. Fuel used in motor vehicles for commercial purposes is included in the transportation sector. Examples of common uses of energy in the commercial sector include space heating, water heating, refrigeration, air conditioning, and cooking.

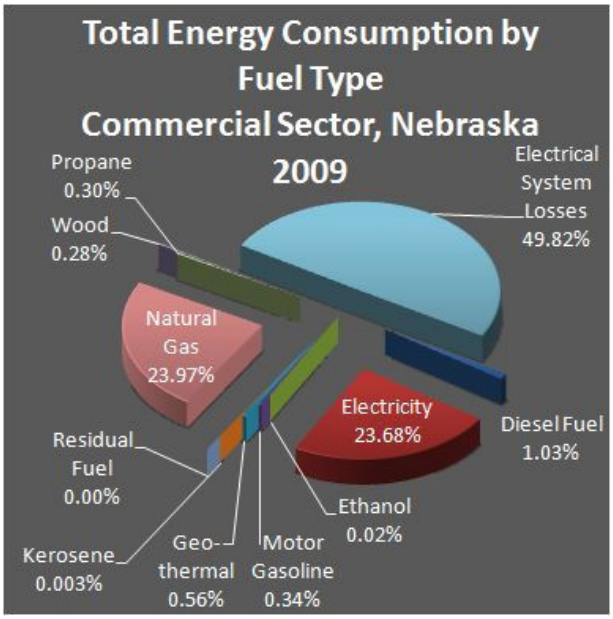
For the residential, commercial, and industrial sectors, a net total or net energy consumption (less electrical system energy losses) is provided to indicate the energy actually consumed by these sectors. In addition, energy consumed in the generation, transmission, and distribution of electricity (electrical system energy losses) is allocated to each sector based on the electricity consumed by the sector. Thus, total energy consumption represents the energy consumed by the sector as well as that used to provide electricity to the sector.

From 2008 to 2009, commercial sector net energy use decreased 5.8 percent to 67.5 trillion British Thermal Units (Btu). Total energy use in the sector decreased 4.4 percent to 134.3 trillion Btu. Natural gas use decreased 8.6 percent from 2008 while renewable energy use increased 8.1 percent despite a decline in electricity of 1.3 percent. Petroleum use decreased 24.1 percent although it comprises only 3.3 percent of the energy used by the commercial sector. Residual fuel consumption was small enough to round to zero in this table for the years 2002 and 2007. Coal consumption was small enough to round to zero in this table for the years 1998, 1999, 2000, 2008, and 2009.

In 2009, almost all (95 percent) of the commercial sector's energy needs were met by electricity and natural gas. Petroleum products made up 3.3 percent of the energy consumed in the commercial sector, and 1.7 percent was renewable energy.

Solar thermal and photovoltaic energy consumption cannot be separated between the residential and commercial sectors. The numbers are reported in the residential sector.





Energy Consumption in Nebraska's Industrial Sector

Energy consumption for the industrial sector in Sheridan County is not available so state figures are utilized.

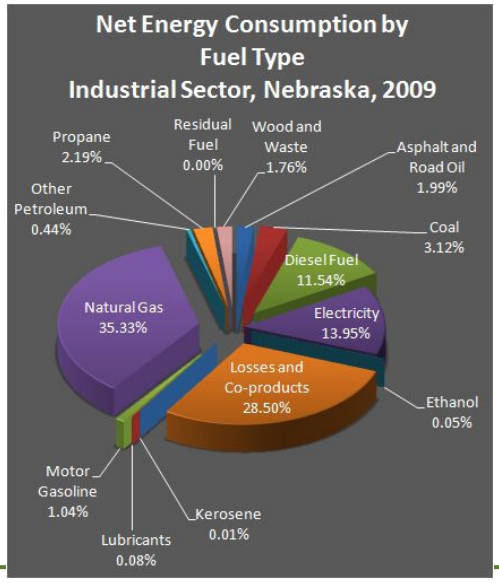
The industrial sector consists of manufacturing, construction, mining, agriculture, and forestry organizations. Energy used by this sector to transport products to market or inputs to the organizations is included in the transportation sector.

