Unit 2) Prairies

Grasslands are found on every continent except Antarctica. Covering nearly one-half of the earth's land surface, these regions produce approximately 70 percent of the food consumed by the world's population, including crops such as wheat, rice, corn, and sorghum that originated from domesticated grasses.

Nearly 26 percent of the land in the United States is in grassland pasture and rangeland according to a May 2006 U.S. Department of Agriculture report on land uses. Grassland, rangeland, forestland, and cropland account for nearly 75 percent of the uses of the land in the United States.

In Kansas, cropland (cultivated from former grassland) is the leading use of land, followed by pasture and rangeland, which includes both native grasslands and grass stands that have been reestablished on land that was once cultivated. These uses represent over 90 percent of the state's land area.

"Grass is the forgiveness of nature–her constant benediction. Fields trampled with battle, saturated with blood, torn with the ruts of cannon, grow green again with grass, and carnage is forgotten. Streets abandoned by traffic become grass-grown like rural lanes, and are obliterated. Forests decay, harvests perish, flowers vanish, but grass is immortal."

John James Ingalls, U.S. Senator from Kansas

According to studies by geologists, the earth is around four and a half billion years old. The features of present-day Kansas indicate that the state has undergone many changes during its evolution. Kansas has at different times been an ocean, a frozen sheet of ice, and a desert. Every alteration has had an effect on the climate, the terrain, the soil, and the inhabitants of the area at the time it occurred, as well as an effect on what can thrive in Kansas today.

Greenwood County
Credit: John Charlton, KGS

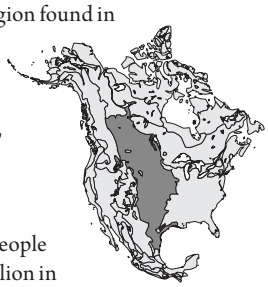
One part of Kansas that looks now much like it has for the last ten thousand years is the prairie. During the Cenozoic Era (sometime in the last 63 million years), after glaciers smoothed the land into plains and the water run-off created rivers and streams, the deep-rooted grass utilized the exposed soil and set down roots. As it matured and ripened, the prairie grass gradually expanded its territory, mostly by the wind which carried seeds further to new soils. In a new spot, the grass usually adjusted its needs as best possible to the environment, including soil type and the amount of water present. This created a constant if always changing appearance.

By the time the first humans roamed the central part of North America, the grasslands were solidly established. The North American prairie was called an inland sea, both for the resemblance its grasses made to ocean waves as the stalks swayed in the wind, and because it reached farther than the eye could see.

Flint Hills
Credit: Megan Blythe

The Great Plains

The Great Plains is a major ecological region found in the central part of the continent of North America, occupying nearly 1.4 million square miles. This area extends from the Canadian provinces of Alberta, Saskatchewan and Manitoba south into northeastern Mexico and from western Indiana to the foothills of the Rocky Mountains. Approximately 34 million people live in the Great Plains, including 32 million in the U.S. portion of the region.

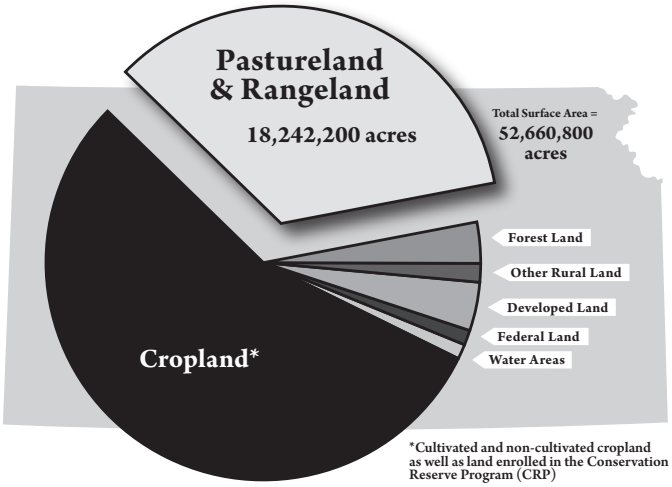


Across the Great Plains, rainfall decreases from east to west–defining different types of native prairies. While there are grassland and forest combinations along the eastern edges of the Great Plains, few native trees occur across other areas of the region. The Great Plains is one of the largest farming and ranching regions of the world and agriculture is the most important economic activity of the Great Plains.

The entire state of Kansas falls within the Great Plains ecological region. However, in Kansas, many people refer to the western two-thirds of the state as the "Great Plains."

Source: EPA

Surface Area of Kansas – Prairies (Pastureland & Rangeland)



Source: 2003 Natural Resources Inventory, USDA NRCS

Names of the Prairie

French explorers and fur traders in the 1700s have been credited with first calling the middle section of America "la prairie," the French word for meadow. The prairie goes by many names.

Rangeland– Land on which the native vegetation is predominantly grasses, grass-like plants, forbs, or shrubs. It includes desert, tundra, and forested rangeland. Rangeland is most suitable for grazing. There are limiting factors prohibiting cropland agriculture such as rocks, trees, or mountains. Surprising to some, rangeland biomes require human and fossil energy to manage and maintain the grassland for many uses. Without proper management, the prairie moves toward a woody vegetation type. Approximately 47 percent of the earth's terrain is rangeland.

Grassland– Grassland is a generic term referring to an area covered with vegetation types dominated by grasses. It can include tame pasture, rangeland, and other types.

Pasture– A unit of grassland which has a fenced perimeter. A modern term that needed definition only after humans began to contain livestock. Often, biologists consider pasture to be made of one or only a few types of grass versus an area containing a wide variety of plant life like the native grass prairie.

Rangeland
Credit: Doug Wilson, USDA ARS

Tame Pasture– land intentionally planted for grazing, usually seeded to perennial grasses or legumes, such as clover or timothy.

Kansas Prairies

"We say of the oak, 'How grand of girth!'
Of the willow we say, 'How slender!'
And yet to the soft grass clothing the earth
How slight is the praise we render."
Edgar Fawcett, American-English novelist and poet

Types of Kansas Prairies

The Kansas grassland biome is divided into tallgrass, mixed-grass, and shortgrass prairies. Areas of sand prairie and sandsage prairie grasslands are found in both the mixed-grass and shortgrass prairie regions of Kansas.

Tallgrass prairie– Before settlement, the tallgrass prairie occupied a north-south strip which encompassed the eastern third of Kansas. The tallgrass prairie exists today since much of the land is not tillable due to terrain, (slope, rock layers, soil depth, etc.). The grasses can grow in excess of six feet tall during moist years if they reside in deep soils. The annual precipitation in this region exceeds 30 inches. The original tallgrass prairie spanned almost 250 million acres. Today, about four percent remains with the largest areas being the Flint Hills of Kansas and the Osage Hills of Oklahoma.

Tallgrass Prairie
Credit: Erwin W. Cole, USDA

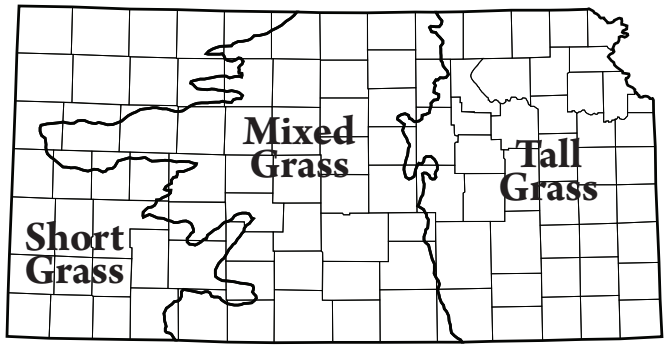
Mixed-grass Prairie at Kanopolis State Park
Credit: Wayne Stoskopf

Mixed-grass prairie– The mixed-grass or midgrass prairie runs through the middle portion of the state. The grasses here often grow to be two and three feet tall. Typically, this region receives 15 to 25 inches of precipitation per year. The primary factors which create mixed-grass prairie in Kansas are precipitation and soil depth.

Shortgrass prairie– The shortgrass prairie lies mainly in the western portion of the middle United States, east of the Rocky Mountains. The grasses here are usually less than two feet tall. The westernmost areas receive, at maximum, 15 inches of precipitation per year.

Shortgrass Prairie in Cheyenne County
Credit: NRCS, St. Francis, KS

Kansas Prairie Regions



Credit: Travis W. Taggart, Kansas Herpetofaunal Atlas, Sternberg Museum of Natural History

Sand and Sandsage Prairies in Kansas

Typical sand dunes in Kansas are 20-40 feet high, although they can exceed 80 feet in height. Smaller sand dunes give the landscape a gently rolling appearance while large sand dunes rise as mounds or small hills. Sand dunes are characteristic of two grassland types in Kansas: the sand prairie and the sandsage prairie.

In Kansas, areas of sand prairie are found in the Arkansas River Lowlands, the Red Hills, the Smoky Hills, and the Wellington-McPherson Lowlands. The largest area of sand prairie in Kansas is the Great Bend Sand Prairie, which lies south of the bend in the Arkansas River and covers 1,100 square miles in Barton, Stafford, Edwards, Kiowa, Pratt, Reno, and Rice counties. According to the Kansas Geological Survey, sometime in the last 1,000 years, northwesterly winds probably blew sand out of the Arkansas River and deposited it on nearby lands to form the Great Bend Sand Prairie.

The primary plant species found in the sand prairie is sand bluestem. Other species found in these areas include prairie sand reed, prairie sunflower, beebalm, fourpoint evening primrose, switchgrass, sandhill plum, and little bluestem.

Tracts of sand prairie in Kansas include Sand Hills State Park in Reno County and Pratt Sandhills Wildlife Area in Pratt County, both owned and managed by the Kansas Department of Wildlife and Parks. Bethel College owns and manages the Sand Prairie Natural History Preserve in Harvey County. Interstate 70 crosses a small area of privately-owned sand prairie in Dickinson County.

Sandsage prairie is found in southwestern Kansas, mostly west of US Highway 183 and south of the Arkansas and Cimarron rivers. Small areas of sandsage prairie are also found in the Red Hills. The conspicuous plant species of the sandsage prairie is sand sagebrush, an aromatic shrub with many gray-green branches that grows up to four feet tall. The lesser prairie chicken is a sandsage prairie resident.

Areas of sandsage prairie in Kansas include the Cimarron National Grassland in Morton County and the Sandsage Bison Refuge and Wildlife Area in Finney County, which is home to the state's oldest publicly owned bison herd. Privately-owned areas of sandsage prairie can be seen along Kansas Highway 25 in southern Hamilton County and Kansas Highway 27 in southern Kearny County.