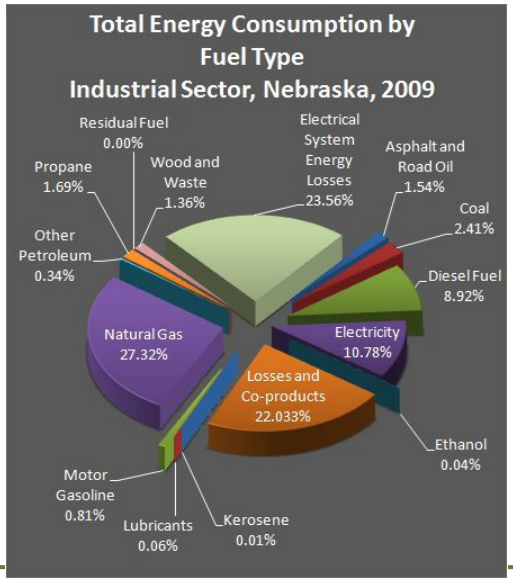
For the residential, commercial, and industrial sectors, a net total or net energy consumption (less electrical system energy losses) is provided to indicate the energy actually consumed by these sectors. In addition, energy consumed in the generation, transmission, and distribution of electricity (electrical system energy losses) is allocated to each sector based on the electricity consumed by the sector. Thus, total energy consumption represents the energy consumed by the sector as well as that used to provide electricity to the sector.

Between 2008 and 2009, industrial sector net energy use decreased 0.3 percent to 232.7 trillion British Thermal Units (Btu). Total energy consumption attributed to the industrial sector in 2009 was 301.0 trillion Btu, a decrease of 0.9 percent from 2009. Natural gas use increased 6.1 percent. Petroleum use decreased 9.1 percent, coal use decreased 6.9 percent, electricity use decreased 1.2 percent, and renewable energy use decreased 0.8 percent from 2008. Renewable energy consumption was comprised of ethanol, losses and co–products, and wood and waste.

In 2009, almost all of the industrial sector energy needs were met by natural gas (35 percent), renewable energy (30 percent), petroleum products (17 percent), and electricity (14 percent). Three (3) percent of the energy consumed in the industrial sector was coal. Diesel fuel (67 percent), propane (13 percent), asphalt and road oil (12 percent), and motor gasoline (6 percent) made up the majority of the petroleum products consumed by the industrial sector; the rest of the products each comprised less than three percent.

Other petroleum products include sixteen (16) separate products, all of which are assigned to the industrial sector. The sixteen products are: aviation gasoline; blending components; crude oil; motor gasoline; blending components; natural gasoline, including isopentane; pentanes plus; petrochemical feedstocks, naphtha; petrochemical feedstocks, other oils; petrochemical feedstocks, still gas; petroleum coke; plant condensate; special naphthas; still gas; unfinished oils; unfractionated streams; waxes; and miscellaneous. Miscellaneous products vary from inexpensive (absorption oils similar to kerosene) to very expensive (hydraulic fluids) products. The greater part of the miscellaneous product line consists of finished petrochemicals, especially the aromatic hydrocarbons: benzene, toluene, and the xylenes.





Energy Consumption in Nebraska's Residential Sector

Energy consumption for the residential sector in Sheridan County is not available so state figures are utilized.

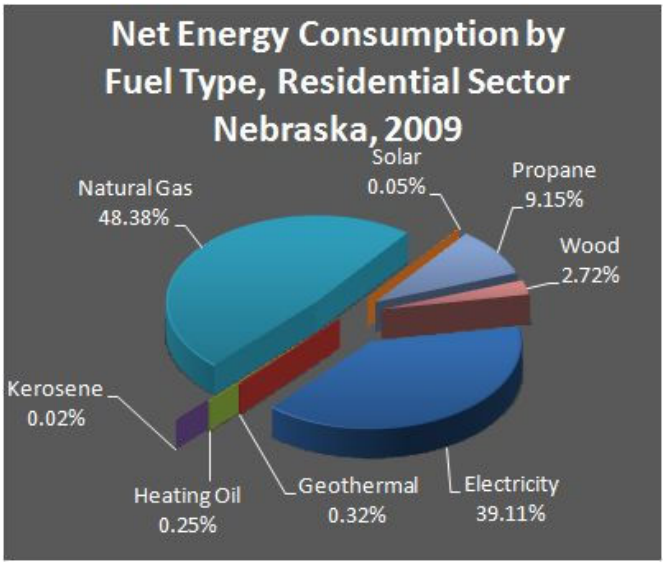
The residential sector consists of private households. Energy is consumed primarily for space heating, water heating, air conditioning, refrigeration, cooking, clothes drying, and lighting. Fuel used for motor vehicles by household members is included in the transportation sector.

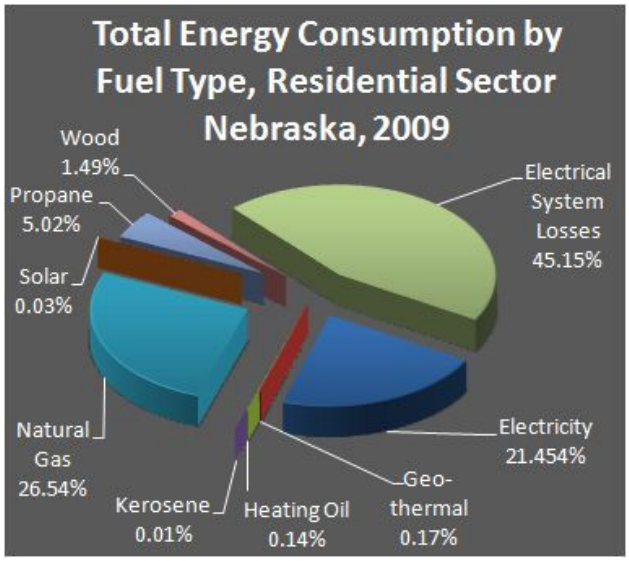
For the residential, commercial, and industrial sectors, a net total or net energy consumption (less electrical system energy losses) is provided to indicate the energy actually consumed by these sectors. In addition, energy consumed in the generation, transmission, and distribution of electricity (electrical system energy losses) is allocated to each sector based on the electricity consumed by the sector. Thus, total energy consumption represents the energy consumed by the sector as well as that used to provide electricity to the sector.

Between 2008 and 2009, residential sector net energy use decreased 4.4 percent to 83.9 trillion British Thermal Units (Btu), which was 13.3 percent below the peak of 96.8 trillion Btu recorded in 1972. Total energy consumption attributed to the residential sector in 2009 was 153.10 trillion Btu, a decrease of 3.7 percent from 2008. Renewable energy use decreased 1.9 percent from 2008, petroleum use decreased 13.0 percent, natural gas use decreased 5.1 percent, and electricity use decreased 1.3 percent while coal consumption remained at a level low enough to round to zero.

In 2009, nearly half (48.4 percent) of the residential sector's energy needs were met by natural gas. Thirty –nine and one–tenth percent (39.1%) of the energy consumed in the residential sector was electricity, 9.4 percent were petroleum products, and 3.1 percent was renewable energy. According to the 2009 American Community Survey, 64 percent of Nebraska's households use natural gas for home heating, 25 percent use electricity, 8 percent use propane, 1.4 percent use wood, 0.58 percent use heating oil, 0.01 percent use coal, and 0.02 percent use solar energy.

The solar data below includes small amounts of solar thermal and photovoltaic energy consumed by the commercial sector that cannot be separately identified.