Kearny County Sand Prairie
Credit: John Charlton, KGS

Burning the Prairie

One practice unique to the tallgrass prairie is the prescribed burning of the native prairie in spring. Periodic fires have played a role in the history of the prairie grasslands. Lightning strikes were probably the first sources of fire on the prairie. What might have seemed devastating at first proved to have great benefits. Within weeks of a fire, a green carpet of fresh grass would surface from the blackened hills. The American Indians saw the effects of the burning and set their own fires to attract the roaming bison to the rich grass closer to the Indians' home territories, making for easier hunting that summer. After settlement of the prairies occurred, more fires were from accidental human causes, and could be devastating, but their positive effects on the grassland were the same.

Fire removes standing dead vegetation and light mulch, allowing sunlight to warm the soil and encourage rapid plant growth. Without recurring fires, the accumulation of old growth and mulch insulates the soil. As a result, plant growth is slower and woody plants are encouraged.

It has been hypothesized that fire occurred two to three times within any five-year period in the evolution of the tallgrass prairie. Many ranchers don't burn every year, but mimic this "natural" schedule for optimal grass management. In addition to encouraging desirable grasses, the fire fights back emergent brush and undesirable plant species. Scientists and ranchers agree that a pasture which has been burned at the proper time can increase the total plant productivity by stimulating the growth of warm-season grasses. The grasses' growing points are protected below ground, while shrubs and trees have their growing tissues at the tips of their branches in direct contact with the searing heat of fire. The blackened ground absorbs more sunlight, allowing the soil to warm much more quickly in the spring. Fire can also create a more even distribution of grass, erasing the effects of heavy grazing from the previous summer.

Fire is used today in the tallgrass region on native grasslands to improve the integrity and diversity of the prairie. The burning is done with safety and proper environmental conditions observed. Ranchers and volunteers, often the owners of the neighboring grass, work together to burn a larger area of grass without having to stop the fire at every pasture fence. If managed and implemented correctly, fire is an important practice for maintaining the prairie, controlling woody plants, increasing forage quality, increasing grazing distribution, and removing excessive old growth.

Burning at the wrong time, or when it is so dry that soils are completely exposed and vulnerable to compaction, can be detrimental to grass production. Even so, the mineralization of the soil is increased by burning organic matter, which increases nutrient availability to the grasses. Surprisingly, there is no total reduction in soil nitrogen, although the burning grass does release nitrogen into the air. Burning on shortgrass and mixed-grass prairies is not as effective as in the tallgrass prairies because they receive less rain than the areas in the eastern part of the state. With fire, ranchers have a tool which can increase the prairie's economic output while helping to keep the grassland biome in balance–an excellent marriage.

Prairie Burning
Credit: Megan Blythe

Because plant life is not static, the eastern and western boundaries of the Kansas prairies blend rather than forming a definite boundary. There is a continual shift of plant communities along the borders of the tall, mixed, and shortgrass prairies, mostly because of changes in precipitation, but also because of the presence of fire and grazing animals. For example, a series of dry years result in an increased dominance of short grasses which are better adapted to a dry climate, moving the region's boundaries to the east. Westward shifts occur after periods of relatively high precipitation, which favor the taller grasses.

Range Plants

Kansas range plants are classified as:

Grasses– The grass family, *Gramineae*, is a diverse group of plants. It has a wide distribution around the world, and a large number of traditional global food crops fall under the grass family, including corn, wheat, rice, and sorghum. Grasses can be introduced or native to the North American continent.

Forbs– Forbs are herbaceous broadleaf plants often referred to as weeds or wildflowers. There are over 1600 known species of forbs in the prairie. Forbs can grow from seed (annual plants) or from previous year's growth (perennial plants). Some plants classified as forbs are the legume or pea, sunflower, and milkweed families. The forb plants perform many roles in the prairie including erosion control, soil conditioning, fertility, and food for wildlife species.

Prairie Coneflower
Credit: Lynn Betts, USDA NRCS

Woody plants– Woody plants are perennial plants with woody stems. Each year, new growth comes via buds on the old growth. This group includes trees, shrubs, vines, cacti, and yucca. Woody plants can be introduced or native to the North American continent. Some species are considered undesirable. Many woody species in the prairie are the result of the elimination of recurring fires that were their natural control.

The following are the dominant native grasses in Kansas. It has been estimated that there are over 180 species of grass in the state.

Tall Grasses

Big Bluestem ***Andropogon gerardii***– Also known as "turkey foot" because the branching seedhead resembles a turkey's foot, its name comes from the bluish cast of the plant during the growing season. In the fall, it takes on a tan to reddish-brown cast. It prefers

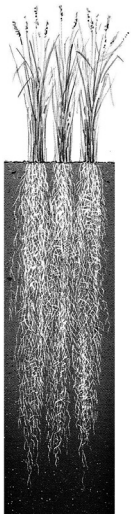
Range Plants

Forbs– plants whose stems and broad flat leaves die down to the soil level at the end of each growing season.
Grass– family of plants characterized by hollow jointed stems and bladelike leaves.
Woody plants– perennial plants with above-ground stems that resemble wood in appearance, texture, or toughness.

Tall Grasses

a. Big Bluestem

b. Indiangrass



c. Switchgrass

d. Eastern Gamagrass

Credits: a. USDA NRCS; b. K-State Research and Extension; c. University of Minnesota Extension Service; d. K-State Research and Extension

Prairie Plants– Selected References

Range Grasses of Kansas
Paul D. Ohlenbusch, Elizabeth P. Hodges, and Susan Pope
(K-State Research and Extension Publication No. C567 Revised, 1983)
www.oznet.ksu.edu/library/crps12/c567.pdf

Kansas Wildflowers and Grasses
Mike Haddock
(Kansas State University Hale Library, Manhattan, Kansas)
www.lib.ksu.edu/wildflower/

Noble Foundation Plant Image Gallery
Russell Stevens and Chuck Coffey
(The Samuel Roberts Noble Foundation, Ardmore, Oklahoma)
www.noble.org/webapps/plantimagegallery/

PLANTS Database
USDA Natural Resources Conservation Service
http://plants.usda.gov

the relatively moist, deep soils found in eastern and central Kansas. In ideal sites, the seed stalks can exceed six feet in height. Early settlers reported that in some areas big bluestem was as tall as a man sitting on a horse.

Indiangrass *Sorghustram nutans*– The name comes from the feather-like ligule, or thin outgrowth, at the junction of the leaf and sheath. The seed heads are plume-like and bronze to yellow in color. Indiangrass prefers the relatively moist, deep soils found in eastern and central Kansas. In ideal sites, the seed stalks can exceed six feet in height.

Switchgrass *Panicum virgatum*– Switchgrass is a deep-rooted grass that grows in bunches and can reach up to six feet tall. The rooting depth can exceed 10 feet in deep soils. The seed head is a pyramid shape with many purplish spikelets. It can be identified by a triangular area of hairs where the leaf blade meets the sheath. It prefers soils that are high in calcium or lime versus wet, acidic soils.

Eastern Gamagrass *Tripsacum dactyloides*– This perennial grass is the most productive and palatable of the tallgrass native species. It can grow to eight feet tall with robust stems which are flattened at the purplish base. It grows from stout, scaly rhizomes. The blades can be up to one inch wide with rough and sharp margins. The inflorescence, or flower cluster, has one to three spikes, up to a foot long, with the male spikelets above the female spikelets. The male spikelets are in pairs fitting into the hollows of the seed stem. This grass is closely related to corn. It grows in fertile bottomland, swamps, and along streams. It can grow on fertile uplands under good management.

Prairie Plant Words

Awns– slender, stiff, bristle-like extensions of a plant, like the beards on a head of wheat.
Axil– the space between a leaf and the stem to which it is attached.
Bulb– an underground stem or root, usually surrounded by scale-like leaves and containing stored food for the shoots of the new plant that grows within it.
Floret– small individual flowers that form a larger flowerhead, such as in a sunflower.
Inflorescence– the flowering part of a plant that consists of more than one flower, often several distinct individual flowers.
Ligule– a small flap or row of hairs on the inner or upper side of a leaf where it grows out of the sheath.
Rhizome– an underground stem that is horizontal and produces roots at the joints.
Root– the underground portion of a plant. Draws food and water from the soil and stores plant food.
Rootstock– any underground stem that will take root at the joints.
Sheath– the lower part of a leaf that fits around the stem.
Spike– a long inflorescence attached directly to a stem with the newest flowers at the tip.
Spikelet– a small flower spike, the basic unit of the flower cluster of a grass plant.
Stolon– a long stem or shoot that droops to the ground and may root and form new plants where it touches the soil.

Source: K-State Research and Extension

Mid Grasses

a. Little Bluestem

b. Western Wheatgrass

c. Sideoats Grama

Credits: a. K-State Research and Extension; b. Robert Mohlenbrock, USDA NRCS PLANTS Database; c. USDA NRCS

Short Grasses

a. Blue Grama

b. Buffalograss

Source: K-State Research and Extension

Mid Grasses

Little Bluestem ***Schizachyrium scoparium***– It is a bunch grass with flattened sheaths, blades and stems purplish to bluish-green, turning leathery brown at maturity. The flower clusters have small fuzzy seeds with twisted awns (slender, stiff, bristle-like extensions of a plant, like the beards on a head of wheat) partially enclosed in the leaf sheaths. It grows on upland and bottomland soils to a height of three feet.

Western Wheatgrass ***Pascopyrum smithii (Agropyron smithii)***– It grows to three feet from gray, slender creeping rootstock. The stems and leaves are blue-green. The leaves are straight, broad, rough, and strongly veined on the upper surface and roll inward with maturity. The seed head is flat and usually awnless. It is most abundant in moist bottomland areas and prefers clay soils.

Sideoats Grama ***Bouteloua curtipendula***– It grows to 3 ½ feet tall with stems growing from strong, scaly rootstock. Hairs grow out of small, bulb-like spots on the leaf blade edges. The inflorescence has many spikelets (20-50) twisting around on one side when ripe, resembling oats. It matures and produces seed in spring and fall. It has good seedling vigor and can withstand long drought periods. It grows on well-drained soils throughout Kansas.

Short Grasses

Blue Grama ***Bouteloua gracilis***– It grows in bunches that reach up to two feet tall with erect stems. The inflorescence has two rooster comb-like spikes that curve downward when mature. It grows on hills and plains in shallow to moderately deep soils, primarily in the western half of Kansas.

Buffalograss ***Buchloe dactyloides***– It is a warm-season sod-forming grass that can produce 12-inch-tall seed stalks. It has creeping stolons which take root at the leafy nodes and forms sod. The leaves have bristly hairs on both sides. The foliage turns reddish brown after frost. The male and female plants grow in separate colonies. Female plants bear seed in bur-like clusters among the leaves. Male plants have a two- or three-spiked, flag-like seed head. Seed is produced throughout the year. It grows on shallow, droughty soils in the western half of Kansas.

Forbs

Showy Partridgepea ***Chamaecrista fasciculata***– It is an annual with slender, erect stems. It can grow from one to four feet tall, and branches freely; the branches have short hairs. Each leaf has six to 15 pairs of linear-oblong leaflets. Yellow flowers are clustered in the axils of the leaves. The flat pod (legume) is from one to 2 ½ inches long and contains from four to 20 seeds.

Showy Partridgepea

Credit: Clarence A. Rechenthin, USDA NRCS PLANTS Database

Catclaw Sensitivebrier ***Mimosa nuttallii***– A perennial trailing or sprawling plant, one to four feet long, ribbed and armed with hooked prickles. Flowers are up to one inch wide, pink to lavender in color, and grow in clusters. The leaves of this plant have a unique response to being touched: they fold up.

Catclaw Sensitivebrier

Credit: Megan Blythe

Blue Wildindigo ***Baptisia australis***– One of the first flowers of spring, it has blue to purple pea flowers grouped on 4- to 20-inch-long stems. The fruit is a pod which is one to two inches long, turns dark-brown to blackish, and tapers into a short beak, containing brown seeds.

Blue Wildindigo

Credit: Megan Blythe

Woolly Verbena ***Verbena stricta***– Stems are stout, leafy, and velvety because of a soft coating of whitish hairs. Grows two to four feet tall. Seedheads are stout, dense 6- to 12-inch spikes which sport small, purplish-blue flowers.

Woolly Verbena
Credit: Jennifer Anderson, USDA NRCS PLANTS Database

Curlycup Gumweed
Credit: Megan Blythe

Curlycup Gumweed ***Grindelia squarrosa***– This is a short-lived perennial. Its tooth-edged leaves are oblong, coarse, thick, and fold around to clasp the stem. The flower head is surrounded by small, pointed leaves which give off a sticky substance.

Ironweed ***Vernonia baldwinii***– Ironweed is a perennial forb with reddish-purple seed heads with 13 to 34 flowers forming a dense mass of color. Its stems are coarse and thick; the leaves are large with short stems. It can grow to five feet tall. It is considered an invader in bottomlands and other deep moist sites.

Ironweed
Credit: Clarence A. Rechenthin, USDA NRCS PLANTS Database

Common Wildflowers

Butterfly Milkweed ***Asclepias tuberosa***– Stems are coarse and hairy, and contain a small amount of milky juice. The bright flower heads are composed of many orange-red florets.

Butterfly Milkweed
Credit: Clarence A. Rechenthin, USDA NRCS PLANTS Database

Sunflowers– The sunflowers are a group of annual and perennial species native to the prairie. These include the state flower of Kansas, the annual sunflower (*Helianthus annuus*). Among the perennial sunflowers are Maximilian sunflower (*Helianthus maximilianii*), ashy sunflower (*Helianthus mollis*) and compassplant (*Silphium laciniatum*).

Maximilian Sunflower
Credit: USDA NRCS

Dotted Gayfeather ***Liatris punctata***– Also called "blazing star," it is an erect plant growing 30 inches tall. It arises singly or in clusters from the rootstock. The flowers are 3- to 8-disked florets in a purple to rose color. It prefers deep, well-drained soils.

Dotted Gayfeather
Credit: USDA NRCS

Photosynthesis Reference

Grass Makes Its Own Food
USDA Agriculture Information Bulletin 223 revised
Natural Resources Conservation Service, Salina, Kansas, 2003

Woody Species

Common native trees include bur oak (*Quercus macrocarpa*), black walnut (*Juglans nigra*), hackberry (*Celtis occidentalis*), and cottonwood (*Populus deltoides*).

Shrubs include American plum (*Prunus americana*), sandhill plum (*Prunus angustifolia*) roughleaf dogwood (*Rhus drummondii*), fragrant sumac (*Rhus aromatica*), and buck-brush (*Symphoricarpos orbiculatas*).

Bur Oak
Credit: USDA NRCS

Buckbrush
Credit: Robert H. Mohlenbrock, USDA NRCS PLANTS Database

The Web of Life

The grassland biome purifies the air through photosynthesis. In the process of photosynthesis, the chlorophyll-containing cells in green plants convert sunlight into chemical energy. As the plants do their work, they take in carbon dioxide and release oxygen. One source of carbon dioxide is human-produced fossil fuel emissions. The grass-filled prairies of Kansas are serving as a cleansing filter for the earth's human population as well as a food supply for its livestock and wildlife and, in succession, its people.

All members of the grass family, not only prairie grasses, live and grow on food manufactured mostly in their own green leaves. Rangeland or any grass crop can flourish only if the individual plant can make food for its own growth. The raw materials to make food are present in the soil and the air.

Beef Cow
Credit: Allison Blythe

Water entering the soil forms a film around each soil particle and dissolves some of the minerals present. Tiny root hairs from the plant come in contact with these films of water and absorb the mineral solution. A network of small roots carries this mineral solution to the main roots. The roots transport it to the stems; stems carry it to the leaves.

Plants use phosphorous, nitrogen, potassium, calcium, magnesium, and sulfur to manufacture their food. They use other minerals such as iron, manganese, molybdenum, copper, boron, and zinc in smaller quantities but must have them for good plant growth. All these minerals are contained in the solution carried to the plant.

Minerals from the soil make up about five percent of the solid material found in plants. Carbon, hydrogen, and oxygen from the air and water make up most of the other 95 percent.

Throughout the growing cycle, grass is consumed by grazing animals: bison, throughout history, and domestic cattle as well as others. The nutrients produced in the muscles of these grazers–some of which are so unique they can be found in no other food source–are passed on to meat eaters in a nutrient-dense package. Each link in this process is vital to the health of the grassland and to other consumers in the web.

Bison Herd
Credit: Bob Gress, GPNC

Climate of the Prairie

"The stranger [to Kansas], if he listened to the voice of experience, would not start upon his pilgrimage at any season of the year without an overcoat, a fan, a lightning rod, and an umbrella."

John James Ingalls, U.S. Senator from Kansas

The most recognized and accepted identification of climates was introduced in 1900 by Wladimir Koppen, a Russian-German scientist. Koppen divided the world into climatic zones which coincided with patterns of vegetation and soils.

The climate of the grasslands biome of North America is considered Dry Mid-latitude, using the Koppen classification system. Other areas in North America classified Dry Mid-latitude climate include the Great Basin and the Columbia Plateau, the arid tablelands between the Sierra Nevada and Rocky Mountain ranges.

Climatic Zone of Kansas

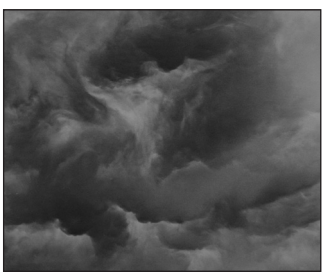
All Dry Mid-latitude climates have a wide range in annual temperature. Summers are warm and winters are cold. Kansas is no exception, as anyone who has spent a year in the state knows! There are huge variations in the temperatures and humidity levels throughout the state during the year. It follows that there are also vastly different ecological communities present in Kansas, including native grasses and prairie plants.

In Dry Mid-latitude climates, there are two main types of air masses: tropical air masses, which move toward the poles; and polar air masses, which move toward the equator. The air masses have a symbiotic, push-pull relationship–either air mass may dominate at one time, but neither has exclusive control. The Dry Mid-latitude climate is created when ocean air masses are blocked by mountain ranges to the west. This allows polar air masses to dominate in winter.

Kansas lies within a zone of interaction between the air masses which affect the climate of the entire North American continent. In summer, warm, moist, unstable tropical air flows north from the Gulf of Mexico and dominates the weather across the state. It is subsequently pushed aside by hot, dry, unstable, continental air masses from the desert southwest. The relative humidity can be high in the eastern part of the state, but the air becomes progressively drier to the west.

Rain Shadow Effect

The rain shadow effect has had a large influence on the Kansas prairie climate. Rain clouds originate off the Pacific Ocean and are forced to great heights by the three major mountain ranges in the West: the Sierra Nevada range, the Great Basin range, and the Rocky Mountains. The clouds cool and condense at high levels, and send moisture downward in the form of rain or snow. As they travel across the eastern slope of each range, they have less and less water to drop.



Storm Clouds Over Kansas
Credit: Edward A. Almquist

As they move further east, these clouds which have been wrung dry combine with moist air masses from the Gulf of Mexico, creating a new mass of moisture-laden clouds over the eastern Great Plains.

Simply put, the rain shadow effect helps create a higher humidity in the east than the west. Consequently, the differing precipitation amounts in each region of Kansas contribute to the type of plants that dominate. At the western border, the average precipitation is less than 16 inches per year. On the eastern border in southeast Kansas, the average precipitation is around 44 inches per year. From east to west across Kansas, the amount of precipitation received during the growing season ranges from 65 to 75 percent. During the growing season, about 45 percent of the precipitation falls in the May–June period and about 55 percent falls in the July–September period.

Soils of the Prairie

"…the Latin name for man, homo, derived from humus, the stuff of life in the soil."

Dr. Daniel Hillel, American professor of soil physics

A Teeming Factory of Life

It has been said that humans know less about the earth under their feet than they do about the far side of the moon. Yet every plant and animal on this planet depends on this vast, hidden ecosystem for food and shelter.