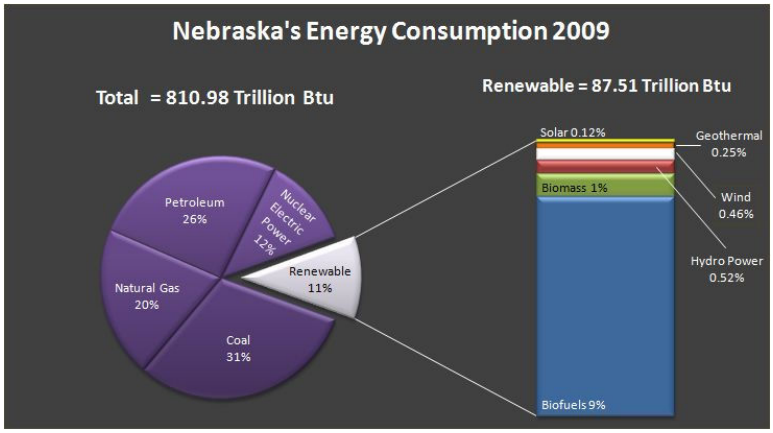


Nebraska's Renewable Energy Consumption

Renewable energy consumption for Sheridan County is not available so state figures are utilized.

In 2009, Nebraska consumed 810.98 trillion British thermal units (Btu) of energy which included 87.51 trillion Btu of energy from renewable energy sources . Renewable resources met 10.8 percent of Nebraska's energy consumption. Nebraska consumed energy from these renewable resources in 2009:

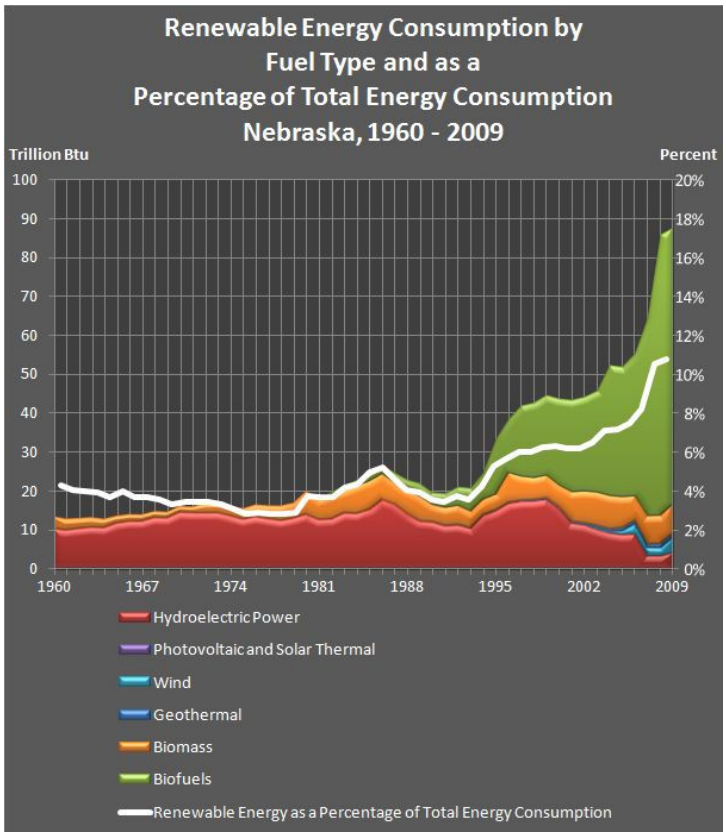
- Biofuels
- Biomass
- Geothermal Energy
- Hydroelectric Power (Conventional)
- Photovoltaic and Solar Thermal Energy
- Wind Energy



Renewable energy consumption was equivalent to 219,000 cords of wood, 434 gigawatthours of conventional hydroelectric power, 56,490,000 gallons of ethanol, 66 trillion Btu of ethanol production and co–products, 383 gigawatthours of wind energy, 1 trillion Btu of geothermal energy, and 40 billion Btu of solar energy

From 1960 to 1980, renewable energy in Nebraska consisted of conventional hydroelectric power and biomass. Ethanol entered the picture in the early 1980s. Geothermal energy and photovoltaic and solar thermal energy projects were reported in the late 1980s. Wind energy projects came on line in the late 1990s. Consumption of renewable energy has steadily increased although modestly.

As a percentage of total energy consumption, renewable energy consumption was relatively stable until 1995 when the percentage began an upward climb. Biofuels had a major role in this increase. Renewable energy consumption has ranged from 2.80 percent to 10.79 percent of total energy consumption. The annual data differs from previous years' analyses due to the addition of the energy used to produce ethanol and the energy value contained in the dry/wet co–products of ethanol.



Energy Outlook

- Transportation (Oil and Gasoline)
- Home and Business (Electricity, Coal, Natural Gas)
- Energy Codes
- Energy Conservation

Energy and Transportation

High gasoline prices place a significant impact on Sheridan County's residents and businesses. A report from the Oil Price Information Service indicates Nebraskan's spent 8.7% of their income on gasoline in April 2011. Many persons who commute to jobs in Chadron or Alliance likely spend more than 10% of their income on gasoline which leaves these workers with less money to spend locally.

Oil prices at the start of 2015 settled below $50 per barrel, though long term projections show crude oil prices rising back from $90/bl to $100/bl again towards 2025. At the writing of this plan, gasoline prices are very low compared to recent years but the county should continue to prepare for higher energy prices as the US shale oil production is expected by the US Energy Department to plateau in 2020 and developing nations with emerging markets continue to consume over half of total crude output.

Given these forecasts, Sheridan County should plan for a future of $3 to $4/gal gasoline prices, especially during the spring. Such a strategy will prepare the county for the most likely and worst case scenarios, providing a competitive advantage over counties that do not prepare for a future of more expensive energy. Even if the best case scenarios are realized, the county will still benefit through greater energy efficiency.

Figure 5. Average annual world oil prices in three cases, 1980-2035 (real 2010 dollars per barrel)

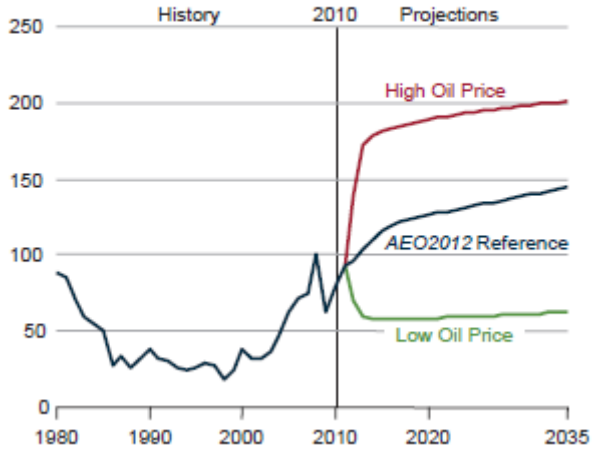
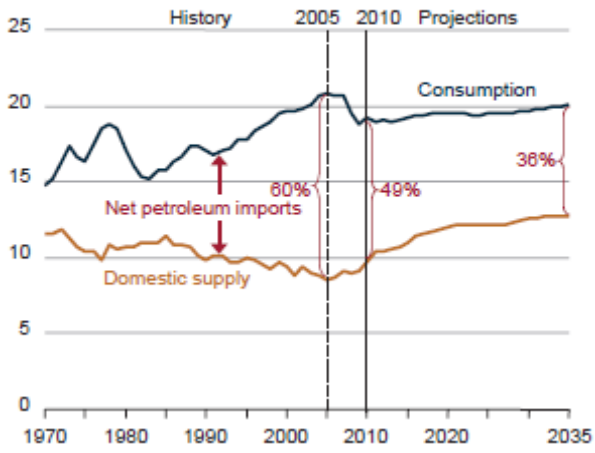


Figure 1. U.S. liquid fuels supply, 1970-2035 (million barrels per day)



Energy, Home and Business

Energy use in residential and commercial buildings represents 39 percent of all energy use in the United States which is greater than the total amount of energy used in transportation and industrial uses.

The primary sources of energy for household uses in Sheridan County are natural gas and coal.

Due to increased production of shale gas in the Great Plains and Appalachia, natural gas prices are expected to remain relatively low for the next decade before modest increases in the following decade that are still well below prices experienced just a few years ago. This is good news for the county as these shale gas reserves should help hold down winter heating costs. It could potentially also help reduce electric costs in future decades if Nebraska electric providers increase the amount of natural gas in their portfolio.

Figure 39. Natural gas prices in the Reference and High Ultimate Shale Recovery cases, 2005-2035 (dollars per million Btu)

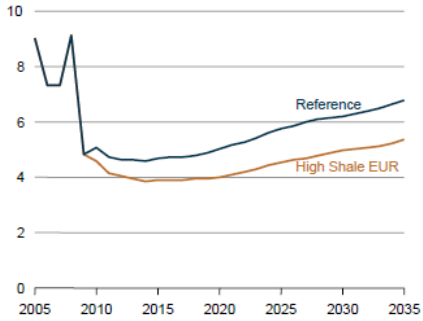
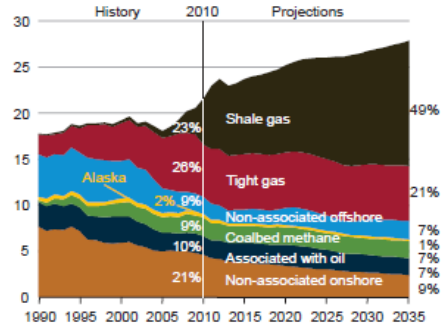
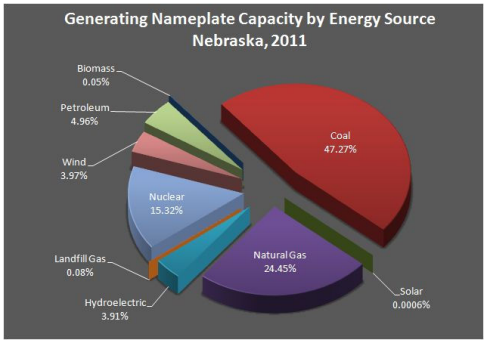


Figure 2. U.S. natural gas production, 1990-2035 (trillion cubic feet)



Coal production in Wyoming is expected to continue to grow in the next 25 years which is good news for the county's utility bills as two-thirds of Nebraska's electricity comes from coal, and that figure is likely even higher for Sheridan County. Due to the county's close proximity to cheaper Wyoming coal, it has benefited from some of the lowest electric rates in the country.

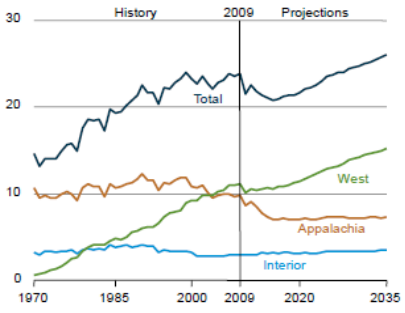


Even though coal production in the western US is expected to rise, worldwide demand for coal is also expected to rise. In recent years the increased demand for coal grew at a faster pace than the growth in coal production and domestic coal exports. However, the EIA is expecting coal production to come in line with this growing demand in the coming decade which will stabilize prices.

Even though coal prices have risen quite significantly in the past five years, the EIA is expecting Western coal prices to remain around current levels for the next decade before experiencing very modest increases in the following decade. The EIA also lays out coal price scenarios which range from modest declines in coal prices to very steep increases.

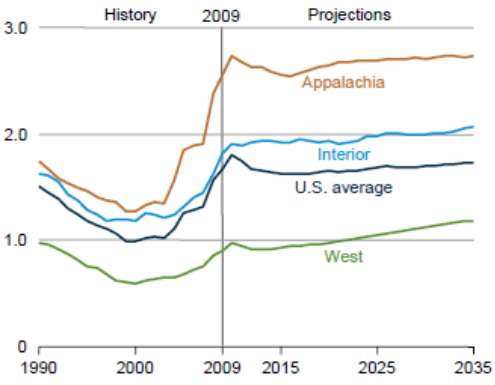
The adoption of a carbon tax or cap and trade scheme could add an additional 30% to the cost of coal which would obviously raise the cost of electricity in the county if alternative fuel sources are not added to the mix.

Figure 101. Coal production by region, 1970-2035 (quadrillion Btu)



Growth in average minemouth price slows compared to recent history

Figure 103. Average annual minemouth coal prices by region, 1990-2035 (2009 dollars per million Btu)



Energy Codes

The State of Nebraska has adopted the International Energy Conservation Code as the Nebraska Energy Code (S.S.81-1608 to 81-1616). Any local government may adopt and enforce the Nebraska Energy Code or an equivalent energy code. If a local government does not adopt an energy code, the Nebraska Energy Office will enforce the Nebraska Energy Code in the jurisdiction.

The purpose of the Code, under §81-1608, is to insure that newly built houses or buildings meet uniform energy efficiency standards. The statute finds

> that there is a need to adopt the . . . International Energy Conservation Code in order (1) to ensure that a minimum energy efficiency standard is maintained throughout the state, (2) to harmonize and clarify energy building code statutory references, (3) to ensure compliance with the National Energy Policy Act of 1992, (4) to increase energy savings for all Nebraska consumers, especially low-income Nebraskans, (5) to reduce the cost of state programs that provide assistance to low-income Nebraskans, (6) to reduce the amount of money expended to import energy, (7) to reduce the growth of energy consumption, (8) to lessen the need for new power plants, and (9) to provide training for local code officials and residential and commercial builders who implement the . . . International Energy Conservation Code.

The Code applies to all new buildings, or renovations of or additions to any existing buildings. Only those renovations that will cost more than 50 percent of the replacement cost of the building must comply with the Code.

Sheridan County has not adopted the Nebraska energy code. Since the County has not adopted an energy code, the Nebraska Energy Office enforces the Nebraska Energy Code in the jurisdiction.

Energy Efficiency Programs The county will continue to work with utility companies that supply energy to the residents and businesses of the county to promote and implement energy efficiency programs that can be utilized by these customers to improve conservation and utilization of electricity, natural gas, and other energy sources.

Residents and businesses are encouraged to work with the utility providers and take advantage of their energy efficiency programs to improve conservation and utilization of electricity, natural gas, and other energy sources.

Energy Conservation

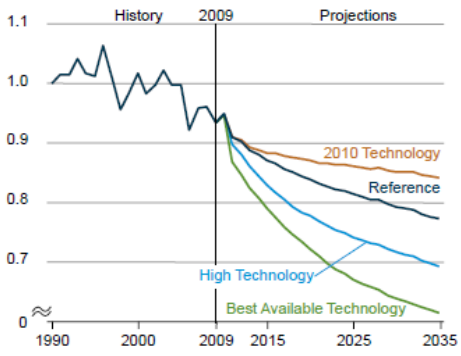
While the EIA expects aggregate energy use to increase due to a growing population, per capita residential energy use is expected to decline. The level of decline will be determined by the level of technology utilized by consumers.

This helps illustrate the importance of incorporating energy efficiency and conservation, as they are the best path toward reducing energy use and costs.

The Nebraska Energy Office has listed ways to save money on energy bills for the home, farm, business, or vehicle. Options for energy savings are listed on the Office's web site at http://www.neo.ne.gov/tips/tips.htm. The County and residents and businesses are encouraged to take advantage of the conversation measures.

Residential energy use per capita varies with end-use technology assumptions

Figure 58. Residential delivered energy consumption per capita in four cases, 1990-2035 (index, 1990 = 1)



Strengths

- Sheridan County is the fourth largest county in Nebraska

- The county has an abundance of wide-open spaces

- The long distance to other retail centers provides an advantage to Gordon, which is a sub-regional trade center for northwest Sheridan, western Cherry and southern Shannon counties

- Sheridan County has an attractive semi-arid climate that is highlighted by low humidity and many sunny days.

- The county has many scenic amenities such as the Sandhills and the Pine Ridge

- There is an adequate supply of potable groundwater in most parts of the county

- The county's floodplains are mapped

- The northern and western parts of the county have significant areas of nearly level land that is well suited for agricultural crops

- Quality pasture land in the Sandhills

- The northwest part of Sheridan County has above average wind speeds, proximity to major transmission lines and cheap land which provide potential for wind energy development

- Sheridan County has good potential for on-site solar and geo-thermal energy

- The county has some lakes that are well suited for water recreation

- Most of the soils in Sheridan County are generally suited for development

- The distribution of coal creates many railroad job opportunities for county residents

- Sheridan County's proximity to cheap Powder River Basin coal in Wyoming has kept electric rates low

- Sheridan County has access to natural gas which provides an affordable source of winter heating for homes and businesses. Recent and projected growth in domestic shale gas should keep heating costs relatively affordable.

-Appropriate zoning regulations

Weaknesses

- The county is very isolated in many respects, including its commuting distance to very large employment centers and its own state capital.

- The long distance to interstate highways along commercial highways provides a major impediment to many economic opportunities

- The county's dry climate and distance to markets limits its ability to produce high value truck crops Some of the soil and lakes are alkaline

- There are a few isolated areas that do not have sufficient groundwater for livestock and domestic use, especially in the northwest corner of the county.

- Sheridan County does not have any natural gas or oil production

- The County's wind energy potential has not been developed due to state policies (most notably the lack of a Renewable Portfolio Standard) and the distance and barriers to large markets

- High gasoline prices place a significant impact on Sheridan County's residents, farms, and businesses

- Most of the products local residents consume have to be transported long distances

Opportunities

- Preparing for a future of high energy costs is a win-win proposition.
  - Provides a competitive advantage over less prepared areas if this likelihood does become reality.
  - Saves energy costs even if future energy spikes do not materialize

.

- Increased demand for western coal will likely create additional railroad related employment opportunities in the area.

- Renewable energy has become a bigger part of the United States' energy portfolio and will likely continue to account for an increasing share of our country's total supply in coming years.
  - Nebraska ranks sixth in wind energy potential
  - Sheridan County has many assets that are well suited for the wind energy industry

- The county's lakes, open spaces, and unique scenery could attract opportunities to develop recreational homes

-Increased energy development along Ports-to-Plains corridor could mean increased nearby traffic

- Increasing worldwide incomes has increased worldwide demand for meat and other agricultural commodities

-Northwest Nebraska High Country offers opportunities and a framework for marketing the regional natural amenities

Threats

-Sheridan County is very susceptible to droughts

-Ground water levels have a decreasing trend around Gordon and the Mirage Flats Irrigation District from predevelopment levels.

-Threat to mirage flats irrigation district if water becomes scarce and dam repairs are not funded

- Many energy experts are projecting a future of higher energy costs which will have an impact on many local residents

- The County's large reliance on coal for electricity could lead to higher electricity rates in the near future

- If Nebraska continues its wind energy policies, the county may be unable to take advantage of its wind energy potential

- Warmer winters could lead to more range fires and a large population of pests such as grasshoppers.