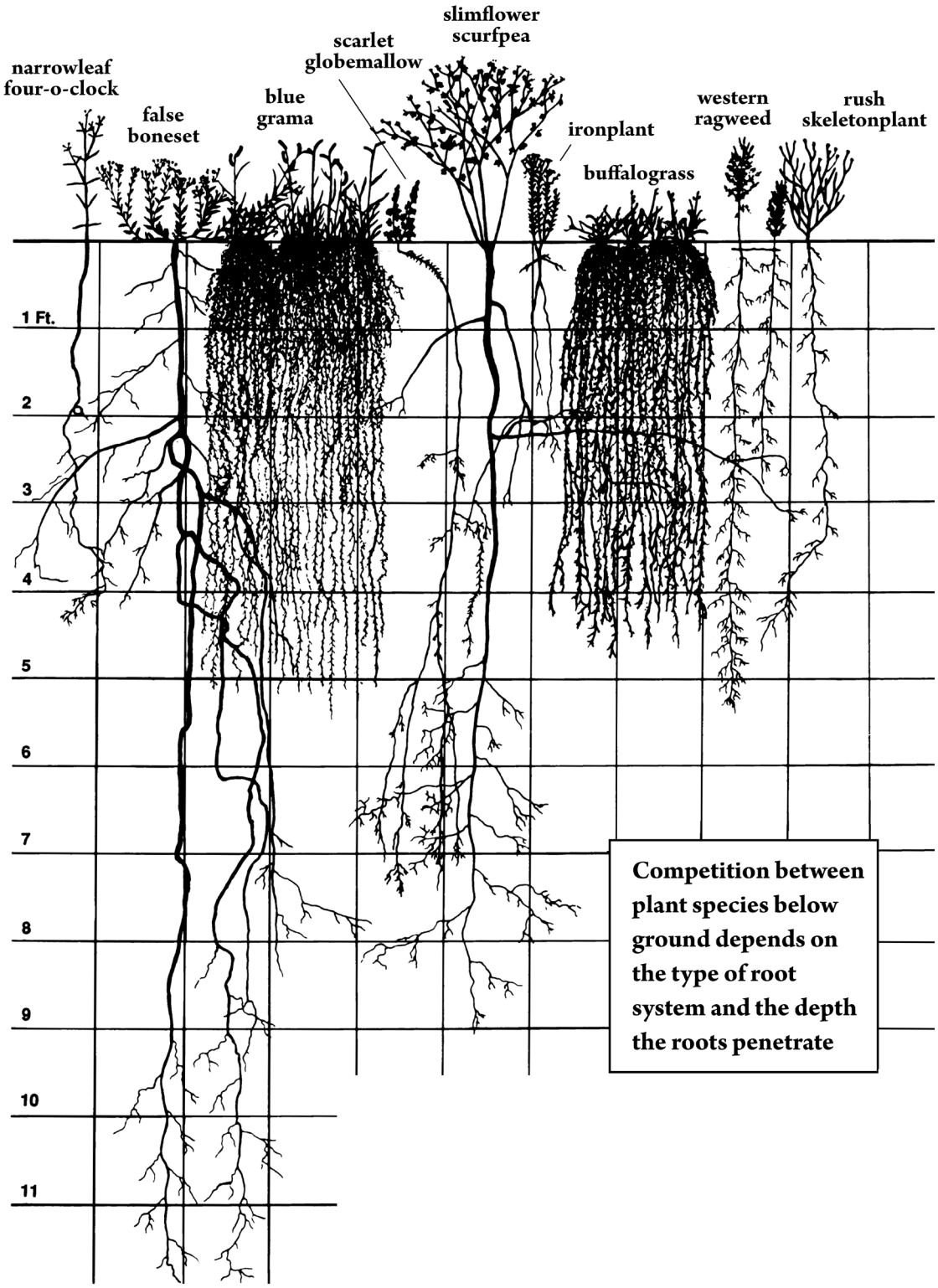
The Kansas prairie soil is highly fertile and has been called a teeming factory of life. It is one of the most complete and delicate ecosystems on earth. This contributes to a hugely diverse grass population that exists much the same today as it has for thousands of years.

At the ground level, plants and animals live and grow. A thick cover of growing grass and decaying plant matter insulates the soil. This aids the soil's ability to capture and utilize water in the form of rain, snow, and runoff. The natural mulch maintains a cooler and moister environment which helps the prairie to adapt to drought, a period of low moisture.

Soil under the prairie is a dense tangle of roots, bulbs, and rhizomes (horizontal stems, above ground or underground, from which aerial stems or leaves can arise). The roots of several species of grass can go deeper than the aerial stems are tall. Some of these roots die and decompose every year, adding large quantities of organic matter to the soil and creating the rich component called "humus." Its dark color permeates through the layers of soil. Roots are able to bring nutrients to the surface for the varied grasses to utilize. Also present in all soils are amoeba, bacteria, mites, nematodes, night crawler worms, and root fungus. All of these contribute to the nutrients which grasses and plants receive from the soil.

Harney Silt Loam
State Soil of Kansas
Source: USDA NRCS

Comparison of Prairie Plant Roots



Source: K-State Research and Extension

Soil Words

Humus– the organic component of soil, formed by the decomposition of leaves and other plant material. Its presence increases the ability of soil to retain water.

Mulch– a mass of leaves or composted material that protects or enriches the soil.

Layers of Rock

Geologists have identified 170 rock layers present in Kansas. Each one can tell a story, including how it was formed and how it was deposited. During parts of the Paleozoic Era, a time period from around 570 million to 245 million years ago, the state of Kansas was covered in water. As soon as any part of the land beneath the water appeared as the oceans receded, the process of erosion tried to wear the rock and soil back down to sea level. The material that eroded, called sediment, was carried by streams and rivers and deposited downstream, compressing into new and different rock layers.

The Cenozoic Era, which began about 63 million years ago, encompasses the most recent time, so scientists know more about it than any other geological time period. Glaciers moved into Kansas from the north during this era. Geologists have found that 70 percent of the original grassland area in North America was formed on soil deposits created by glacial ice. After the glaciers melted, wind and water carried the soil away from some areas and deposited it in other places. As mountains were formed in the western United States, layers of dust were introduced and deposited in Kansas.

Tallgrass Prairie Soil

Soils in the tallgrass region are born from layers of shale and limestone. When clay and silt are compacted into a solid rock, it is called shale. Shale erodes quickly into clay when exposed in outcrops. The shale creates slopes in the hillsides, giving the landscape a terraced shape. Some limestone has chert or flint nodules in it, which on freezing and thawing break up into the characteristic flint pieces that give the Flint Hills their name. Chert is stronger than the limestone which surrounds it, so it stays in larger pieces and makes the ground rocky.

As shale and limestone eroded, limestone layers or outcroppings were formed. The limestone layers formed benches that proved too rocky for the settlers to plow. The solution was for livestock to "harvest" the grasses that grew there.

True prairie soils are called mollisols, a type of soil recognized to have high fertility. Many eastern Kansas soils were formed from silt which had been deposited by wind and water. Loess (pronounced "lus") is windblown silt, carried after the mud hardened and turned to dust. The dust was carried by storms to many areas in the state leaving thicker deposits to the west and thinner deposits in the east. Thick glacial loess deposits occur in northeast Kansas where rocks and gravel were ground down by glaciers and water.

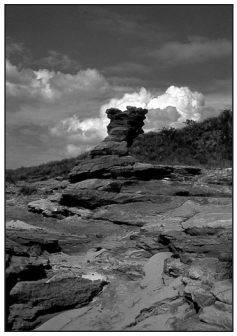
Flint Hills– Chase County
Credit: John Charlton, KGS

Chert– Chase County
Credit: Grace Muilenberg, KGS

Wabaunsee County Outcrop
Credit: Robert Swain, KGS

Mixed-Grass and Shortgrass Prairie Soils

The Smoky Hills region of Kansas lies west of the Flint Hills, in the north-central part of the state. Certain rocks present here were on the sea floor during the Cretaceous Period. The hills of the eastern Smoky Hills are capped with sandstone formed by rivers bringing sediment into early Cretaceous seas from the east. The hills in the central Smoky Hills region are topped with limestone formed from shallow deposits, which contain many small fossils. In the western part of the Smoky Hills, thick chalk beds were deposited at the bottom of the deeper parts of the Cretaceous ocean. As some of the layers eroded, the chalk beds were exposed and carved into tall, steep-sided formations by erosion. These remnants of the ancient chalk beds, known for the fossils of swimming reptiles and other dinosaurs, can be seen in Gove, Trego, and Logan counties.

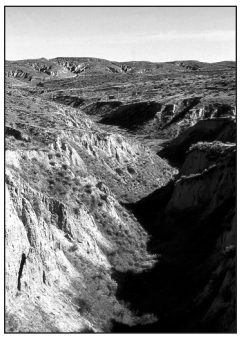


Sandstone– Marion County
Credit: John Charlton, KGS

Limestone– Russell County
Credit: John Charlton, KGS

Almost all of the western one-third of the state of Kansas is called the High Plains. The High Plains region is a huge, gently sloping floodplain, the result of millions of years of erosion at work on the Rocky Mountains to the west. The Rocky Mountains were formed during the late Cretaceous and early Tertiary periods. Streams flowing out of the Rocky Mountains carried masses of sand, gravel, silt, and rocks that eventually filled the stream valleys and covered the hills. Beneath the surface, the eroded materials trapped water in underground aquifers, including the Ogallala aquifer, which is one of the main sources of groundwater in western Kansas.

Monument Rocks– Gove County
Credit: John Charlton, KGS

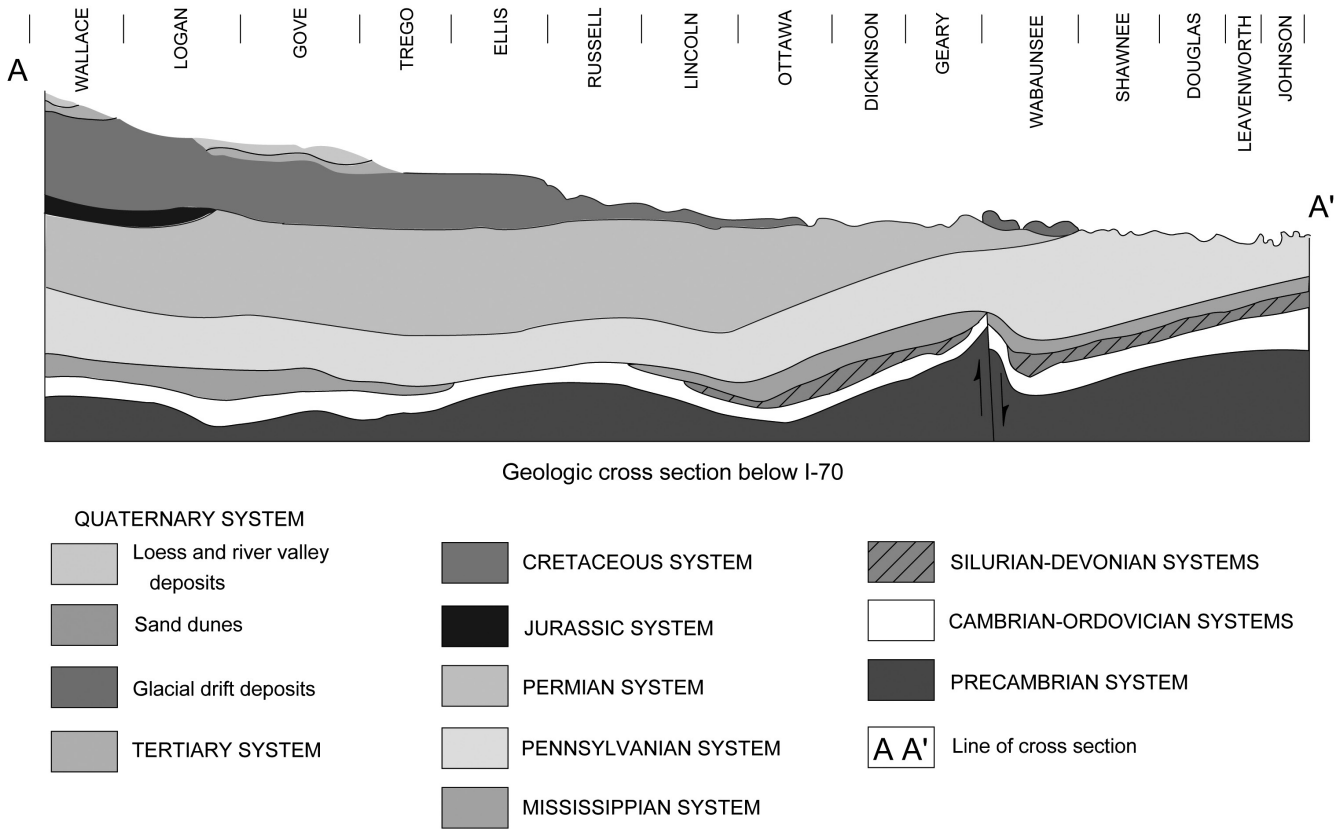


Arikaree Breaks– Cheyenne County
Credit: John Charlton, KGS

Driving across the state from west to east, most travelers don't recognize the gradual shift in elevation. The change in sea level is greater than 3,000 feet from the highest point in Wallace County near Colorado to the lowest point in Montgomery County near the southeastern border. The change in elevation is caused by additional layers of sediments present in western Kansas, but not in the east. Most of this sediment originated from the erosion of the Rocky Mountains.

In the shortgrass and mixed-grass regions of Kansas, the subsoil moisture is used each year by the vegetation. The soil remains dry and fertile because there is very little excess water to absorb any nutrients not used by the plants. The soil found in the shortgrass and mixed-grass prairies is sandier than in eastern Kansas.

Geological Cross Section of Kansas
(West to East along I-70)



Source: Kansas Geological Survey

Learning from the Prairie

Farmers have learned from nature and the prairie model: if you regularly rotate which crops are planted, it creates a balanced soil profile. Each crop lends different nutrients to the soil, and most crops benefit from the others' recent presence.

No-till farming and conservation tillage, practices becoming more popular in Kansas and throughout the United States, are a tribute to native grasslands. To reduce erosion from wind and water, farmers reduce the mechanical manipulation of the soil in fields in between the harvest of one crop and the planting of the next. The goal is to preserve the precious topsoil and to create a decomposing crop residue to nourish the new crop.

Wildlife on the Prairie

"Any glimpse into the life of an animal quickens our own and makes it so much the larger and better in every way."
John Muir, American naturalist

With 20 million acres of grassland in the Kansas prairie, it is not a surprise that grazing animals have been the dominant wildlife. Bison have roamed here, along with mule deer, white-tailed deer, and pronghorn antelope. Smaller mammal species have existed as well, including the coyote, black-tailed prairie dog, jackrabbit, and badger.

A large variety of birds live on the prairie, including western meadowlark, upland sandpiper, red-tailed hawk, burrowing owl, and prairie chicken. There are snakes and reptiles, including prairie and timber rattlesnakes and ornate box turtles. Insects are not usually classified as wildlife, but biologists at the Konza Prairie Biological Station near Manhattan have also identified over 50 types of butterflies and over 100 different grasshoppers alone. One species was found and given its common name by a Fort Riley Middle School class participating in their Schoolyard Long Term Ecological Research program.

Pronghorn Antelope
Credit: Jack Dykinga, USDA ARS

Western Meadowlark
Credit: Bob Gress, GPNC

Ornate Box Turtle
Credit: Bob Gress, GPNC

Kansas Students name Grasshopper

While participating in the Konza Prairie Grasshopper Inventory in September 2001, Mr. Gunderson's eighth grade class from Fort Riley Middle School caught a grasshopper that had no official common name. The students were asked to create a common name for the grasshopper, which has the scientific name *Boopedon gracile*. The students chose "Restored Prairie Calico Grasshopper" because the grasshopper was captured in a field that had recently been planted to native grasses and forbs. The appearance of the grasshopper reminded the students of a calico cat.

American Bison
Credit: Bob Gress, GPNC

Bison Facts

- Bison weigh from 800 to 2,000 pounds when fully grown and roam in herds.
- When the bison population was at its peak, it was estimated that one herd could number in the tens of thousands and be 12 miles long.
- The average life span of a bison is 15 to 20 years.
- Females, or cows, usually calve at two or three years of age.
- Bison calves weigh from 35 to 65 pounds at birth, and are yellowish-red in color.
- The American bison (scientific name *Bison bison*) was adopted as the Kansas state mammal in 1955.
- Bison actually belong to the same family of animals as domesticated cattle, sheep, and goats and are not related to Asian and African buffaloes, although early explorers called them "buffalo" when they first saw the animals in North America.

American Bison
Credit: Jack Dykinga, USDA ARS

Bison

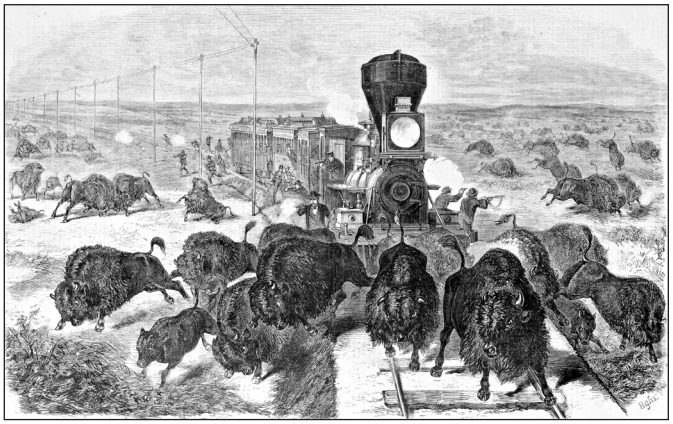
The largest grazing animal of the prairie was the American bison, commonly referred to as buffalo. It has been said that no other indigenous animal has influenced the history of the prairie and Old West so much as the buffalo.

Bison belong to the family *Bovidae*, the same family to which musk ox and domesticated cattle belong. The Latin name is *Bison bison*, specifying that it is not a "true" buffalo like the Asian or African buffalo, which has no hump. About 40,000 years ago, some small Asian buffaloes probably traveled across the Bering Strait into what is now North America. These were the ancestors of the present-day bison.

Prior to the Europeans' arrival on the continent, it is estimated that there were from 30 million to 75 million bison in North America. The first humans in the area probably traveled across the same land bridge as the bison. As the American Indian tribes evolved into hunting and gathering societies, the relationship which bound them to the bison held huge significance. The tribes roamed the entire continent, tracking and hunting the grazing animals. The bison had an effect on how the American Indians lived on the plains: where they lived, the structure of their societies, what tools and weapons they made, the stories they told, and the songs they sang. The demand and subsequent hunt for bison by the white man started in the 1830s. Fur trappers had almost exhausted the supply of beaver for pelts to send to Europe. Noting the large number of bison, the American Fur Company and the Hudson Bay Company switched their orders to bison robes to clothe their European customers.

Encouraged by the Homestead Act of 1862, farmers began to settle the Great Plains. The post-Civil War era brought many more people into the prairies of Kansas, and towns sprang up. As the European settlers moved westward, the population of bison declined in the late 1800s. The settlement of the Great Plains conflicted with the ability of the American Indians to continue their lifestyle. Sitting Bull, a Sioux chief, said of the decrease in the number of bison: "A cold wind blew across the prairie when the last buffalo fell … a death-wind for my people." Initially, bison meat was used locally, but after the railroad system was established, trains allowed for easy shipment of goods. This catered to the taste the people in the East had developed for the bison meat. Additionally, a new tanning process was developed for the hides in the early 1870s, making the preservation of hides easier.

The seemingly endless supply of bison encouraged wastefulness in the hunters. In 1872, two million buffalo were killed just for their



Shooting Buffalo on the Line of the Kansas-Pacific Railroad, 1871
Source: Library of Congress; Credit: Frank Leslie's Illustrated Newspaper

hides, which were selling for around $3.50 apiece. Based on the number of bones shipped east on the railroad (used to make bone china and fertilizer and in the sugar refining process), approximately 31 million bison were killed between 1868 and 1881. It was estimated that the amount of meat wasted during the period of great slaughter in the 1870s could have fed one million people.

In 1886, the Smithsonian Institute and the New York Zoological Society sent taxidermist William Temple Hornaday to the West to obtain a bison for preservation purposes. As he searched, Hornaday became aghast at the low numbers and he started a national effort to save the bison. In 1905, the American Bison Society was formed with Hornaday as its president. Theodore Roosevelt, who would become the 26th U.S. President but was then a rancher and former New York assemblyman, was selected as an honorary leader. They gathered the remaining few bison onto refuges across the country to regenerate the American herds' total numbers.

Currently there are around 270,000 bison in the United States. The U.S. Department of Agriculture Census for 2002 pinpointed the number of bison in Kansas at 8,767. American bison are raised on private, federal, and state lands.

Prairie Chickens

Greater Prairie Chickens
Credit: USDA NRCS

Prairie chickens have thrived in the Kansas prairie biome, but their population diminished when their habitat became settled by humans. In the late twentieth century, efforts were made to protect prairie chickens, and many people now recognize and enjoy their interesting traits. Unlike most birds, greater and lesser prairie chickens are not migratory. They spend the year in the same home area.

The most unique characteristic greater and lesser male prairie chickens share is an intricate courtship ritual called "booming." Areas called "leks"–elevated shortgrass areas, such as hilltops or ridges, often the tallest point for a quarter of a mile–are chosen by the male birds in mid-March. A male will attract a female by stomping and fluffing his feathers while inflating the large orange air sacs on the sides of his neck and giving a muffled cry which sounds like a "boom." The peak of the booming season is usually the first two weeks in April every year, but can run from the end of March to the beginning of May. Reserved sites for viewing the prairie chicken can be found at the Cimarron National Grasslands near Elkhart. More "reserved blinds" are being developed by the Kansas Department of Wildlife and Parks.

Greater Prairie Chickens

The greater prairie chicken, *Tympanuchus cupido*, is a bird which was once very prevalent in the tallgrass biome. It is related to the grouse and has a round, plump body with short legs and neck. The greater prairie chicken weighs two pounds, and it has a wingspan of 28 inches. It forages for seeds, buds, and fruit of native plants and also eats insects.

The greater prairie chicken prefers tallgrass and mixed-grass prairie which has been properly managed by grazing, burning, and fencing of livestock. They utilize many habitats in the tallgrass prairie, using the lightly grazed areas for nesting and the more heavily grazed for their booming.

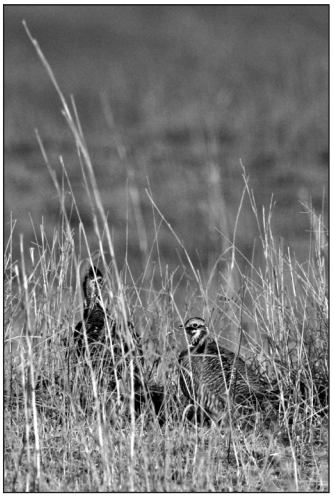
The original range of the greater prairie chicken stretched from Canada south to Oklahoma and Texas. Now, their year-round populations are focused in parts of Kansas, northeastern Colorado, Nebraska, and North and South Dakota.

Greater Prairie Chicken
Credit: USDA NRCS

Lesser Prairie Chickens

The lesser prairie chicken, *Tympanuchus pallidicinctus*, is a round, stocky ground-dwelling bird that looks–and behaves–much like its cousin the greater prairie chicken. The lesser prairie chicken prefers a more sandy-soiled range with sagebrush and little bluestem grass. Remaining populations are found in pockets in Kansas, Colorado, New Mexico, Oklahoma, and Texas.

The lesser prairie chicken can weigh one and a half pounds and lives from two to five years. Its largest clutch size is 14 eggs. Lesser prairie chickens do not migrate, but prefer a home range less than 1,200 acres in size.



Lesser Prairie Chickens
Credit: Stephen Ausmus, USDA ARS

The lesser prairie chicken is considered a candidate species for protection under the Endangered Species Act. Their population declined 78 percent from 1963 to 1980 due to the expansion of cropland agriculture.

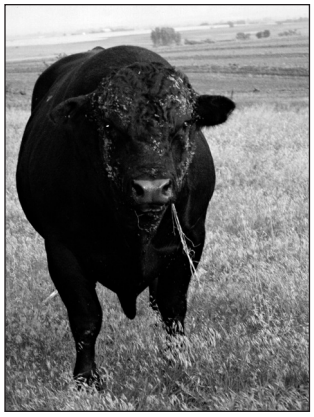
The Conservation Reserve Program of the U.S. Department of Agriculture may be an aid in prairie chicken conservation. Farmers and ranchers enroll in the program, agreeing to plant appropriate vegetation, often reseeding native prairie grasses on eligible fields to encourage wildlife habitat and retain topsoil.

Species in Harmony

Today, the Kansas prairie is home to both wildlife and livestock. In most situations, it is not a case of opposing interests. A grassland will support both native and domesticated species in harmony if the biome is thriving and healthy. Ranchers regard their stewardship of the soil and grass as a serious responsibility.

Proper management of grasslands can help wildlife most when a diverse grass and forb community is maintained. If herbaceous and woody plants are tall enough, this can provide cover for small mammals and birds. Management aids domestic livestock most when its forages are plentiful and sustained throughout the grazing season.

Mare and Foal
Credit: Tim McCabe, USDA



Angus Bull
Credit: Julia Stoskopf-Debes

Throughout history, ruminant animals like bison and cattle have grazed and fertilized the prairie, using their four-compartment stomachs to break down the cellulose found in prairie grasses. The stomach of a ruminant digests plant material through microbial digestion. Grass cannot be digested by humans; instead they must eat animal and plant products to absorb the nutrients they need, including the most critical nutrient, protein. Complete proteins like meat and milk contain all the necessary amino acids, the building blocks for muscles, nerves, and organ tissues.

The 20 million acres of grassland in Kansas support a beef industry that generated over $6 billion in sales in 2005. According to The Kansas Agricultural Statistics Service, there are over 6.65 million cattle in Kansas, including about 1.5 million cow-calf pairs and 3-4 million yearling cattle. The beef industry generates thousands of jobs in Kansas and plays a leading role in the state's economy, which is recognized by state and national leaders.

Grazing the Prairie

Cattle, like humans, have foods that they prefer or would choose over another. They will eat certain grasses first. Often a preference for a certain grass will change as the grass reaches a different stage of growth. This can be good and bad for grass production; the prairies have such a wide variety of grasses that there is usually one kind that is at the prime stage at any particular time during the growing season. However, if a single plant species is dominant, it could lead to overgrazing. Also, when there is a single grass species– a monoculture situation–an insect or plant disease outbreak could devastate the area.

Ruminants can travel great distances as they browse. Some scientists believe that the hooves of ruminants aerate the soil and encourage plant growth without damaging the prairie floor or its deep roots. Additionally, their waste deposits (manure) give nitrogen back to the soil, in a ready-to-utilize form.

The ability of perennial grasses to recover quickly after grazing or mowing makes them especially valuable for forage production and soil conservation. However, if rangeland is overgrazed with too many cattle on too small an area or for too long a period of time, it can appear healthy for a while before it shows the stress. The prairie grass is resilient and can recover a bit by relying on food stored in the roots and crown (the area where new shoots arise and the leaf meets the stem). It cannot overcome repeated loss of green leaves during the growing season. Repeated removal of green foliage causes a corresponding reduction in the root system. Top growth that is limited cannot feed a large root system. Neither can a stunted root system supply enough raw materials to support a large growth of stems and leaves. For every pound of growth above ground, most grasses produce a pound or more of roots. It has been said that two-thirds of the living prairie is underground.

Decaying grass roots, leaves, and stems, as well as the manure produced by grazing animals, supply organic matter to the soil. This maintains soil fertility and increases the soil's water absorption capacity, reducing erosion. The presence of grass lessens the amount and severity of water flowing off the land, reducing floods and excessive runoff.

If wind erosion occurs, it is largely on land that has little or no plant cover because of extremely dry conditions (drought), improper cultivation, or poor grazing management. Wind-tunnel studies have shown that a good growth of grass breaks the force of the wind before it can reach the ground and move the particles of soil.

Kansas Cattle Fact
The 6.65 million cattle in Kansas nearly equals 2 ½ times the state's human population of 2.7 million people.

Source: Kansas Livestock Association

Impacts on the Prairie

"Not everything that can be counted counts, and not everything that counts can be counted."
Albert Einstein, physicist

Several issues are impacting the prairie by changing or limiting its management. They include fragmentation or urban sprawl, alien and invasive species, water quality, air quality, wildlife management, and industrial power. Of these, some range biologists believe that fragmentation and invasive and alien species are the greatest threats.

Fragmentation

Credit:Daniel F. Merriam, KGS

Fragmentation, or urban sprawl, is reducing the amount of agricultural land in the United States at a rate of over 1,000 acres per day. Fragmentation results when land is sold in small acreages (1-20 acres), when roads and interstate highways expand rights-of-way, and when new water impoundments are developed. All these factors encourage individuals to move to the country. In addition to reducing the land available for food and fiber production, management options can become limited. For prairies, especially the tallgrass prairie, the continual loss of land under management that can maintain or improve the prairie is an issue. If fragmentation limits the use of prescribed burning as part of the management, the prairie will disappear.

Alien and Invasive Species

Alien and invasive species are relatively new terms used to classify undesirable species. Both pose a threat to the future of the prairies. Alien species are those that are brought into the North American continent either accidentally or deliberately for a specific purpose. Over time, these species become adapted and increase rapidly, replacing existing native or introduced species. Examples of alien species are musk thistle (*Carduus nutans*), sericea lespedeza (*Lespedeza cuneata*), Canada thistle

Musk Thistle
Credit: KDA

Sericea lespedeza
Credit: USDA NRCS

Eastern Red Cedar
Credit: Megan Blythe

Tamarisk (Saltcedar)
Credit: Delores Eberle, USDA NRCS

(*Cirsium arvense*), and Russian knapweed (*Centaurea repens*). In Kansas, these species have been declared noxious by law. Musk thistle was first promoted for ornamental use, while sericea lespedeza was imported for forage, erosion control, and wildlife food. Canada thistle and Russian knapweed were accidentally introduced as contaminants in seed.

Invasive species can be introduced species or native species that have increased in numbers and have replaced desirable grasses. This may occur due to changes in management, weather, or the absence of a natural control. Examples of invasive species are Eastern red cedar (*Juniperus virginiana*), Johnsongrass (*Sorghum halepense*), saltcedar or tamarisk (*Tamarix gallica*), and Causasian bluestem (*Bothriochloa bladhii*). Eastern red cedar is a native tree that invades prairies in the absence of fire. Johnsongrass and Causasian bluestem were introduced as forage species and have increased in many areas. Saltcedar is an introduced species that is found in the Cimarron and Arkansas River drainages.

Water Quality

Water quality has become a major concern affecting prairies. Livestock grazing is considered by some groups to pose a significant risk to water quality. However, research has shown that well-managed prairies have a low level of pollutants in the runoff leaving the land compared to most other land uses. Good management styles benefit both livestock production and wildlife habitat and result in a prairie landscape that can be enjoyed by many.

Air Quality

In 2003, weather conditions reduced the normal burning period of the Flint Hills. It is estimated that the normal burning activities were compressed from six weeks to about one week. Coupled with thermal inversions and heavy cloud cover, the smoke from the burning remained close to the ground. The result was a large plume of smoke that affected cities as far east as Tennessee. Current regulations allow landowners to conduct burning activities in a timely manner. If this flexibility is reduced or severely restricted, management practices of the tallgrass and mixed-grass prairie will be limited.

Wildlife Management

Wildlife management is an issue warranting increasing attention; in some instances because there are too few desirable animals, and in some because there are too many. Threatened and Endangered Species petitions have been submitted for the black-tailed prairie dog and swift fox. The lesser prairie chicken is being considered for petitioning. A large deer population has caused more automobile accidents in recent years, and their grazing has caused damage to and loss of crops. Coyotes can harm livestock and even pets in urban areas. Diseases such as rabies are transmitted by wildlife. Prairies provide the major habitat for many of these species. In addition to the humane treatment of wildlife, the primary concerns of landowners are how their own management options will be affected and what adjustments will be made for their loss and inconvenience.

1886 Ranch
Source: Library of Congress; Solomon D. Butcher, photographer

Wind Energy

"Madame, bear in mind,
That princes govern all things–save the wind."
Victor Hugo, French writer and poet

Wind is the result of solar energy. The sun's radiation heats the earth mostly during the day. As air becomes heated, it rises and cold air replaces it. The result is wind.

History

Since the early 1800s, windmills have been a part of Kansas agriculture–pumping water for livestock and people. Wind power has also been used to generate electricity for individual homes. In 2004, *The Wall Street Journal* identified wind power as one of the top ten growing trends in agriculture across the country.

Wind energy can be used to generate electricity. A wind energy conversion system transforms the kinetic energy of the wind into practical use. The electricity generated by large-scale wind turbines can be collected and mixed with electricity from other power plants and delivered to customers.

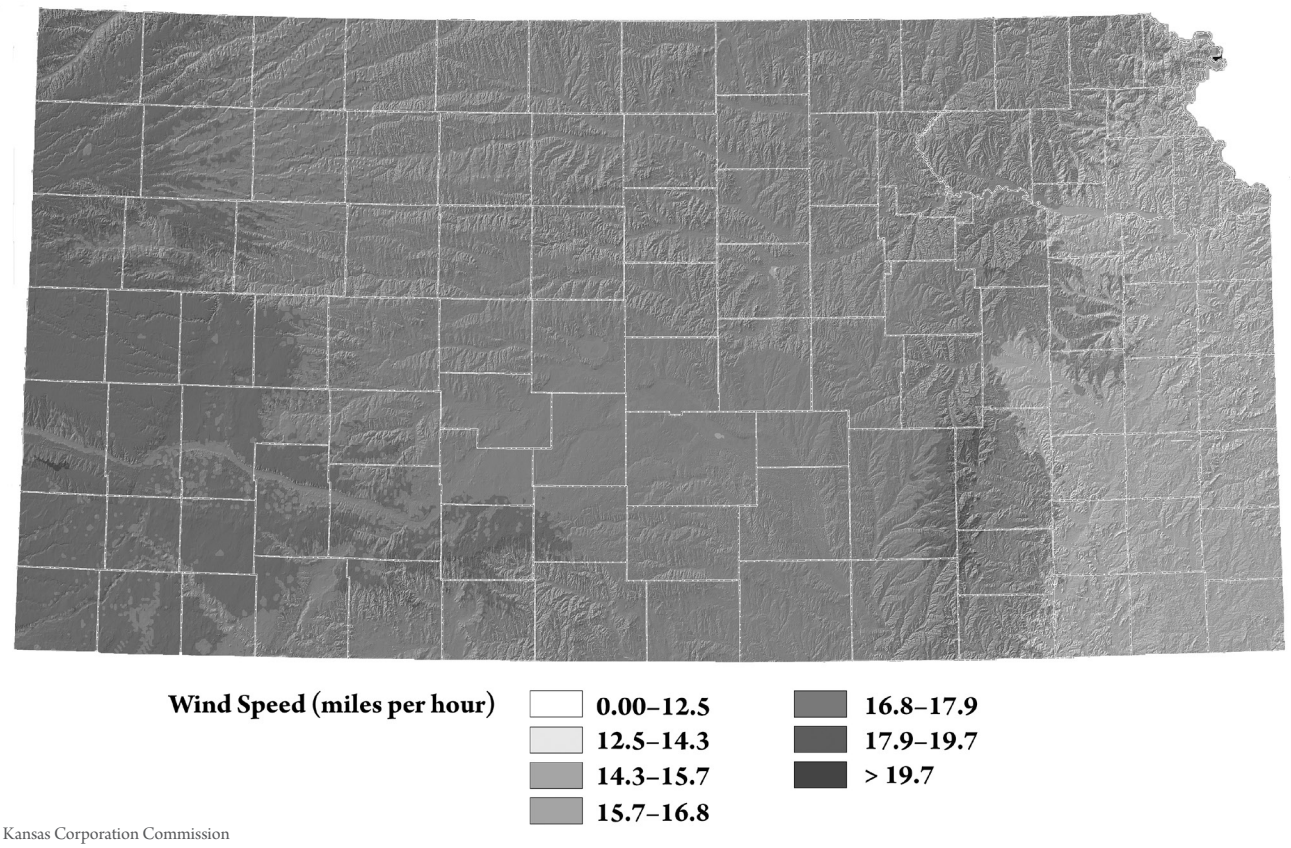
Gray County Wind Farm Facts

- The turbines at the Gray County Wind Farm are called Vesta 600-kilowatt turbines.
- At 217 feet tall, each tower is taller than the Statue of Liberty.
- Each tower has three blades. Each blade is 77 feet long and weighs 3,300 pounds.
- The average wind speed at the Gray County Wind Farm is 20 miles per hour.

Gray County Wind Farm
Credit: Sheila Forrester, USDA NRCS

Source: Aquila

Kansas Wind Resource Map



Source: Kansas Corporation Commission

Wind Energy in Kansas

Studies by the U.S. Department of Energy show that Kansas has the country's third-highest wind energy potential, because Kansas winds are mostly strong and constant. The largest wind energy system in the state is Gray County Wind Farm in the southwest, which opened for operation in 2001. According to data from Gray County, the 170 turbines have a generating capacity of 112 megawatts, equal to enough electricity for 33,000 homes. The facility uses six acres of the 12,000 acres it covers for towers and access roads. In addition, farmers can continue to grow their crops around the towers. Landowners earn approximately $2,000 per tower each year in lease payments.

The negative arguments against wind power include erosion from improper installation and landscaping, bird and bat kill from collision with turbine blades, and upset of wildlife from fragmentation of their habitat. Visual appearance and noise are also complaints. Even within the environmental lobby, there is controversy about wind energy. For example, in 2005 in the Flint Hills, local chapters of the Audubon Society and Nature Conservancy opposed the installation of wind turbines, arguing that they would befoul the landscape and harm wildlife. At the same time, Kansas Sierra Club leaders countered that utilizing wind power could help reduce the United States' dependence on fossil fuels.

Credit: Sheila Forrester, USDA NRCS

The Timeless Prairie

"If you're not from the prairie,
You've not heard the grass,
You've never heard grass." [1]

David Bouchard, Canadian author

The first explorers who came across Kansas were familiar with the forested regions of Europe and the eastern United States. When they reached the prairie and saw grass instead of trees, they assumed that the soils were inferior. Even as the population of the United States expanded, few people challenged those assumptions and the potential of the prairies remained hidden beneath the waving grasses. Today, the North American prairie is recognized as one of the most productive areas of the world. Increasingly, the world is looking to the Kansas prairies for research and assistance in addressing issues ranging from food security to air quality. Meanwhile, Kansas ranchers and farmers continue to care for the prairie soils and grasses and appreciate the Kansas prairie for its uniqueness.

Career Profile:
Jan Lyons
Cattle Rancher, Lyons Ranch

Courtesy: Lyons Ranch

She is a grandmother of seven, the mother to two, a wife of one, the caretaker to a respected herd of cows, and a leader of the entire beef industry. Jan Lyons raises Angus cattle near Manhattan in the tallgrass region of Kansas. She discovered her love of cattle early, showing steers at the county fair and helping her father on the family farm. "We never had too much extra growing up, so all the kids helped. I found out how much I enjoyed being outside, working with my dad and the cattle rather than being inside."

Lyons and her family settled in northeast Kansas and started Lyons Ranch, a purebred Angus cattle operation. As the ranch grew, so did her involvement in industry organizations, like the Kansas Livestock Association, which represent producers on the county, state, and national levels.

In 2004, Lyons was elected president of the 26,000 member National Cattlemen's Beef Association, the largest and oldest beef industry group. For "vacations" from the ranch, she has lobbied and testified before Congress on behalf of the cattle industry and traveled to meetings across the country to discover and share the concerns of producers from different states. The phone in her kitchen rings constantly—from reporters wanting background and quotes on international trade and health issues to neighbors wanting to buy another Angus bull from her herd. She says it is sometimes a crazy juggling act, but certain things make life come into focus: one of her favorite things to do is to see her cows and their calves grazing contentedly just before sunset.

Lyons says her favorite part of the year is in the spring when the cows are calving. "Seeing the new babies bond with their mothers–it is truly miraculous. It is like Christmas for me when they start having their long-awaited calves."

Lyons says that ranching is a privilege. "We are so fortunate to be entrusted with the care of some of the most unique and powerful grasses anywhere in the world. The native grass is ideal for grazing cattle–cows and calves and yearlings all thrive here in Kansas."

Proper management of the prairie is the key to keeping the native grass biome productive and healthy. "So many of our activities on the ranch such as burning pastures, chopping thistles, developing good water sources, and utilizing rotational grazing, are done to help the native grass," Lyons says. "We must use optimal stocking rates and manage the grass so it is replenished every year and will sustain for many generations to come."

Lyons stresses that ranchers and farmers are intelligent caretakers of the land, not plunderers of its bounty. "We know that our survival depends on our judicious use of the precious resources like grass and water. Being involved in farming or ranching is a great life," she says. "It isn't easy, but the people who are in it have chosen not only a business but a way of life. The people you meet are salt-of-the-earth, good people who work hard and have a deep, strong value system. I feel very lucky to be one of them and to have represented them."

Endnotes

1. David Bouchard, *If You're Not from the Prairie* (Orca Book Publishers, 2002), p. 14.

References

Grass Makes Its Own Food. Rev. ed. Salina, Kansas: U.S. Department of Agriculture Natural Resources Conservation Service, 2003.

Haddock, Michael John. *Wildflowers and Grasses of Kansas: A Field Guide.* Lawrence, Kansas: University of Kansas Press, 2005. <*http://www.kswildflower.org*>

Ohlenbusch, Paul D., Elizabeth P. Hodges and Susan Pope. *Range Grasses of Kansas.* Rev. ed. Manhattan, Kansas: Kansas State University, 1983. <*www.oznet.ksu.edu/library/crps12/c567.pdf*>

Pasture and Range Plants. Hays, Kansas: Fort Hays State University, 1989.

Taggart, Travis W. *Kansas Herpetofaunal Atlas: An On-line Reference.* Hays, Kansas: Sternberg Museum of Natural History, Fort Hays State University, 2007. <*http://webcat/fhsu.edu/ksfauna/herps*>

Teacher Resources

Books:

* *Teachers & Advanced Readers;* AR - *Accelerated Reading Level*

American Bison
Berman, Ruth. 1992 (AR - 6.7)

An American Safari: Adventures on the North American Prairie
Brandenburg, Jim. 1995 (AR - 7.5)

America's Prairies
Staub, Frank. 1994 (AR - 7.0)

America's Prairies and Grasslands: Guide to Plants and Animals
Wallace, Marianne. 2001 (AR - 6.2)

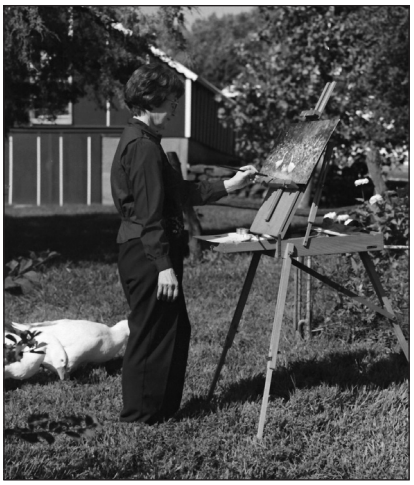
Bison
Winner, Cherie. 2001 (AR - 5.5)

Bluestem Horizon: A Story of a Tallgrass Prairie
Lee, Evelyn. 1998 (AR - 4.8)

The Buffalo Train Ride
Webber, Desiree M. 2005 (AR - 6.3)

Butter in the Well
Hubalek, Linda. 1994

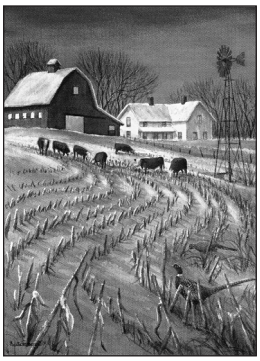
Career Profile:
Maleta Forsberg
Artist, Olive Springs Schoolhouse Gallery



Courtesy: Olive Springs Schoolhouse Gallery

It has been said by naturalists that the artwork that Maleta Forsberg creates is some of the best and most biologically correct at depicting wildlife. She uses pen and ink, pencil, watercolors, acrylics, and oil paints to create her realistic canvases. Although she likes to work "on-site," navigating her four-wheel drive pickup truck down the back roads of the state and carrying her supplies through farm fields and native pastures to reach the ideal spot, Forsberg also paints and sketches at her home on a hillside near Lindsborg in a studio designed to capture the north light. From its windows, she has a panoramic view of the valley below. "I watch the deer and the wild turkeys as they pass through. For inspiration, I don't have to go very far," she says.

Forsberg grew up in eastern Kansas "in the day when we still put up hay by hand," she remembers. "I used to go out to my grandfather's farm and watch the crew work. I loved the colors of the grasses and the prairie hay as it matured." As a young girl, Forsberg liked to sketch and was always drawing for enjoyment. "I don't think we had so many distractions as there are for kids these days. And there were always subjects close for me to work with: all sorts of animals, horses, the prairie, people. My uncle had a pony for me before I was even born," she laughs.



Twilight by Maleta Forsberg

"Nature has always been a huge inspiration to me," she says. "I love the wildflowers that come out around August, the sunflowers and the gayfeathers. I watch the wheat fields go from green to ripening when they make the waves of grain like a golden ocean."

Forsberg has a deep appreciation of the land and its inhabitants. "I really love seeing how the changing of the seasons can affect the colors and variety of the area. Sometimes you can see the same thing over and over, but then, all of a sudden, one day, see something completely different in it." In addition to her own independent works for galleries and shows, people often commission Forsberg to paint their family farmstead to help record their own precious memories and enhance their lives. She tries to work every day and is truly seeing her surroundings with an artistic eye, always thinking about her work if not actually painting.

"I think there are so many things to see around you, wherever you are," Forsberg says. "People are in such a hurry on their way to get somewhere. If they just buzz through Kansas without really taking a look, they are missing a lot."

Teacher's Resources (continued)

Cowgirls: Women of the American West
Jordan, Teresa. 1992

Energy at Work: Wind Energy
Sherman, Josepha. 2004

Food Chains in a Meadow Habitat
Nadeau, Isaac. 2002. (AR - 5.1)

Grasslands
Scheff, Duncan. 2001. (AR - 4.3)

If You Were a Pioneer on the Prairie
Kamma, Anne. 2003 (AR - 5.1)

The Prairie
Ormsby, Alison. 1999 (AR - 7.5)

PrairyErth *
Least Heat-Moon, William. 1991

Prairie Animals
Winner, Cherie. 2004

Temperate Grasslands
Hoare, Ben. 2003 (AR - 7.5)

They Came from the Bronx: How the Buffalo Were Saved from Extinction
Waldman, Neil. 2001 (AR - 5.8)

A Walk in the Prairie
Johnson, Rebecca. 2000 (AR - 4.2)

We Pointed Them North *
Abbott, E.C. 2003

Other resources for teachers:

Sod Box Requests:
Cimarron National Grassland
242 East Highway 56
P.O. Box 300
Elkhart, KS 67950
(620) 697-4621

Prairie Showcase:
Konza Prairie Biological Station

Konza Prairie Biological Station is a native tallgrass prairie preserve owned by The Nature Conservancy and Kansas State University. It is operated as a field research station by the K-State Division of Biology. The station, which is just over 8,600 acres in size, is dedicated to a threefold mission of long-term ecological research, education, and prairie conservation. It is a unique outdoor laboratory, open to scientists and students from throughout the world. It also serves as an environmental education facility and as a "benchmark" for comparisons with areas that have been affected by humans. Konza Prairie is a member of the Organization of Biological Field Stations and the Association of Ecosystem Research Centers, and is a National Science Foundation Long-Term Ecological Research site.

Konza Prairie
Credit: May Hammel

Konza Prairie is located in the Flint Hills region of northeastern Kansas, approximately six miles south of Kansas State University and the city of Manhattan. There are more than 600 plant species on Konza Prairie and several dozen species of fish, amphibians, reptiles, and mammals. Over 200 species of resident and migratory birds have been recorded on the preserve.

The objective of the Konza Environmental Education Program is to teach students the process of science through hands-on ecological research. Over 900 students visit the Konza Prairie each year through the Schoolyard Long-Term Ecological Research program. Another Konza Prairie project– "Prairies Across Kansas" –allows 5th through 12th grade teachers and students from across Kansas the opportunity to interact with Konza Prairie research efforts while studying native prairie sites near their own schools. This program is designed for Kansas teachers who are not able to bring students to the Konza Prairie.

Websites:

Great Plains Nature Center
http://www.gpnc.org

Kansas Grasses
Clinton E. Owensby, Professor of Range Management,
Kansas State University
http://spuds.agron.ksu.edu/ksgrasskey/linedraw.htm

Konza Prairie Biological Station
http://climate.konza.ksu.edu/konza/

The Noble Foundation Plant Image Gallery
www.noble.org/webapps/plantimagegallery/

PLANTS Database
USDA Natural Resources Conservation Service
http://plants.usda.gov

On the Prairie
The University of Minnesota's Bell Museum of Natural History
www.bellmuseum.org/distancelearning/prairie

USDA Forest Service National Grasslands
www.fs.fed.us/grasslands

Notes:

Prairie Showcase:
Cimarron National Grassland

The Cimarron National Grassland is located in the southwest corner of Kansas within Morton and Stevens Counties. Named for the Cimarron River which runs through it, the grassland is one of 20 national grasslands in the United States that are administered by the U.S. Department of Agriculture Forest Service.

Cimarron National Grassland is the largest parcel of public land in Kansas. After severe drought and dust storms devastated areas of the United States in the 1920s and 1930s, President Franklin D. Roosevelt and the United States Congress directed the reclamation and regeneration of marginal land. Following a recommendation by the National Planning Board in 1933, the Resettlement Administration purchased the Cimarron grasslands for around $4 an acre. Today, Cimarron National Grassland covers 108,175 acres. Most of the grasses are native types that have been seeded to create a typical grassland environment.

The area contains the longest publicly owned stretch of the Santa Fe Trail in the country. Ruts from the Santa Fe Trail commerce route, which was traveled from 1821 to 1880 and ran from Missouri to New Mexico, are still visible. A hiking trail has been created alongside the Santa Fe Trail–far enough from the visible ruts for hikers to be able to view but not disturb the landmarks.

Wildlife on Cimarron National Grassland includes pronghorn antelope, mule deer and white-tailed deer, quail, turkey, lesser prairie chicken, mountain plover, and dove. At last count, 345 bird species and 31 species of amphibians and reptiles live on the grasslands. Species numbers and diversity change over time as a result of weather fluctuations that affect food supplies and breeding habits. Cimarron National Grassland is open for camping, fishing, four-wheeling, hunting, and wildlife viewing. It has been recognized as one of the top 100 places in the United States for bird watching.

The condition of the grasslands is manipulated through the use of livestock grazing and prescribed burning. Each year, from May 1 to October 31, members of the Morton County Grazing Association graze around 5,000 head of cattle there–depending on moisture and grass conditions. (Each member of the association has obtained grazing permits allowing them to use the land.) There are approximately 500 miles of fence and over 250 watering facilities on the grasslands.

According to Nancy Brewer, Rangeland Management Specialist for Cimarron National Grassland, the area contains three main ecosystems: a shortgrass prairie ecosystem, a riparian ecosystem around the Cimarron River, and a sand and sage prairie ecosystem. Each system contains its own vegetative species.

Teachers are invited to request a Sod Box from the Cimarron National Grassland office to share with their students. Each box contains interactive projects that help teach about the prairie ecosystem, including books and grass seeds.

"Point of Rocks" in Cimarron National Grassland
Credit: John Charlton, KGS

Notes: