Executive Summary

The Loess Hills of western Iowa are a distinctive topographic region encompassing more than 640,000 acres and extending for nearly 200 miles in a narrow band that parallels the Missouri River valley. Here, exceptionally thick deposits of windblown silt form a region of unique hill forms that have been described as "the best example of loess topography not only in the Central Lowlands, but in the United States" (National Park Service 1985). The striking terrain is an outstanding example of landscapes formed by two fundamental geological processes-- the action of wind and the erosive sculpture of water. The intricately dissected region is characterized by distinctive shapes: narrow corrugated ridges with alternating peaks and saddles; numerous steep side slopes and branching spurs, often featuring natural benches known as "catsteps"; and precipitous bluffs, some with sheer, nearly vertical faces rising from the adjoining Missouri River floodplain. The geologic significance of the Loess Hills has been recognized for well over a hundred years, and the biological significance for nearly as long. The area's rich archeological and historical resources, combined with the extensive prairie ecosystems, contribute to the landform region's exceptional value.

In 1999, Congress directed the National Park Service to conduct a special resource study to evaluate the Loess Hills of Iowa for possible designation as a unit of the National Park System. The study includes a natural and cultural resources overview that describes the study area, and evaluates the national significance of the Loess Hills as well as the suitability and feasibility of including this entire landform region as a unit of the National Park System. In accordance with this legislative direction, the National Park Service has provided management recommendations for the long-term preservation of the Loess Hills of western Iowa in this study document.

The National Park Service recognizes that there is a strong desire by many people and organizations to preserve the scenic and natural values of the area. Already, a number of promising efforts to protect and interpret the Loess Hills have been initiated by state, local, and private entities. These entities include seven local County Conservation Boards, Golden Hills Resource Conservation and Development, Loess Hills Alliance, Western Iowa Tourism Region, Western Hills Area Education Agency, Iowa Department of Natural Resources, Loess Hills National Scenic Byway Council, Iowa Natural Heritage Foundation, Loess Hills Preservation Society, and The Nature Conservancy. Additionally, the Environmental Protection Agency, U.S. Fish and Wildlife Service, U.S. Geological Survey, and the Natural Resource Conservation Service serve as federal partners in several efforts currently underway to study and protect the Loess Hills.

Based on the application of National Park Service criteria, the National Park Service concludes that the Loess Hills landform region contains resources of national significance. It also finds that the Loess Hills would be a suitable addition to the National Park System.

However, the ownership pattern, size, multiple jurisdictions, threats, and lack of comprehensive planning make designation as a unit of the National Park Service not feasible. Five management frameworks for the long-term preservation of the Loess Hills are identified and evaluated in this special resource study. One management concept provides for the continuation of local management at the city and/or county level (no change), while another calls for a more holistic approach to managing the region through the formation of a Joint Powers Board. The Joint Powers Board could be composed of representatives from each county containing a portion of the landform region. Neither of these concepts includes federal designation. The other two alternatives include National Park Service involvement by designating either portions of, or the entire region as a National Reserve, an affiliated area of the National Park Service. Each management option considers land protection programs already available in the Loess Hills, comments received from landowners and citizens living within the study area, as well as comments from the general public. Together, these four alternatives, while having various degrees of federal, state and local involvement, remain sensitive to private landowner concerns and complement existing conservation efforts of state, local, and private entities.

In evaluating the management alternatives, the National Park Service recognized the value of having strong, locally based support and commitment to preserving the Loess Hills landform region. The National Park Service also recognized that the agency could provide support to local efforts to protect the significant resources of the Loess Hills and could help ensure that these resources are preserved for generations to come.

The recommended management strategy for the Loess Hills landform region is a blend of the four management alternatives previously discussed. This combination relies upon local planning efforts and the voluntary formation of a Joint Powers Board. Upon completion of a Comprehensive Plan that meets National Park Service criteria, the Loess Hills of western Iowa, or selected segments of the Loess Hills, could be designated as a National Reserve by request of the Joint Powers Board and the Governor of Iowa. This strategy provides for an initiative that originates at the local level and allows for state and federal assistance. This recommendation recognizes the national significance of the Loess Hills, encourages and enables local units of government to develop measures to protect the resources of the Loess Hills. The recommendation also provides for federal participation in the preservation of the Loess Hills at a level of involvement supported by local units of government and citizens of the region.

Additionally, the study team recommends the following studies:

- An evaluation of the *Glenwood Archeological Locality* and the *Jones Creek Watershed* properties for possible National Historic Landmark designation.
- An evaluation of any or all of the 12 Special Landscape Areas identified by this study (Appendix D) for National Natural Landmark designation.
- An ethnographic resources study to include a cultural affiliation component and a cultural properties survey that identifies places in the Loess Hills that are important to the cultural traditions and beliefs of native peoples who have an historical association with the Loess Hills.

INTRODUCTION

"These Bluffs are a Great Curiosity"
- John Insley Blair, 1863

Purpose of the Study

The National Park Service (NPS) has undertaken a special resource study of the Loess Hills landform region in western Iowa (study area) in response to the requirements of Public Law 106-113 (1999). The purpose of this Special Resource Study is to evaluate the Loess Hills landform region for possible designation as a unit of the National Park System. Special Resource Studies are designed to evaluate natural and cultural resources within a selected study area. The evaluation determines if an area is nationally significant, and whether it meets suitability and feasibility criteria for addition to the National Park System.

The study is a technical document that is used by Congress to determine whether or not to add a potential area to the System. Special Resource Studies also identify a range of appropriate management strategies for resource protection and public enjoyment. This study evaluates a range of five management alternatives that are sympathetic to the concerns of private landowners in the study area and are compatible with on-going protection efforts of state and local governments. The National Park Service, through the Secretary of Interior, forwards the study and any recommendations to Congress.

Location

Approximately 640,000 acres, the Loess Hills are a distinct landform region of steep bluffs, and sharp irregular ridge crests that border the Missouri River valley in western Iowa. The study area is located in portions of seven counties (Figure 1): Plymouth, Woodbury, Monona, Harrison, Pottawattamie, Mills, and Fremont. The metropolitan areas of Sioux City and portions of Council Bluffs are included in the study area. Access is available from U.S. Interstate 29, which runs parallel (north-south) to the Loess Hills, U.S. Interstate 680, and from U.S. Interstate 80, which provides a major east-west artery, passing through the Loess Hills near Council Bluffs. Several U.S., state, and county hard-surface and gravel roads provide access within the landform region. Additionally, the 220-mile Loess Hills National Scenic Byway travels through the heart of the landform region.

Methodology

Public law 106-113 authorized the National Park Service to study the "Loess Hills of Iowa." The study team further defined the scope of the study to include the entire natural geologic formation located in portions of Plymouth, Woodbury, Monona, Harrison, Pottawattamie, Mills, and Fremont counties (640,000 acres). Because of time and funding constraints, the study team chose to focus on the entire landform region and did not evaluate individual sites, counties, or specific landscapes within the region. The study team initially considered highlighting the existing National Natural Landmarks, but due to study constraints chose not to focus on these areas. During the study, the team identified 12 Special Landscape Areas that warrant further research. These 12 landscapes, defined on the basis of biological, geological, and topographic components, contain important natural, archeological, and cultural resources. These 12 landscapes were not evaluated individually or in varying combinations for possible designation. Appendix D further describes the 12 Special Landscape Areas and methods that were used in their identification.

Maps of the Loess Hills landform region were produced using summit heights, distinct topographic features, steepness of slope, local relief, loess thickness, and drainage density. The floodplains of rivers and streams through the Loess Hills were purposely included to provide a holistic, continuous depiction of the landform region. The boundary of the landform region as depicted on maps utilized in this report are generalized boundaries, intended for interpretive use, particularly along the eastern border. The landform region boundaries do not have legal standing.

The study team utilized NPS policies and guidelines outlined in NPS *Management Policies* (NPS 2001) in developing the evaluation. During the study process, team members consulted with individuals, public and private organizations, officials from the State of Iowa, city and county representatives, universities, resource experts, and colleagues. Team members reviewed an extensive collection of publications, reports, articles, and studies related to the Loess Hills. This included works on the geology, archeology, paleontology, and ecology of the landform region. Cultural, historic, scenic, and recreational resources were also reviewed. Selected team members have conducted numerous individual site visits to the Loess Hills over the years; a group site visit was conducted during the summer of 2000. Subsequent discussions and team meetings were held to evaluate the resource and explore management alternatives.

Public meetings were held in the seven-county study area during the week of February 28, 2000, and a public workshop was held on May 12, 2000, to inform the public of the project and gather input. During the week of November 13, 2000, additional workshops were held to solicit public input, respond to questions, identify issues and concerns, and document viable management alternatives (Appendix E). Subsequent discussions and meetings were held to evaluate approaches to preservation, in light of the final determination of significance, suitability, and feasibility.

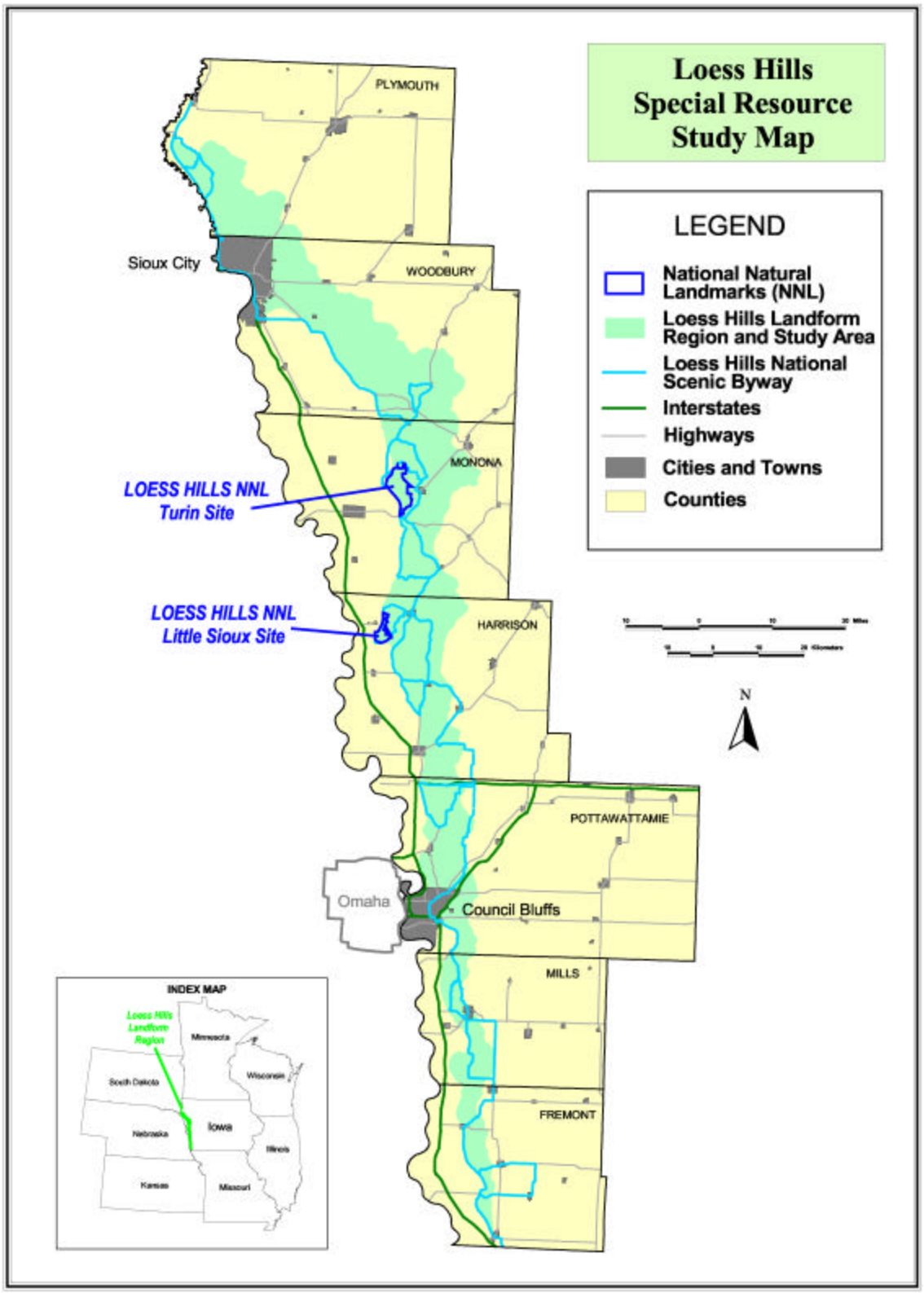


Figure 1: Loess Hills Special Resource Study Area

Background

Loess (pronounced "luss"), which is German for loose or crumbly (U.S. Geological Survey 1999), is a sedimentary deposit of wind blown silt. The Loess Hills are a region of exceptionally thick loess deposits that express the geologic work of glaciers, the action of wind, and the erosive sculpture of water in shaping the land. The geologic significance of the Loess Hills has been realized for well over a hundred years, and the biological significance for nearly as long. White (1870), Bain (1896, 1898), Shimek (1896, 1909b, 1911), and Udden (1901, 1903) provided early geologic accounts of the unusual terrain. Later, in the 1930s, three state parks were established in the Loess Hills. However, it was not until the last 30 years that local interest in permanently preserving the Loess Hills began to gather momentum. In 1977, the Western Hills Area Education Agency began conducting a field seminar series for the purpose of educating the general public, teachers, and residents of the Loess Hills about the area's natural history. These annual seminars have served an important role in educating local landowners and citizens throughout Iowa and neighboring states about the special character of the Loess Hills. The annual Loess Hills Prairie Seminar series is still conducted today, some 25 years after its inception. In 1981, the State Preserves Advisory Board funded a series of studies designed to underscore the Hills' significance, to inventory the region's biota, and to provide a basis for preservation. Results of these studies culminated in a symposium on the Loess Hills that was presented at the 96th annual meeting of the Iowa Academy of Science on April 17, 1984.

Scientific interest in the area continued into the 1980s and 1990s. In 1986, over 10,000 acres of state and private lands (Turin and Little Sioux-Smith Lake units) were included on the National Registry of Natural Landmarks as the "Loess Hills National Natural Landmark" (Figure 1). These two portions were thus nationally recognized as presenting the best expression of Loess Hills topography and native vegetation of classic loess deposits (NPS 1992). Public portions of the National Natural Landmark (NNL) are managed as wildlife areas; those lands in private ownership are used for agriculture and grazing. Through the efforts of multiple public agencies, local communities, and private organizations, the Loess Hills Scenic Byway was established in the early 1990s. In 1995, the Natural Resource and Conservation Service (U.S. Department of Agriculture 1995) completed the *Loess Hills Landscape Resource Study*, which determined that nearly 85,000 acres of the Loess Hills contains critically important natural and cultural resources. This was followed by the *Loess Hills Scenic Byway Corridor Management Plan* (CMP) (Golden Hills Resource Conservation & Development, Inc. 1998). Both documents include resource assessments, inventories, and guidance for managing the scenic, natural, and cultural qualities of the byway. Most recently, the U.S. Geological Survey (1999) conducted geologic research in the Loess Hills to evaluate rates of erosion and to test ice-age climate models. On June 15, 2000, the Loess Hills Scenic Byway was designated as a National Scenic Byway by the Federal Highway Administration (Figure 1).

As academic interest in the area grew, so too did public interest. In the 1970s, and again in the 1990s, the *Des Moines Register* promoted the concept of NPS designation with a series of articles. An increase in tourism in the area led to the formation of the Loess Hills Hospitality Association (in 1990), which provides tourism and cultural exchange opportunities in the

Loess Hills. The Iowa legislature requested the Loess Hills Development and Conservation Authority and the Golden Hills Resource Conservation and Development (GHRC&D) to organize a public forum to discuss concerns and possible conservation, development, and promotion programs within the Loess Hills. The forum, sponsored by the Iowa legislature, was held in 1998. The effort identified the most critical concerns facing the region, and quickly recognized the need for a voice of common vision to address these issues.

In June of 1999, the Iowa State Legislature codified the Loess Hills Alliance (LHA). The Alliance is a broad based, grassroots organization composed of representatives from each of the seven counties in the Loess Hills. The Alliance's mission is to create a common vision for Iowa's Loess Hills, and to protect special natural and cultural resources while ensuring economic viability and public and private property rights. Four sub-Committees (Stewardship, Protection, Information and Education, and Economic Development) have been established to carry out specific projects of the Alliance. Together, these committees help to promote private land conservation efforts in the Loess Hills.

Today, in addition to the activities of the Loess Hills Alliance, there are numerous private individuals and groups, and several local, regional, and state entities that have successfully engaged in projects designed to protect the environmental and economic integrity of the Loess Hills. These include, but are not limited to the following groups: seven County Conservation Boards, GHRC&D, Iowa Department of Natural Resources (IDNR), Soil and Water Conservation Districts, Natural Resources Conservation Service (NRCS), The Nature Conservancy, Iowa Natural Heritage Foundation, Iowa Environmental Council, Loess Hills Preservation Society, National Parks Conservation Association, and the Western Iowa Tourism Region. Additionally, several nature centers and county conservation boards sponsor educational programs, workshops, and field trips to promote principles of preservation and stewardship in the Loess Hills. Nature centers located in the study area include the Dorothy Pecaut Nature Center (Woodbury County Conservation Board), the Loess Hills Visitor Center (Loess Hills State Forest, IDNR), and the Hitchcock Nature Center (Pottawattamie County Conservation Board). Finally, the Loess Hills Hospitality Association operates a visitor's center in the town of Moorhead.

DESCRIPTION OF THE STUDY AREA

"There is great power in being in place, in knowing the watershed we belong to, in knowing the processes that have shaped the geography"

-- Terry Tempest Williams

NATURAL RESOURCES

Artist George Catlin, traveling by steamboat up the Missouri River in 1832, went ashore to climb a steep prairie-covered bluff and discovered a landscape where, as he wrote, "…thousand velvet-covered hills go tossing and leaping down with steep or graceful declivities" (Mutel 1989a). He was describing the Loess Hills: a narrow north-south band of rugged hills stretching along the eastern edge of the pancake-flat Missouri River floodplain in present-day Iowa. These "mountains in miniature" (as they were later called) could not fail to draw the attention of early explorers.

Photo courtesy of Don Poggonsee

Topography

The Loess Hills are a distinctive topographic region encompassing over 640,000 acres and extending for nearly 200 miles in a narrow band adjacent to the Missouri River valley. They constitute one of seven principal landform regions in Iowa (Figure 2). Although loess is a widespread geologic deposit, its development in western Iowa is of such magnitude, accumulating to depths of 150 feet in some places, that it dominates the landscape. The terrain is characterized by distinctive shapes: steep, narrow ridge crests, peaks, and saddles; numerous steep side slopes and branching spurs; and precipitous bluffs, some with sheer, nearly vertical faces rising from the adjoining Missouri River floodplain. These deposits form an extensive landscape of unique hill forms that are unparalleled in the United States and rare around the world. The Loess Hills' intricately sculptured loess deposits

have been described as "the best example of loess topography not only in the Central Lowlands, but in the United States." (NPS 1985). This striking landform is an outstanding example of a landscape formed by two fundamental geological processes -- wind and erosion.

Geology

Loess is a common geologic material and is thinly spread over much of the country's agricultural midsection. More significant accumulations of this windblown silt are known especially from eastern Washington State, southeastern Nebraska, the central and southern Mississippi Valley, as well as the Midwest. It is, however, the large contiguous tracts of unusually thick loess sculpted into a distinctive topography with a significant geologic record that sets the Loess Hills of western Iowa apart from the others.

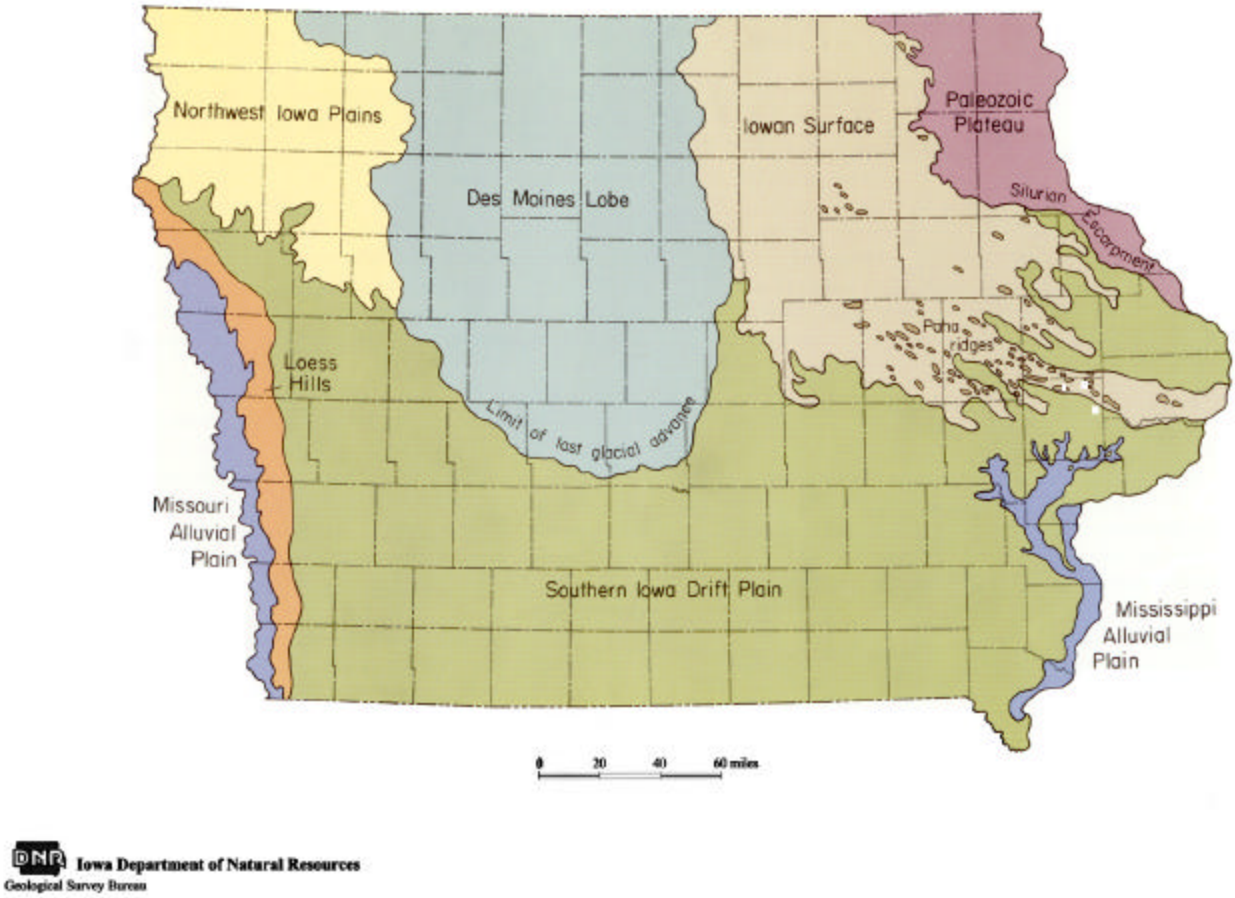
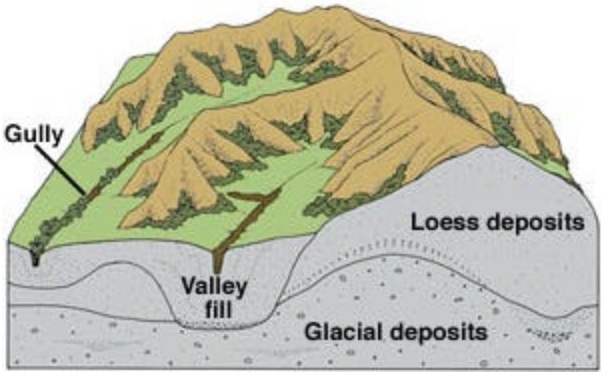


Figure 2: Seven Principal Landform Regions of Iowa (Prior 1991)

The Loess Hills are composed of three major geologic units. From oldest to youngest, the layers are known as the Loveland Loess (140,000 to 160,000 years old), the Pisgah Loess (28,000 to 35,000 years old), and the Peoria Loess (12,500 to 25,000 years old). Most of the landform region consists of large continuous tracts of deep silt deposited by the wind 30,000 to 12,000 years ago, and sculpted into distinctive terrain during the last 12,000 years (Bettis 1990).

During parts of the Wisconsinan glacial period (especially 30,000 to 12,000 years ago), the Missouri River valley was covered with a maze of braided streams carrying the outwash of glaciers that were melting to the north, their waters milky with glacier-ground silt. The Missouri River was one of the largest of these meltwater routes. Streams surged during the warmer months of the year and dissipated when winter's cold ended glacial melting. At those times, drying expanses of abundant silt were lifted by strong winds and carried eastward until topographic obstructions and shifting air currents caused the particles to drop. Over time, massive accumulations of loess were deposited. The deepest deposits formed directly adjacent to the north-south stretch of the Missouri Valley source, forming the nascent Loess Hills.



Adapted from: Landforms of Iowa, J.C. Prior, 1991. Patricia J. Lohmann, artist. Iowa Dept. of Natural Resources.

While glaciers and wind provided the raw material for the hills, it was the action of water, over the last 12,000 years, that sculpted the thick loess deposits into the distinctive topographic features that are visible today. Such rugged, high-relief landscapes are otherwise uncommon in the Central Lowlands, the nation's broad mid-section where Pleistocene glaciers have leveled the land. The divergent, angular ridges form a steep, corrugated landscape with a maze of sharp ridgelines, sheer bluffs, and sidespurs that extend across the horizon. The more gently sloped valley bottoms are often entrenched with deeply incised gullies. Side spurs lead off of major ridgelines, only to diverge again to form their own sidespurs – all of which give testimony to the dense drainage network carved into this landscape. The Loess Hills constitute an eolian landform region that expresses the work of glaciers, the action of wind, and the erosive sculpture of water in shaping the landscape.

These massive accumulations of unconsolidated lightweight material, unlike sand dunes, normally remain remarkably firm and stable. Cohesion of the silt particles enables steep, dramatic bluffs to stand erect and intact as long as the loess remains dry and undisturbed. Natural processes tend to keep it this way: the well-drained loess dries rapidly after rain because water infiltrates easily, and precipitation moves quickly off the steep slopes. However, if saturated or disturbed, the gritty particles can succumb easily to forces of water and gravity. This combination of particle cohesion and high erosion potential explains the shapes that dominate this landform region. Slabs – sometimes entire bluffs – of saturated

loess collapse and slump downslope; eroded loess spreads out into valley bottoms or is carried away in sediment-laden streams; dramatic gullies advance headward and deepen; and bit by bit the Loess Hills continue to change in form.

In contrast to the distinct, precipitous western edge of the Loess Hills along the Missouri Valley, the eastern boundary of the landform region is more difficult to define. The Loess Hills merge gradually with the adjoining Southern Iowa Drift Plain or Northwest Iowa Plains. The classic elements of Loess Hills' topography are not as obvious, nor as plentiful in these marginal, eastern areas of the landform region. This is because of the gradual thinning of the wind-deposited wedge of loess in an eastward direction, away from the Missouri River source area. It becomes more difficult to differentiate the true Loess Hills terrain from the steeply rolling topography of the Southern Iowa Drift Plain, which is also loess mantled but without sufficient thickness to alter the appearance of the landscape. The eastern boundary is a somewhat arbitrary line based on the presence or absence of distinguishing topographic features, summit heights, the degree of drainage density, the presence of defining drainage divides, soil types, and loess thickness. Because of the variability in the original loess depth, the thickness of the underlying glacial drift, and the elevation of the underlying bedrock, features of the Hills also vary from north to south. The sharp, intricate terrain typical of the central and southern Hills is more subdued in far-northern Plymouth County, where bedrock is closer to the surface. In contrast, angular, dissected features are especially well developed in Harrison and Monona Counties, where the loess deposits are broadest and deepest.

Geologic Investigations

The Loess Hills claim a long history of geologic interest and investigations. Clues within the loess have helped geologists reconstruct significant geologic events and develop climatic models. Scattered deposits of whitish volcanic ash, exposed near the Harrison-Monona county line, have been traced to eruptions from now-extinct volcanoes located near Yellowstone National Park in Wyoming. These windblown deposits, dated between 620,000 and 710,000 years ago, have been valuable in separating and dating mid-continental glacial deposits. Geologists also visit the scientifically significant exposure of Loveland Loess at its geological type-section in the central Loess Hills, where Interstate 80 cuts through the bluffline in northwestern Pottawattamie County. Here, 130 feet of vertical exposures reveal the internal composition of the loess deposits. Glacial till is covered with 19 feet of Loveland Loess deposited between 140,000 and 160,000 years ago (Illinoian age). This is covered by over 100 feet of younger Wisconsin age loess. This particular exposure is the standard used by geologists to define the characteristics of the Loveland Loess formation, the most widespread pre-Wisconsinan loess in the mid-continent. Loess kindchen (loess dolls), often exposed in Loess Hills roadcuts, have caught the interest of geologists and the public alike. These knobby pebbles and stones ranging up to the size of grapefruit are concretions of calcium carbonate formed in the loess by percolating groundwater. The nodules are of increasing geologic interest because of their potential to preserve a geochemical record of paleoclimatic change in continental environments.

Elsewhere along roadcuts and in quarries, far older Cretaceous-age sedimentary bedrock of limestone, sandstone, and shale (in the northern Loess Hills) and Pennsylvanian limestones (farther south) are exposed beneath the loess and glacial drift. These rock units, as well as

sand and gravel deposits and the loess deposits, have long been quarried for aggregate, as a construction resource, and for fill-dirt. It is worth noting that these deeper earth materials and their relative resistance to erosion account for the scalloped character of the Loess Hills bluffline and changes in the overall width of the Missouri Valley. Soil loss and the susceptibility of loess to gully erosion in the Loess Hills have prompted research into erosional processes and soil preservation strategies. Additionally, because loess was deposited by Ice-Age winds, it represents a record of past climates. The U.S. Geological Survey is collecting information valuable to testing computer models of past climates.

Paleontology

Significant fossil assemblages, some of the richest in Iowa, have been found in the Loess Hills. Fossils of Pleistocene snails and small mammals have helped to decipher the sequence of shifting forest and grassland communities that alternately covered the region in ancient times. More spectacular are the outstanding fossil remains of mammoths, mastodons, ground sloths, caribou, camel, and giant beaver, along with other animals that roamed this region during the Pleistocene. Numerous fossils of this diverse Ice-Age fauna have been unearthed from sand and gravel layers within glacial drift deposits that underlie the loess. The so-called "Aftonian fossil fauna," discovered in the Loess Hills and described by naturalist Bohumil Shimek and geologist Samuel Calvin in the early 1900s, provided the first detailed reports of Iowa's fascinating glacial-age animals (Calvin 1909; Shimek 1909b).

Abundant snail fossils found within the loess provided a crucial key to deciphering the origins of loess and Iowa's Loess Hills. Eighteenth-century geologists initially conjectured that loess had been laid down in water. In the early 1900s, however, naturalist Bohumil Shimek and others correctly deduced that loess was a wind deposit. Shimek's identification of numerous fossil land snails buried in the loess supported his theory.

Natural Communities

Photo courtesy of Loess Hills Alliance

For over a century, Iowa's Loess Hills have attracted botanists who have studied the unusual assemblage of plants found in this area. Approximately 700 species of vascular plants – over a third of Iowa's flora – have been identified in the Loess Hills. The high diversity of both species and ecological communities is explained by the varied microsites created by the dissected terrain. The regional climate, on the whole, is mid-continental with extreme temperature variations exemplified by cold winters and hot summers. However, in this landscape with its diverse exposures, one can climb within a few hundred feet from moist valley woodlands onto sun-scorched, droughty

ridgetop sparsely vegetated with drought-tolerant grasses and forbs.

Until the 1850s, fire-dependent native prairies dominated the Loess Hills, as was true of most of the western Central Lowlands. Eastern deciduous forest species flourished only in moist sites along creeks and at the base of sheltered slopes. A dynamic border separated the two major types of ecosystems, with frequent wildfires favoring the sweeping expanses of prairie grasslands. The post-settlement exclusion of wildfire has allowed woodlands to expand into many areas previously covered by prairie. However, prairies still cover broad expanses of the driest, harshest Loess Hills sites: the westernmost bluffs and sun-and wind-exposed ridgetops with their adjacent south- and west-facing slopes. Protected from intensive agricultural use by rugged topography, many of these prairies have retained much of their original integrity and diversity and remain relatively large. Indeed, Loess Hills prairies in Iowa in 1980 comprised a minimum of 22,250 acres (three-percent of the landform region), over half of the remaining prairies in the state that was once the heart of the tall-grass prairie (Selby 2000; Appendix D).

The expanses of native prairies and forests that today dominate the Loess Hills constitute a highly diverse mixture of eastern and western plant and animal species, many of which reach the edge of their distributional range. At this significant biological crossroads, eastern deciduous forest species at or near the edge of their range interlace with dry prairies that are fostered by the harsh extremely dry environment (produced by wind, sun, and well drained soils) and include a rich mixture of plants and animals typically found much farther to the west. A total of 96 Loess Hills species are of interest because they are either western species at or near the eastern edge of their range, eastern species at or near the western edge of their range, or are listed by the State of Iowa as endangered, threatened, or special concern species. The 39 state-listed species constitute one of the largest concentrations of rare species in the state. While 11 of the listed species have woodland affinities, 25 are prairie species, a dominance that reflects the relatively large amount of prairie habitat remaining in the Loess Hills (Appendix A). The continued woodland invasion of remaining prairies poses a major threat to many of these regionally rare species. While seven federally listed species occur in one or more of the seven counties that the landform is located in, there are no known occurrences within the upland areas of the Loess Hills (Howell, personal communication).

Most scientific interest has been focused on the prairies that house a variety of rare western plants and animals at the eastern terminus of their distributional range. These dry prairies are dominated by the grasses little bluestem and side-oats grama, joined on the westernmost bluffs by plains muhly. Great Plains forbs such as skeletonweed, soapweed, and scarlet gaura lend a distinctive element to mid-grass communities. These plant communities like all prairies-evolved in the presence of wildfire, which stimulates the vigor and health of these fire-adapted ecosystems. The plant communities are matched by western animals such as the Great Plains skink, prairie rattlesnake, and plains pocket mouse, which join more ubiquitous species such as the badger to form a grassland fauna of small, secretive animals. Western species are most diverse toward the north, where Loess Hills prairies are the largest. These mid-grass prairies, with their western forbs, are unique in Iowa. They probably resemble the mixed grass prairies 70 miles and more to the west more than either other dry prairies in the

region, or the tallgrass prairies that are the norm for this longitude (for a listing of species scientific names, see Appendix B).

Renewed awareness of the landform region's significance shifted attention toward the identification of areas worthy of preservation, and led to the identification of the Loess Hills in 1998 as one of The Nature Conservancy's national priorities. The Nature Conservancy's studies of the central tallgrass ecoregion have revealed that the Loess Hills contain the best examples in the world of three natural community types: Eastern Great Plains Big Bluestem Loess Prairie, Loess Hills Little Bluestem Dry Prairie, and Eastern Great Plains Bur Oak Woodland. Additional recent scientific studies include vegetation analyses primarily by Rosburg and lepidopteral investigations. These have progressed simultaneously with intensified management efforts.

Woody vegetation (primarily forests) covers about 73,500 acres (11 percent) of the landform region (IDNR 1992). The majority of the forests result from woody invasion of prairies, a process that has been aggravated by the exclusion of wildfires that kill most trees and stimulate native grasslands. Bur oak is the most abundant tree species. Subdominants such as ironwood or red elm may commingle with the bur oak but the understory of bur oak woodlands is often sparse, consisting of a few common species such as Virginia creeper. The low species-richness and diversity emphasize the immaturity of these forests. This is also true of very dense eastern red cedar woodlands that plague pastures. Invasive woodlands of green ash and red elm mix with cottonwood, ironwood, or other trees to cover very disturbed hillsides. Although uncommon, older forests occupying historically wooded locations remain western outposts of the eastern deciduous forest. Examples of such more diverse woodlands can be seen in the three Loess Hills state parks and elsewhere, usually as pockets in deep ravines.

Woodland animals include common species such as the fox squirrel, eastern cottontail, and woodchuck, as well as a diverse assemblage of birds. Larger animals such as the red fox, white-tailed deer, and coyote wander between woodlands and grasslands. A few rare species such as the hickory hairstreak butterfly and speckled kingsnake also inhabit Loess Hills forests. Forest animals in general are increasing and expanding their ranges northward as woodlands expand, often at the cost of prairie animals. For example, all increasing Loess Hills reptiles are woodland species, while prairie reptiles are declining in number (Christiansen and Mabry 1985).

Wetlands and Floodplains

The floodplains of rivers and streams through the Loess Hills were purposely included in the Study Area to provide a holistic, continuous depiction of the landform region. As such, two classes of streams are found in the Loess Hills. The first class includes the numerous small, intermittent streams originating in local Loess Hills watersheds. These have not been channelized. There are also larger streams in big valleys such as the Little Sioux, Floyd, Maple, and Boyer, which originate east of the Loess Hills, and cross through the region before joining the Missouri River. Most of these tributaries have been channelized in their lower reaches or are silt-laden and unproductive. Broad, alluvial plains are associated with

the larger streams, including some oxbow lakes and backwater sloughs. Small impoundments are also scattered on lower slopes throughout the region. The natural alluvial wetlands in particular often are within the view of scenic vistas from the Loess Hills.

SCENIC RESOURCES

"The question is not what you look at, but what you see"

-Henry David Thoreau, 1854

The Loess Hills have numerous scenic qualities and hence, have considerable visual appeal. Natural landscapes, a rich cultural legacy, and agricultural traditions contribute to the scenic quality, and the character of the Loess Hills. The sharply defined western edge of the region is the strongest and most scenic characteristic; the stark contrast along the bluff and the river floodplain creates the most recognizable visible "signature" of the landform. Andreas (1875) described the views as thus:

> Bordering [the Missouri River bottoms] on the east, the range of bluffs rises steep and grand, in many places almost perpendicular from two to three hundred feet in height. The range is parted by numerous narrow valleys and ravines, which descend from the adjacent uplands, but never loses its distinctive outlines. This remarkable range, rising abruptly from the sweeping plain, without a rock or stone on its face presents a view at once varied, grand and beautiful. The adjacent uplands are broken and in many places [are] too uneven for tillage; but are well adapted to grazing, and are frequently interspersed with thrifty groves of timber. Further east the broken outlines give place to a beautiful, undulating or waved surface, peculiar to the Western Slope, alternating with level valleys from a half mile to a mile in width bordering the streams. Everywhere there is a pleasing variety of scenery enhanced in loveliness by a pure atmosphere and a constant succession of rich, mellow tints which never fail to charm the eye with new and delightful forms and colors revealed by the perpetual play of light and shadow upon the varied outlines.

Photo courtesy of Don Poggensee

Within the interior Loess Hills, scenic views unfold along the many byways that traverse the Loess Hills. Farms appear nestled into coves surrounded by the wooded hills, terraces of crops or pastures step up the side of rolling hills, and the Missouri River bottoms are occasionally glimpsed through folds in the hills. Historic churches and pioneer cemeteries dot the landscape. From high points on the bluffs, spectacular views open up over the broad and fertile expanse of the Missouri River bottom. Interviews conducted for *The Loess Hills Scenic Byway Corridor Management Plan* (GHRC&D 1998), hereafter the Byway Plan, found that "[t]he scenic qualities of the Loess Hills are widely recognized as one of the Scenic Byway Corridor's most distinguishing features. … viewing the fall colors of native prairie and hardwood forests in the Loess Hills is among the most popular attractions for travelers." The *Plan* also notes that farming and the associated historic structures that reflect the agrarian lifestyles are "important components of scenic quality in the Loess Hills." Visual perception studies conducted for the Byway Plan identified a number of preferred features. These include native prairie vegetation, water (as a stream, lake, or wetland), a combination of land cover (forest, prairie, and grassland), juxtaposition of the extreme edge (steepest topography) to the inner landform (moderately rolling topography), proximity to public recreation areas, and landscape views. The Byway Plan identified over 15 scenic overlooks dispersed throughout the 7-county study area that contribute to the overall scenic resources of the National Byway. Viewshed maps are contained in the Byway Plan (a viewshed, as defined by the Byway Plan, is a quantitative measure of distance seen from a given point on the Byway) and can assist with the development of land-use strategies to preserve the scenic quality of the Loess Hills.

A SENSE OF PLACE: THE HUMAN STORY

"When I am here, the spirits of our ancestors are all around me"

-Pete Fee, Ioway Tribe
Iowa-Portrait of the Land (2000)

The human story of the Loess Hills of western Iowa is integrally related to the tale of the landform region's prehistoric and historic occupants over the last 12,000 to 13,000 years. American Indians have lived in, hunted in, farmed in, and traveled throughout the landform region for thousands of years. In the historic period, the Loess Hills were home to tribes that were indigenous to the region, such as the Ioway (Iowa) and Otos; they were also home to the displaced Potawatomis. French fur traders and missionaries discovered the Loess Hills in the early 1700s. Several historically important routes crossed through and paralleled the Loess Hills, including the paths taken by Lewis and Clark in 1804 and the Mormons from 1846-1869. A "track" of the Underground Railroad led slaves from Kansas to freedom by way of the Loess Hills of Fremont County. Determined farmers employed whatever technology was available to raise crops on the steep hillsides. This human story is woven into the fabric of the Loess Hills.

A brief sketch highlighting human use and occupation of the Loess Hills follows. For a detailed report on the prehistory and history of the study area, see Appendix C.

American Indian Occupation

Present knowledge of Loess Hills archeology hints at special relationships between humans and Loess Hills resources at different times in the past. The steep and narrow valleys in the Loess Hills may have offered shelter from the elements, at least on a seasonal basis, and thus been a preferred place of seasonal residence. Small valleys within the Hills may have offered both timber and arable land needed for small farming communities to prosper in Late Prehistoric times. One locality, near Glenwood, appears to have especially attracted farming people, whose lodges and fields dotted the prehistoric landscape there for perhaps 250 years or more. The sweeping vistas of the Missouri River valley afforded by the high bluffs and ridges of the Loess Hills may have been a factor in choosing suitable eternal resting places for the dead. The reasons for these apparent relationships may be better understood in the future as our knowledge of the archeological record of the Loess Hills increases. The Loess Hills may be viewed as a storehouse of knowledge that is "banked" for the future.

Paleoindian Period: As glaciers receded in the upper Midwest, winds accumulated fine quartz silt into thick loess deposits in western Iowa. Humans arrived soon after most of the sediment was deposited, about 11,000 B.C. to 8,500 B.C. These Paleoindians were small bands of foragers who led a nomadic existence, roaming the hills and plains in search of large game herds, such as bison, mammoths, and mastodons (Benchley et al. 1997; Alex 2000). These people are characterized in the archeological record by the highly distinctive, finely crafted, chipped stone projectile points that they fashioned to serve as spear tips and hand cutting tools. In the Loess Hills, Paleoindian projectile points have been found as isolated artifacts in several locations, but no habitation or game kill/processing sites are known. Although evidence of the Paleoindian period in the Loess Hills is scant, future discoveries of Paleoindian artifacts, associated with the remains of large game animals hunted during Paleoindian times, is a strong possibility.

Archaic Period: The next archeological period represented in the Loess Hills is the Archaic (8,500 B.C. to approximately 800 B.C.). Archaic sites, recognized by notched and stemmed projectile points, have been documented in the study area. Although still highly mobile, Archaic peoples made greater use of semi-permanent base camps as well as smaller seasonal camps. Throughout the approximately 8,000-year span of the Archaic period, small mobile groups, probably based on nuclear or extended families, engaged in hunting and gathering as primary economic pursuits. However, through time, as the resources exploited became more diversified, groups became less mobile. Greater use was made of seasonal resource exploitation base camps and band composition became larger and more cohesive. People came together repeatedly to bury their dead in given localities and with more variety of burial artifact accompaniments. These changes were gradual and are difficult to perceive in the archeological record because Archaic-age archeological sites are few and generally little investigated, particularly in the Loess Hills. The eventual transition to what archeologists call the Woodland period is marked not so much by changes in lifestyle as by the introduction or elaboration of new ways of obtaining food and burying the dead.

Woodland Period: The Archaic period was succeeded by the Woodland (approximately 800 B.C. to A.D. 1200) and is characterized by the introduction of ceramic vessels, burial of the dead in mounds, and increased reliance on wild and cultivated plant foods. Regional differences in artifact assemblages, particularly the decoration of pottery, became more distinct through the Woodland period. Woodland period people were more sedentary than their predecessors were, as exemplified by the small hamlets of substantial wattle-and-daub or earth-covered structures that they lived in. Like the Archaic period, the Woodland period is divided into Early, Middle, and Late subperiods. The regional Woodland variation found in western Iowa, including the Loess Hills, is often termed Plains Woodland or sometimes the Mid-America Woodland tradition (Benchley et al. 1997; Benn 1986). Woodland sites are generally more abundant than Archaic sites.

The Late Prehistoric Period: By the advent of the Late Prehistoric period (A.D. 900-1000 through approximately A.D. 1650), changes transformed Late Woodland cultures into several strikingly different regional archeological complexes that were centered on a settled village life and based largely on the raising of garden crops. Widespread cultivation of corn on an intensive scale led to the development of several distinctive regional cultures whose people lived in permanent settlements and whose economy was based on a blend of corn cultivation and hunting. These included three distinctive village complexes that flourished in the Loess Hills. All three (Great Oasis, Mill Creek, and Nebraska Phase) were approximately coexistent, and their presence in the Loess Hills lasted about 300 years. With the possible exception of Great Oasis, who may not have raised much corn, but may have obtained it from Mill Creek neighbors, these complexes shared a basic economy that consisted of horticulture and seasonal hunting of bison and other mammals, supplemented by the gathering of wild plant foods, mussels, and fish. The Nebraska Phase people, like their Mill Creek and Great Oasis neighbors in the northern Loess Hills, disappeared from the archeological record in Iowa by about A.D. 1300 (Alex 2000).

Early Euro-American Contact and Settlement

Whatever unknown circumstances caused the elimination of Late Prehistoric peoples from the Loess Hills in the 14th century, the effect was lasting. For more than three centuries, the Loess Hills were virtually devoid of human activity. Evidence indicates that by the mid-17th century, occasional use of the Loess Hills by native people, now in contact with the early French fur traders, had recurred.

The French trader LeSeuer heralded the beginning of the historic period in 1701 by creating the first documentary record of human activity in Western Iowa, a description of an Ioway village northeast of the Loess Hills near Spirit Lake (Mutel 1994). Rivers provided initial access for the traders and priests, and later for more substantial numbers of settlers. Further inland, fur traders followed the Indian trails. In the northern Loess Hills, these paths tended to follow the ridge tops; farther south, they nestled in the valleys.

Westward Expansion: French fur traders and missionaries were the first Euro-Americans to discover the Loess Hills, claiming the region for their mother country. Following their loss of the Seven Years War in 1763, the French transferred their claim to Spain. However, the Spanish returned the area to France in 1800 and in 1803, France sold the area to the United

States as part of the Louisiana Purchase. The following year, President Thomas Jefferson sent Meriwether Lewis and William Clark to explore the new territory. The expedition spent much of July and August 1804 traveling the portion of the Missouri River adjacent to the Loess Hills, exploring, hunting, and documenting their beauty and bounty.

In 1833 the U.S. government relocated the Potowatomis, approximately 2,000 in number, from Illinois to southwestern Iowa. The largest village was near modern day Council Bluffs, with smaller villages farther south. The Potowatomis lived primarily by hunting the game-laden Loess Hills, gathering native plants and planting small gardens.

White settlers trickled into the Loess Hills area in the late 1830s and early 1840s. The early towns were established along transportation routes, near the Missouri River, at the base of the bluffs, or in the valleys of the Missouri's tributaries.

The first steamboats began running the Missouri River to serve the fur traders in 1831. Gradually the market changed and agricultural supplies and residential goods became the primary cargoes. In the 1850s and 1860s, most of those coming to Council Bluffs traveled by land to St. Louis or Jefferson City, Missouri, then by steamboat up the Missouri River (Holt 1925). For more than a quarter-century, Council Bluffs was the northernmost regular stop. Regular steamboat service to Sioux City was established in 1859 (Holt 1925); and by 1860 Sioux City's market dominated the Missouri River traffic.

Early roads went north-south along the base of the bluffs, and east-west along river valleys when feasible. By the 1850s stagecoach service was available along Iowa's western border, and post offices were established in most towns along the routes (Rogers 1990). Additional stagecoach roads traversed the hills; the trace from Glenwood to Tabor is still easily visible along the ridge tops (Blackburn, personal communication). Nevertheless, development of the Loess Hills region was sparse until railroads came in the 1860s and 1870s, permitting settlement further away from the waterways.

The Railroads: Railroad companies promoted the area, and as soon as they published their routes, men came to assist in constructing the railroads, and stayed to work on the railroads or farms. Hotels were established to accommodate the laborers, and continued to thrive on the business of rail travelers. Women made money as laundresses and bakers, and rented rooms to boarders. Towns grew around the railroads following a rhythmic pattern: first depots and grain storage facilities, then businesses, and finally homes (Bonney 1994; Conard and Cunning 1990). This pattern is still evident in most railroad towns located in the Loess Hills.

Agriculture: Nineteenth-century farmstead development reflected a functional response to the terrain and its suitability for agriculture. Settlers built their homes and farmsteads close to a source of water, which could be either a creek or a spring exiting at the base of the bluff. Prior to about 1940, farmsteads were often located on the elevated terraces located at the base of the bluff edge, usually on the north side of the alluvial fan of small tributaries. The main house and primary farm structures were generally oriented to the southwest or south with bluffs buffering the north winds. Cellars were built into the base of the bluffs. Farmers

Photo courtesy of Loess Hills Alliance

adjusted their land use in accordance with what was available at any particular time, cultivating the prairie tops when the valley was too marshy; moving to the valley once the marshes were drained and all the while using the hillsides for grazing (Sayre 1989).

The farms of Iowa produced wheat, corn, oats, grains, potatoes, sorghum, flax, grasses/hay, root plants, "salad" plants, and other fruits and vegetables. In addition, Iowa was fifth nationally in livestock production. In specific categories of livestock production, Iowa ranked fourth in production of hogs; fifth in horses; and sixth in cattle and oxen (Iowa Board of Immigration 1870).

Western Iowa's farmers were among the first to feel the effects of the Depression. Prices for farm goods plummeted, and the agricultural depression preceded the disastrous stock market crash by several years. During the Great Depression, much land changed hands as banks or insurance companies foreclosed on loans, and neighbors bought and sold parcels (Blackburn personal communication). Hoping to stop the foreclosures, the governors of the Midwestern farm states met in Sioux City in September 1932 to plan a program including a moratorium on farm debts, increased credit at lower interest, and surplus controls. About 5,000 farmers were also in attendance (Schweider 1996).

Depression-era farmers benefited greatly from New Deal programs, better farming methods, and new technology. Technological developments with durable effects included the electrification of rural areas, the genesis of hybrid seed corn, and the increased availability of farm machinery (Schweider 1996). The introduction of steam- and later, gasoline-powered machinery encouraged the use of more land for market crops (Sayre 1989). Aerial photographs from 1938 to the 1970s show that the size of farm fields and of farms themselves increased steadily. Rising farm product prices in the 1970s encouraged farmers to increase the size of their land holdings and buy more machinery, thus increasing their debt. The risk was realized in the 1980s when product prices plummeted. By 1984, the value of farmland decreased by twenty percent from the previous year. Many farmers, particularly those under the age of 35, were threatened with the potential loss of their land, precipitating what became known as the "Farm Crisis." Agriculture-related industries also suffered. By 1987, Iowa had 22,000 fewer farms than it had in 1973 (Schweider 1996).

Conservation and Reclamation: Among the most visible and lasting New Deal achievements in the study area was the creation and/or improvement of public recreational facilities. Among those accomplishments was the establishment of Stone State Park in Woodbury County and major modifications to Waubonsie State Park in Fremont County. Monona County hosted the Jones Creek watershed project. The Jones Creek watershed

Photo courtesy of Loess Hills Alliance

project was one of ten experimental land reclamation projects in the country that were responsible for changing the direction of the nation's land reclamation program. The success of the Jones Creek watershed project encouraged the Soil Conservation Service (today's Natural Resource Conservation Service) to continue the construction of “little dams” nationwide instead of the extremely expensive "large dams" on major waterways that were common before the test projects. Small dams, dikes, and other erosion control features are now common in the Loess Hills landform region.

Changes to the Landscape: Human alterations to the Loess Hills landscape were at first small in scale; horse hooves formed trails “where passage was easiest—through lowlands or along the western edge of the bluffs” (Mutel 1989b). Then more dramatic changes occurred: settlers built dams for water power; carved the bluffs to construct caves for storage, kilns, and stables; quarried limestone, sand, gravel, shale and construction fill; leveled bluffs to make way for cities; constructed roads and railroads; and farmed the prairies. Settlers reshaped the valleys as well, straightening the meandering Missouri River and its tributaries into channels to hasten drainage and constructing dams to control flow and dikes to prevent flooding. Some impacts were inadvertent: plowing slopes for cropland accelerated erosion; grazing large herds of cattle degraded the prairies, also exacerbating erosion; and baring soil for construction or recreational purposes. Exposing the soil to water destabilized the loess, often rendering it unable to support its own weight. Farmers cut native woodlands for construction and fuel, and replaced them with exotic species. They simultaneously suppressed wildfires, which allowed woody species to commence massive invasion of the prairie grassland. River channelization and drainage projects destroyed formerly abundant marshlands. Settlers altered native habitats and hunted many large mammals to local extinction. The Loess Hills had been transformed.

CULTURAL RESOURCES

> ***"The soul of a people is the image it cherishes of itself, the aspect in which it sees itself against its past, the attributes to which its future conduct must respond"***
>
> *-Archibald MacLeish, 1949*

Significant Prehistoric Resources: The western Iowa fluvial system has been extremely dynamic during the last 10,000 years (Holocene), caused by the combination of easily eroded materials, high drainage density, and great local relief. Major episodes of stream

entrenchment and sediment transport are recorded in numerous valley fills. This geomorphic history has important implications for the preservation of prehistoric cultural remains. These geological processes have served both to preserve archeological deposits and to destroy them. Where archeological sites have not been eroded, archeological remains of certain ages can be expected to occur within alluvial fills that were deposited during those times. Thus, knowledge of Holocene geomorphology not only provides clues to where sites of certain ages may be found, but also provides an indication of the general age of archeological deposits. Although a rich record of the prehistoric human past has been recorded within the Loess Hills, continuing erosion of the Loess Hills means that the potential for this prehistoric record to be expanded in the future is great.

There are 827 archeological sites that have been recorded within the Loess Hills, though an extremely small percentage of the region has been subjected to intensive, systematic archeological surveys. Undoubtedly there are thousands more that have yet to be discovered and recorded. Consequently, the archeological resources within the Loess Hills, singly in most instances and surely collectively, have the potential to illuminate much about prehistoric cultures that were present in the Loess Hills.

Two archeological properties in the Loess Hills are listed on the National Register of Historic Places--the multi-component Benson site and Pony Creek Park (Jones 1998). The Benson site is a large, multi-component Woodland site located in Woodbury County. It was observed in 1982 in the form of deeply buried hearths, pottery, and other cultural debris visible in gully walls for a distance of 2,200 feet. Components of Late Archaic, Early Woodland, Middle Woodland, and Late Woodland age are believed to be present (Thompson 1984). Although excavations have not taken place here, the Benson site offers tremendous potential to yield information that will be important to understanding major changes in cultural adaptations to late Holocene environments (Thompson 1984). The Benson site was listed on the National Register of Historic Places in 1984. Located in Mills County, Pony Creek Park is owned and operated as a recreational park by the Mills County Conservation Board. It was listed on the National Register in 1971 and contains two Nebraska Phase earthlodge sites. Forty-six other presently recorded archeological sites in the Loess Hills consist of two or more Native American archeological components or occupations (Jones, personal communication). Most of these offer the potential for comparative study, and many more will be discovered as archeological research continues in the Loess Hills.

Currently, there is no comprehensive list of archeological properties found to be eligible for the National Register of Historic Places, although several sites have been determined eligible, or are considered eligible by the State Historical Society of Iowa (Jones, personal communication).

Significant Historic Resources: There are four National Historic Landmark (NHL) properties in the Loess Hills. The following includes descriptive information from the National Historic Landmark documentation.

> ***Floyd Monument:*** Located in Sioux City, the 100-foot-tall sandstone obelisk overlooking the Missouri River valley commemorates the burial site of

Sergeant Charles Floyd. Floyd was the Lewis and Clark expedition's only fatality, and the first United States soldier to die west of the Mississippi River. Lewis and Clark buried Floyd's remains high above the Missouri both to protect the burial from flood damage and to provide a landmark by which subsequent travelers could fix their location. The Floyd Monument was the first property to be designated as a National Historic Landmark under the authority of the Historic Sites Act. The monument is publicly owned and accessible.

National Park Service photo

The Sergeant Floyd: One of few surviving U.S. Army Corps of Engineers vessels, the survey and towboat is dry-berthed on the banks of the Missouri River at mile marker 730, adjacent to the Floyd Monument (Sioux City). The steel-hulled, twin-screwed vessel has a steel and wood superstructure. It measures 138.4 feet in length with a 30-foot beam, a 5.6-foot depth of hold, a draft (fully loaded) of 3.9 feet, a height of approximately 37 feet, and a 306-ton displacement. The *Sergeant Floyd* was part of the federal government's comprehensive plan for flood control and improved navigation on the Mississippi and Missouri Rivers. It is publicly owned and accessible.

Woodbury County Courthouse: Architect William L. Steele's Woodbury County Courthouse has been called one of the finest examples of Prairie Style architecture in the United States. Occupying nearly a city block in Sioux City, the basic structure is a nearly square four-story building with an eight-story tower rising from the center core. The exterior is comprised of granite, brick, and terra cotta punctuated with steel-framed windows. The structure, which continues to serve its original function, was designated for its architectural significance, and does not contribute to the significance of the Loess Hills landform region. The courthouse is publicly owned and accessible.

Dodge House: Situated on a loess bluff in historic Council Bluffs, this three-story, fourteen-room brick structure was designed by architect W.W. Boyington of Chicago. Four chimneys pierce the mansard roof. The interior is graced with black walnut woodwork, stucco medallions, and bronze and silver hinges. The residence was designated a National Historic Landmark for its association with Civil War General and railroad tycoon Greenville Dodge. It does not contribute to the significance of the landform. The Dodge House is publicly owned and accessible.

SOCIAL AND ECONOMIC ENVIRONMENT[1]

Population

The people of the Loess Hills are evocative of those found in communities and rural areas throughout much of Iowa and the Midwest. The seven counties have a combined estimated 2000 population of just over 264,000. All counties within the study area lost population between the 1980 and the 1990 censuses. That trend, however, has largely reversed during the 1990s. Fremont and Monona County continued to experience a decline in population during the past decade. Mills County, because of its proximity to the Omaha metropolitan area, has realized the greatest expansion in population, growing by more than 11 percent during the 1990s. The racial composition of the study area is largely Caucasian (over 96 percent of the population). Only Woodbury and Pottawattamie Counties have non-white populations greater than one percent. Between 1990 and 2000, most of the growth in western Iowa occurred in the Omaha-Council Bluffs or Sioux City areas (U.S. Census Bureau 2001). Table 1 summarizes the estimated 2000 population for the seven counties, together with recent trends in the population.

Table 1: Population Estimates and Trends, Seven-County Area

County	1980 Census	1990 Census	2000 Estimate	% Change 1980-1999	% Change 1990-2000
Plymouth	24,743	23,388	24,849	0.3	6.2
Woodbury	100,884	98,276	103,877	0.5	5.7
Monona	11,692	10,034	10,020	-13.7	-0.1
Harrison	16,348	14,730	15,666	-6.9	6.4
Pottawattamie	86,561	82,628	87,704	-0.2	6.1
Mills	13,406	13,202	14,547	9.7	10.2
Fremont	9,401	8,226	8,010	-18.0	-2.6
Total	263,035	250,484	264,673	-1.0	5.7

Source: U.S. Census Bureau 2001

The landscape of western Iowa is predominantly rural and agricultural. A number of small communities can be found throughout the hills, in addition to portions of the metropolitan communities of Sioux City and Council Bluffs. Many of these communities have seen population trends that parallel those of the county where they are located. The populations of most communities within Fremont County have declined over the past two decades. Conversely, many of the communities in the Woodbury County, which includes Sioux City, have experienced double-digit population gains over the same period. Table 2 summarizes the estimated 1998 population for the communities of the region, together with recent trends

[1] Social and economic data specific to the landform study area as depicted in figure 1 (640,000-acres) are not available. Therefore, unless otherwise noted, data presented in this section are representative of the entire county or for the entire seven-county region (3,236,108 acres).

in the population. The communities listed are those that are within the Loess Hills landform region or are along the Loess Hills National Scenic Byway.

Economy and Tourism

As is true for western Iowa and other areas in the Great Plains, agriculture has been highly important to the Loess Hills counties. However, the nature and extent of farming is in transition. Farming is experiencing trends similar to those observed in many other agricultural regions. For example, the number of farms in the study area has steadily declined over the past three decades while, concurrently, the average size of a farm has increased. As noted previously, the farm crisis of 1984 affected the state; by 1987, Iowa had 22,000 fewer farms than it had in 1973 (Schweider 1996). Table 3 illustrates these trends.

In terms of earnings, farming is the leading economic sector for one county in the study area, Harrison County (Table 4); farming accounts for 22.7, 22.5, and 21.2 percent of the source of earnings for Monona, Harrison, and Fremont counties, respectively. Overall, the counties of the study area have a comparatively diverse economy. Manufacturing is the leading economic sector in Fremont and Plymouth Counties. The service sector is the primary sector in Monona, Pottawattamie, and Woodbury Counties. The government sector accounts for more than one-third of total earnings in Mills County.

Another noteworthy component of the Loess Hills economy is quarrying. According to data from the Iowa Department of Natural Resources (IDNR 1997), there are 27 state-licensed mining operations active in the Loess Hills; an additional 25 licensed facilities within the region are listed as "closed." Almost all of these facilities extract sand and gravel; a few quarry limestone or agricultural lime. Most operations are small businesses, employing fewer than 20 people. About one dozen such businesses operate within the counties of the study area.

Loess also is extracted from the Hills for use as construction fill and for other purposes. The "borrow pits" from which the loess is extracted scar the landscape and often are left in highly erodable conditions. Iowa statute and regulation does not consider loess a mineral, hence, the Iowa Division of Soil Conservation does not license or register sites working with just loess. As a result, the full extent and impact of loess extraction is difficult to quantify. Most units of local government do not have ordinances that are designed to protect the loess. Plymouth County, however, is working to modify its zoning ordinances to reflect protections for the Hills that were set forth in a recently adopted new comprehensive plan.

Tourism is important to the economy of western Iowa. The Loess Hills, related resources, and other nearby attractions are magnets that attract recreationists and other visitors to the region. Visitors to the area require amenities such as service stations, restaurants, and lodging. Table 4 shows that the retail and service sectors account for between 16.6 and 41.4 percent of total earnings in the seven counties of the study area.

Table 2: Population Estimates and Trends, Counties and Major Towns

Community	1980 Census	1990 Census	1998 Estimate	% Change 1980-1998	% Change 1990-1998
Plymouth Co.					
Akron	1,517	1,450	1,445	-4.7	-0.3
Westfield	199	160	158	-20.6	-1.3
Woodbury Co.					
Bronson	289	209	233	-19.4	11.5
Lawton	477	482	637	42.5	32.2
Oto	172	118	140	-18.6	18.6
Sergeant Bluff	2,416	2,772	3,095	28.1	11.7
Sioux City	82,003	80,505	82,697	0.8	2.7
Smithland	282	252	271	-3.9	7.5
Monona Co.					
Castana	228	159	162	-28.9	1.9
Moorhead	264	259	235	-11.0	-9.3
Rodney	82	71	74	-9.8	4.2
Turin	103	95	96	-6.8	1.1
Harrison Co.					
Logan	1,540	1,401	1.443	-6.3	3.0
Magnolia	207	204	224	8.2	9.8
Missouri Valley	3,107	2,888	2,822	-9.2	-2.3
Pisgah	307	268	292	-4.9	9.0
Pottawattamie Co.					
Council Bluffs	56,449	54,315	56,312	-0.2	3.7
Crescent	547	469	458	-16.3	-2.3
Mills Co.					
Glenwood	5,280	4,960	5,244	-0.7	5.7
Fremont Co.					
Hamburg	1,597	1,248	1,159	-27.4	-7.1
Riverton	342	333	307	-10.2	-7.8
Sidney	1,308	1,253	1,178	-9.9	-6.0
Tabor	1,088	994	986	-9.4	-0.8
Thurman	221	239	226	2.3	-5.4

Source: U.S. Census Bureau 1998

Table 3: Number and Size of Farms, 1969-1992

County	No. of Farms 1969	No. of Farms 1997	% Change 1969-1997	Average Farm Size (acres) 1969	Average Farm Size (acres) 1997	% Change 1969-1997
Plymouth	2173	1490	-31.4%	247	344	39.3%
Woodbury	1970	1306	-33.7%	262	381	45.4%
Monona	1267	697	-45.0%	322	527	63.7%
Harrison	1490	876	-41.2%	282	448	58.9%
Pottawattamie	2277	1325	-41.8%	246	405	64.6%
Mills	868	496	-42.9%	310	468	51.0%
Fremont	976	568	-41.8%	328	560	70.7%
Total	**1574**	**965**	**-38.7%**	**285**	**448**	**56.9%**

Source: Iowa State University Extension 1999

Table 4: Sources of Earnings: Employed Persons 16 Years of Age or Older in 1994

	Counties						
Economic Sector	Plymouth	Woodbury	Monona	Harrison	Pottawattamie	Mills	Fremont
Farm	15.5%	**2.0%**	22.7%	**22.5%**	4.6%	17.7%	21.2%
Manufacturing	**23.2%**	15.6%	4.9%	4.9%	15.3%	1.4%	**31.1%**
Retail	9.1%	10.7%	10.3%	13.4%	13.1%	11.8%	5.2%
Finance*	4.1%	4.6%	3.5%	3.2%	3.7%	2.8%	2.5%
Services	15.2%	30.7%	**28.0%**	**17.1%**	**24.5%**	17.2%	**11.1%**
Government	10.8%	11.7%	14.7%	17.7%	15.9%	**36.7%**	10.1%
Other**	22.1%	24.6%	15.9%	21.3%	22.8%	12.4%	18.9%
* finance, insurance, & real estate							
** ag, services, mining, construction, transportation, public activities, wholesale trade							

Source: Iowa State University 1997

A 1996 study by two faculty members from Iowa State University evaluated the economic impact of recreation in the Loess Hills (Alexander and Otto 1997). That study identified a range of visitation, expenditures, and related variables that can be attributed to tourism within the region. The most conservative estimates identified in the study suggest that annual recreation-related visitation to the area was about 556,900 persons. Roughly visitors to the area spent $11.8 million per year. The average party size was about 2.4 persons, and the average daily expenditures of each party is about $51. The study estimated that these

expenditures support about 231 jobs, of which about two-thirds are in the retail sector and about 30 percent in the service sector. Expenditure information cited is in 1996 dollars. The Alexander and Otto study also found that 72 percent of respondents to their survey were local residents (defined as living within 100 miles of the point of survey). Local residents were likely to take multiple recreation trips to the Loess Hills each year (the average number of trips ranging between 7.8 and 11.6). About two-thirds of recreation visits to the region occurred on weekends, and most parties visited several sites in the area. The study found that DeSoto National Wildlife Refuge is by far the most popular single site that recreationists visit in the region; the southern Loess Hills (south of Council Bluffs) are much less frequently visited than the northern Hills.

Outdoor Recreation & Tourism Infrastructure: Tourism to the Loess Hills currently is promoted by entities such as the Iowa Division of Tourism, the Western Iowa Tourism Region, the Convention and Visitors Bureaus in Council Bluffs and Sioux City, the Welcome Centers in Harrison County (Missouri Valley) and Sioux City (the Sergeant Floyd Center), and the Loess Hills Hospitality Association.

Although some persons arrive in the area via flights to commercial airports in Sioux City, Iowa and Omaha, Nebraska, most visitors travel to the Loess Hills via automobile. A well-developed network of roads provides easy access to and within the region. Interstate Highway 29, a multi-state freeway connecting Canada and Kansas City, Missouri, generally runs parallel to the Loess Hills from Sioux City to the Iowa-Missouri line. Interstate Highways 80 and 680 intersect with the region in the vicinity of Council Bluffs, providing a simple "jumping-off point" for travelers from the east and the west who wish to explore the Hills. Many well-maintained state, county, and local roadways complement these highways.

The primary artery for automobile travel within the region is the Loess Hills National Scenic Byway. The Byway is a 220-mile road network that weaves throughout the landform region and nearby areas (Figure 1). The main stem of the Byway is a paved route that generally runs north to south. Sixteen loop routes that provide for short side trips enhance this primary route. The loop routes range between three and 19 miles in length, and are located along both paved and gravel roads. The main stem and the loop routes all are identified by distinctive highway signs that facilitate navigation through the Hills. A guidebook produced by the Federal Highway Administration and National Park Service (*Iowa's Loess Hills Scenic Byway*, date unknown) and other printed materials are available that interpret the resources of the region and direct travelers to area attractions.

Visitor services are well distributed through the Hills. Gasoline, diesel fuel, automobile service, lodging, and restaurants can be found in many communities. Hospitals or medical services are found in Sioux City, Moorhead, Missouri Valley, Tabor, Riverton, and Council Bluffs. Camping, both for tents and for recreational vehicles, is available in several locations.

Many of the attractions within the Loess Hills are related to the area's natural environment or to outdoor recreation. Both publicly and privately owned facilities provide opportunities for a wide range of outdoor recreation activities including hiking, picnicking, bicycling, horseback

riding, fishing, hunting, camping, and wildlife watching. The area also provides some opportunities for winter activities such as snow skiing, sledding, and snowmobiling.

According to *the Loess Hills Scenic Byway Corridor Management Plan* (GHRC&D 1998), there are more than 100 parks, recreation and wildlife areas, and outdoor recreation attractions in the Byway corridor. These attractions cover more than 57,000 acres of land both within and adjacent to the Study Area. Table 5 lists over 50 of the outdoor recreation areas along the Loess Hills National Scenic Byway and within the seven-county region. The areas shown in Table 5 range between two and 9,800 acres, with the majority being less than 100 acres in size.

The DeSoto National Wildlife Refuge, located along the Missouri River in Harrison County, is the only federally owned and managed facility near the study area. The Lewis and Clark National Historic Trail (NHT), a component of the National Trails System, parallels the Loess Hills from the Missouri state line to Sioux City.

Other attractions not directly associated with the Loess Hills also encourage visitors to the region. Good potential exists to integrate promotion of the Loess Hills as a destination into the marketing programs of these other regional sites. Examples of places in or near the landform region that draw people to the area include the Sioux City Art Center, Siouxland Historical Railroad Museum, Western Historic Trails Center, General Dodge House, Mount Crescent Ski Area and several casinos. Attractions near Omaha, Nebraska also bring people to the area. These include the Henry Doorly Zoo, Joslyn Art Museum, and the Western Heritage Museum.

As part of their investigation of the economic impacts of recreation in the Loess Hills, Alexander and Otto (1997) also explored the amenities that contribute to people's enjoyment of the region's resources. The study found that those amenities that contributed most positively to recreational experiences were closely associated with the natural environment (for example, scenic overlooks, trails, interpretive signs, picnic tables, grills, etc.). Amenities perceived to have neutral or negative contributions to enjoyment of the Hills included golf courses, RV parks, hotels and motels, restaurants, and service stations.

It is important to remember that nearly three out of four persons who participated in the study were local residents. Therefore, the perception that amenities such as hotels, restaurants, and service stations do not contribute to enjoyment of the area is logical, in that many respondents could fulfill their needs for lodging, food, and fuel by returning to their homes after a day in the Hills. Further, it is notable that the study surveyed only persons who were already visiting the area. Perceptions of desirable amenities might have been different if the survey had sampled *potential* visitors. It is possible that the lack of certain amenities actually dissuades some people from visiting the Loess Hills.

Table 5: Outdoor Recreational Resources in Seven County Region

NAME	ACRES
Plymouth County	
Big Sioux Park	33
Broken Kettle Grassland	1200
Deer Creek Lake	1020
Five Ridge Prairie State Preserve	790
Hillview Recreation Area	230
Knapp Prairie	277
Millsite Access	16
Silver Maple County Park	60
Woodbury County	
Bacon Creek Park	240
Curtain Timber	90
Fowler Forest Preserve	108
Inkpaduta River Access	2
Loess Ridge Nature Center	15
Oak Ridge Conservation Area	765
Riverside Bluffs	135
Sergeant Floyd Monument	120
Sgt. Floyd Welcome Center	5
Sioux City Prairie Preserve	151
Southwood Conservation Area	623
Stone State Park (also in Plymouth Co.)	1085
War Eagle Monument	23
Wimson Park	5.5
Monona County	
Gray's Landing	43
Loess Hills State Forest	3081
Loess Hills Wildlife Area	2800
Pawnee Recreation Area	10
Preparation Canyon State Park	345
Rodney Pits Recreation Area	60
Savery Pond	25
Schoenjahn Wildlife Preserve	125
Whiting Woods	80
Harrison County	
DeSoto National Wildlife Refuge	9800
Fish Lake Wildlife Area	19
Gleason-Hubel Wildlife Area	165
Harrison County Historical Museum & Village	3
Lewis and Clark Memorial	40
Loess Hills State Forest	7800
Murray Hill Scenic Overlook	3
Sawmill Hollow Wildlife Area	155
Sioux Dam Fishing Access	10
Pottawattamie County	
Folsom Prairies (also in Mills Co.)	277
Hitchcock Nature Center	732
I-680 Scenic Overlook	Unknown
Smith Wildlife Area	2160
Wabash Trace Nature Trail	Unknown
Mills County	
Foothills Park	45
Mile Hill Lake Rec. Area	47
Pony Creek Park	50
Tree Lake	9
West Oak Forest	308
Fremont County	
Forney Lake	1128
Green Hollow Wildlife Area	341
O.S. Wing	140
Pinky's Glenn	58
Riverton Wildlife Area	2700
Sidney Recreation Area	150
Waubonsie State Park	1200

Source: Golden Hills RC&D 1998; IDNRb 2000

Land Ownership

Attesting to the rural character of the region, approximately 39,500 acres of the 640,000-acre study area are within the boundaries of incorporated areas. Hence, nearly 94 percent of the study area is unincorporated. Only 4.4 percent of the landform region is in public ownership or owned by The Nature Conservancy, a private conservation organization (Figure 3). The vast majority of the region is privately owned. Table 6 depicts private and public ownership within the landform study area, organized by county.

Overall land-cover patterns within the study area also reflect its rural character. Land cover is a generalized description of basic characteristics of the land as it appears on satellite imagery or aerial photography.

Land cover provides an approximation of land use within an area. Table 7 shows that 86 percent of the landform region is covered by grassland or row crops. These land covers are most prevalent in Woodbury County (91.3 percent) and least common in Fremont County (67.5 percent). Fremont County does have the highest percentage of wooded area (30.6).

Development of the landform region as evidenced by the "artificial" classification is most prevalent in the Council Bluffs/Omaha area (Pottawattamie and Mills County) and near Sioux City (Woodbury County).

The land use and land cover patterns described in Table 7 are derived from 1992 satellite imagery. Unfortunately, more recent data are not readily available that would allow for measurement of changes in these patterns. However, it is indisputable that changes are occurring within the Loess Hills landform region. These changes have the potential to drastically alter the character of the Loess Hills in some locations. Significant urban expansion is occurring in the Omaha, Council Bluffs, and Sioux City metropolitan areas. As a result, many areas in Mills, Pottawattamie, and Woodbury Counties are being converted from agriculture or natural land uses to residential and other types of built environments. The same trend is occurring, albeit to a lesser extent, in the other counties of the study area.

Photo courtesy of Don Poggensee

The scenic character that makes the Loess Hills so very attractive to recreationists is the same character that makes the landscape highly desirable as a place to build homes. Growth in residential development in the counties of the study area, as evidenced through the number of permits issued for new private housing units, has shown a generally upward trend over the past two decades. Further, the demand has accelerated during the 1990s. Between 1979 and 1990, the average annual number of private housing units authorized by building permits for the entire seven-county region that includes the study area was 412.

During the period of 1991-1997, the average annual number of permits was 925 (an increase of more than 124 percent). Of the entire seven county area, Woodbury and Mills Counties experienced the greatest percent change in the annual number of building permits issued from 1991-1997 as compared to the average issued between 1979 and 1990 (U.S. Census Bureau 1998). It is important to note that these statistics are for the counties as a whole, and not just for the study area. However, the desirability of the Loess Hills as a place to build homes would suggest that the study area itself experienced a similar, if not greater, level of growth in new housing starts.

This increase in residential development often has resulted in a corresponding decrease in the number of acres in agricultural land. Although most buyers of agricultural land in Iowa continue to be farmers who are increasing the size of their holdings, about 30 percent of purchases made in 1999 were by investors (Iowa State University 2000).

Table 6: Land Ownership of Loess Hills Study Area (640,000 acres)

	Percent Private	**Percent Public**	**Percent Other**
Plymouth County	89.3	7.3	3.4
Woodbury County	93.0	1.8	5.2
Monona County	94.2	5.6	0.2
Harrison County	90.6	6.5	3.0
Pottawattamie County	86.4	1.7	11.9
Mills County	92.2	4.1	3.7
Fremont County	93.1	5.8	1.1
Entire Landform Region	91.5	4.4	4.1

Source: As analyzed by Golden Hills Resource Conservation & Development, Inc., from IDNR data) (by percentage of total unincorporated land).

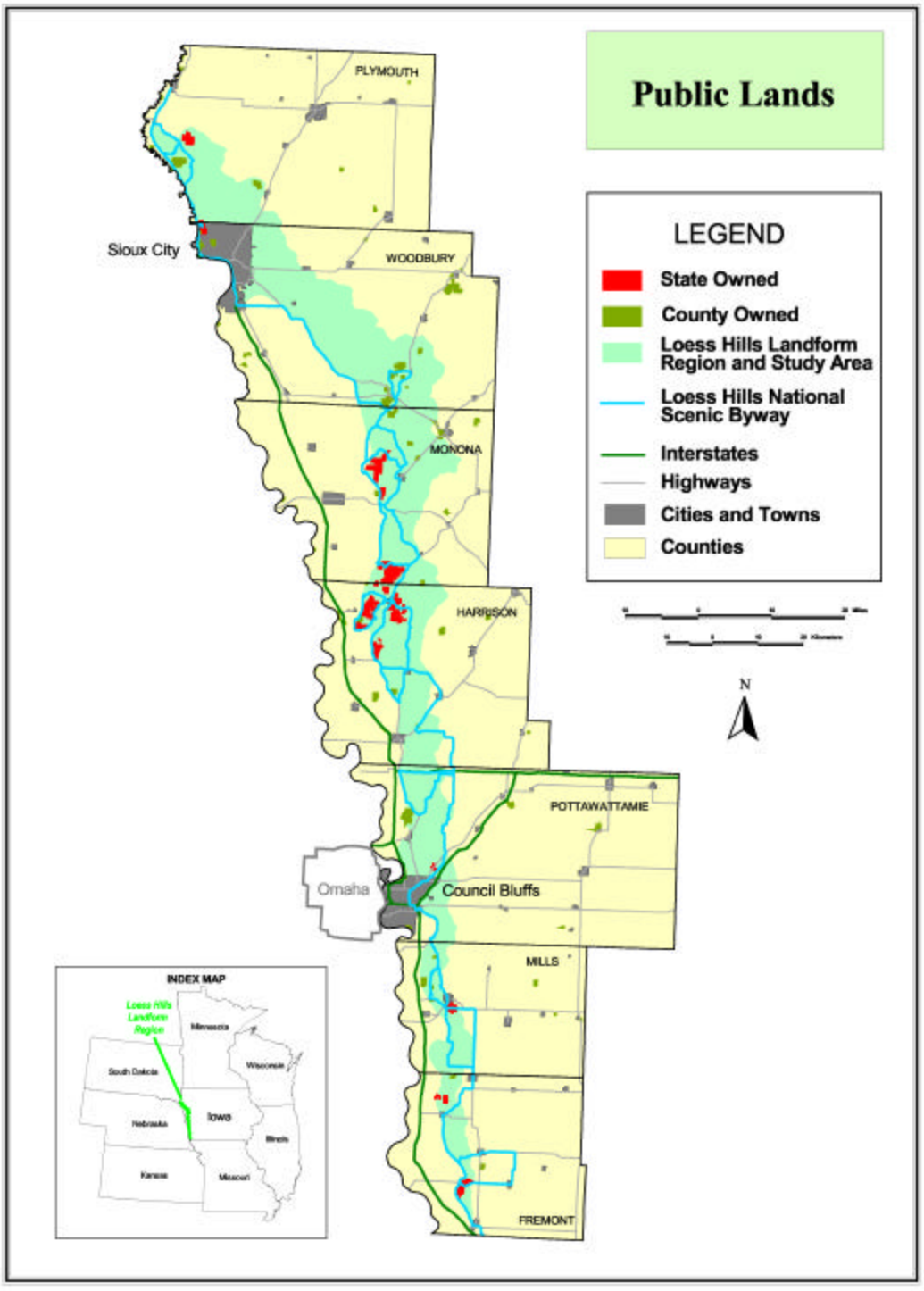


Figure 3: Public Lands

Table 7: Generalized Land Cover of Loess Hills Study Area (Expressed as a percent of total)

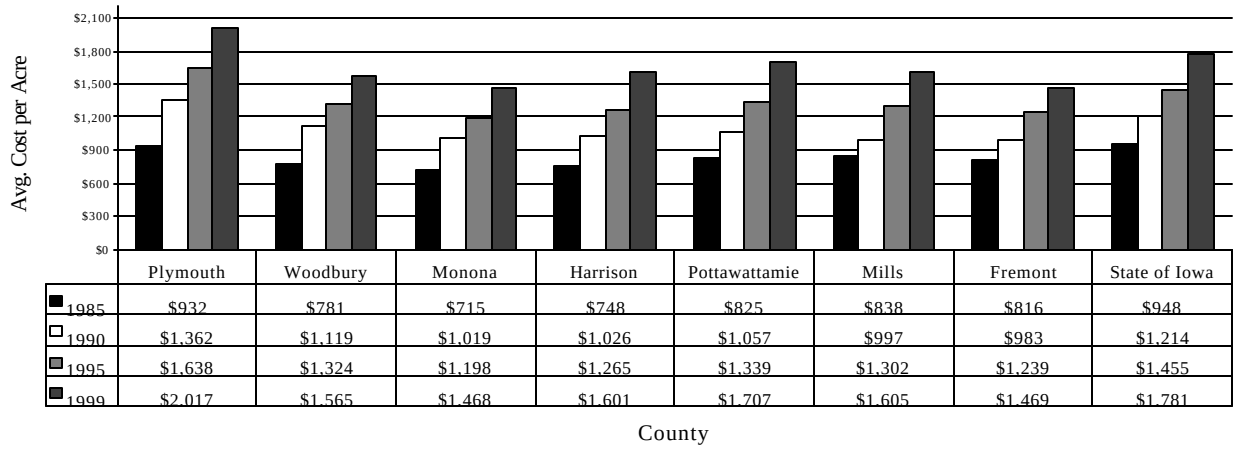
County	Percent Grassland	Percent Row Crops	Percent Woodland	Percent Artificial	Percent Barren/ Flood	Percent Water
Study Area (640,000 acres)	50.4	35.6	11.3	1.5	1.0	0.2
Plymouth *	65.3	28.0	6.0	0.2	0.3	0.1
Woodbury	51.1	40.3	4.4	2.3	1.7	0.2
Monona	52.5	32.2	13.8	0.1	1.1	0.3
Harrison	40.5	45.1	13.7	0.3	0.4	0.1
Pottawattamie	45.8	34.6	14.2	4.0	1.3	0.2
Mills	50.5	25.4	19.9	2.9	0.6	0.6
Fremont	48.7	18.8	30.6	1.3	0.4	0.2

Source: Golden Hills Resource Conservation & Development, Inc 2000.
*About 7,561 acres, mostly in Plymouth County, could not be classified due to persistent cloud cover on the satellite imagery.

Generalized Description of Land Cover Categories

Grassland – consists of non-woody surfaces such as prairies, wetlands, pastures, lawns, golf courses, hay fields.
Row Crops – consists mostly of agricultural crops (especially soybeans & corn).
Woodland – deciduous and coniferous forests, highly mixed grass & trees, windbreaks, & dense shrubs.
Artificial – pavement, concrete, roofing materials, metal structures. This classification includes roads, parking lots, buildings, etc.
Barren/Flood – natural surfaces covered with bare soil, gravel, & sand bars. Includes gravel pits, rock quarries, feedlots, & construction sites.
Water – includes lakes, reservoirs, large rivers & streams, sewage lagoons, and open water in wetlands.

Land values within the study area have steadily increased since the mid-1980s. Appreciation in land values within six of the seven counties within the study area has outpaced the growth of land values in Iowa as a whole. Five of the seven counties have experienced a more than two-fold increase in average land values since 1985. The largest percentage gain in land value was in Plymouth County (116.4 percent); the smallest percent gain was in Fremont County (80 percent). Respondents to a 1999 survey conducted by Iowa State University (Iowa State University 2000) identified five factors as having the most positive impacts on land values during 1999: government program payments, interest rates, crop yields, the supply of land available, and demand by investors. Figure 4 illustrates trends in the average value of farmland since 1985.



	Plymouth	Woodbury	Monona	Harrison	Pottawattamie	Mills	Fremont	State of Iowa
1985	$932	$781	$715	$748	$825	$838	$816	$948
1990	$1,362	$1,119	$1,019	$1,026	$1,057	$997	$983	$1,214
1995	$1,638	$1,324	$1,198	$1,265	$1,339	$1,302	$1,239	$1,455
1999	$2,017	$1,565	$1,468	$1,601	$1,707	$1,605	$1,469	$1,781

Source: Iowa State University 2000.

Figure 4: Trends in Farmland Values, 1985-1999
(Values are for the entire county, including areas outside the study area)

All counties within the landform region except Mills have countywide zoning ordinances in place. However, none of those ordinances have regulations specifically designed to address issues that are threatening the Loess Hills. These ordinances do not protect the region from insensitive residential, commercial, industrial, and agricultural developments. No tools are in place to help preserve the scenic attributes of the Hills. Excavation and quarrying within the Hills continues to erode the landscape and alter the natural configuration of the skyline and horizon.

Conservation Programs and Land-Use Planning

A number of state and federal conservation programs are contributing staff and funding for erosion control, wildlife habitat and water quality improvement, and prairie restoration programs in the Loess Hills. The Loess Hills Alliance (LHA), Fish and Wildlife Foundation, Golden Hills Resource Conservation and Development, Iowa Natural Heritage Foundation, Natural Resource Conservation Service, Soil and Water Conservation Districts, The Nature Conservancy, and other groups continue to provide information and services associated with a variety of conservation programs. In 2000, the LHA provided funding and matching grant opportunities that resulted in over $750,000 of land protection or economic growth projects (Loess Hills Alliance 2000). An ongoing effort, the Whole Farm planning initiative is utilized by six of the seven counties included in the Loess Hills landform region. Designed as a matching grants program with local Soil and Water Conservation Districts (SWCD) and in cooperation with the Iowa Division of Soil Conservation, local SWCD were able to promote and complete whole farm plans on 250 acres of private land. Whole farm plans are designed to encourage landowners to make maximum use of available state and federal soil, water, wildlife, and conservation programs (Loess Hills Alliance 2000). Most recently, $250,000

has been earmarked under the Farmland Protection Program (FPP) to preserve the Loess Hills from non-agricultural development.

The Nature Conservancy, Fish and Wildlife Foundation, the U.S. Fish and Wildlife Service, and the National Park Service have provided landowner assistance (funding, staff, and/or equipment) for prairie restoration, woody plant and exotic species control, and workshops on fire ecology and the use of prescribed fire. Other federal programs, such as the Conservation Reserve Program, Partners for Fish and Wildlife, Stewardship Incentives Program and the Wetlands Reserve Program are available to assist private landowners.

A number of comprehensive planning and zoning efforts are underway. In 2001, the LHA began soliciting requests for proposals to prepare a Comprehensive Plan for the seven-counties of the Loess Hills. This Plan will document existing studies, and other land-use data and serve as a template for counties in the Loess Hills to use (Sproul 2001). Plymouth County recently adopted an updated Comprehensive Plan that includes specific measures designed to control growth and protect the landforms; the county is proceeding to update its zoning regulations to reflect policies in the new plan. Two other counties, Mills and Woodbury, are developing Comprehensive Plans. The LHA is also developing a grant program to encourage county and city governments to undertake comprehensive planning and zoning which consider critical resource protection strategies for the Loess Hills landform. Finally, the *Loess Hills Scenic Byway Corridor Management Plan* (Golden Hills Rural Conservation Development 2000) is a useful tool available for land use planning. The *Byway Plan* identifies important resources and includes model ordinances designed to preserve the integrity of the resources in the Loess Hills.

RESOURCE EVALUATION

"If we could first know where we are and whither we are tending, we could better judge what we do and how to do it…"
- Abraham Lincoln

SPECIAL RESOURCE STUDY CRITERIA

In order for a resource to be considered eligible for the National Park System, it must meet criteria for national significance, suitability, and feasibility. Resources must also require direct NPS management, instead of alternative protection by other public agencies or the private sector (NPS 2001).

For a resource to be *nationally significant*, it must meet the following criteria:

- It must be an outstanding example of a particular type of resource;
- It must possess exceptional value or quality in illustrating or interpreting the natural or cultural themes of our nation's heritage;
- It must offer superlative opportunities for public use and enjoyment, or for scientific study;
- It must retain a high degree of integrity as a true, accurate, and relatively unspoiled example of the resource.

The National Park System includes sites that represent major themes and facets of the nation's natural and cultural history. The determination of *suitability* for inclusion in the System requires an evaluation of how a particular type of resource is currently represented in existing units of the National Park System or in other areas managed by federal, state, or local governments and the private sector. Additionally, it must also offer superlative opportunities for public use and enjoyment, or for scientific study. If a resource type is adequately represented in existing units, or in other areas that are comparably managed for protection and public use by other entities, it is not considered suitable for addition to the National Park System.

The potential for successful management is analyzed to determine *feasibility.* Important considerations include size and configuration, land ownership, current and potential uses, acquisition costs, accessibility, threats to the resource, staffing or development requirements, and public interest in acting to protect and manage an area. An evaluation of feasibility

considers the resource in the context of natural systems and historic settings and other factors necessary to ensure the long-term protection of the area and to accommodate public use. For areas to be managed by the NPS, special attention is given to the potential for efficient administration at reasonable cost.

DETERMINATION OF SIGNIFICANCE

The Loess Hills landform region is an outstanding example of terrain formed by two fundamental geological processes--wind and erosion. While loess is a common and widespread geologic deposit, its development in western Iowa is of such magnitude that it dominates the form and substance of the landscape. The Loess Hills are the only place in the country where loess actually *constitutes* an extensive landscape of unique topography and hill forms. The extreme thickness of the loess layers and the intricately carved terrain of the Loess Hills make them a rare physiographic and geologic feature not found anywhere else in the United States.

Ecologically, the Loess Hills support a number of unique communities and include large tracts of prairie remnants. Unique plant associations in the study area are a function of the terrain and the loess. The course silt and the steeply sloping terrain both favor rapid drainage of water and promote the locally dry (xeric) environments that favor drought tolerant species. The prairie plant communities contain a mixture of species from the eastern tallgrass prairie and from the Great Plains mixed-grass prairies. It is this blend of east and west that sets the prairies in the Loess Hills apart from other native prairies.

From a research and educational perspective, opportunities to study past environmental conditions are plentiful. Because loess was deposited by Ice-Age winds, it constitutes a record of climates. The concretions of calcium carbonate, formed in the loess by percolating groundwater, potentially preserve a geochemical record of paleoclimatic change in continental environments. The loss of soil and the susceptibility of loess to gully erosion have prompted investigations into landscape processes and preservation strategies. Geologists frequently visit the scientifically significant exposure of Loveland Loess at its geological type section in the central Loess Hills. This particular exposure is the standard used by geologists to define the characteristics of the Loveland Loess formation, the most widespread pre-Wisconsinan loess in the mid-continent.

In 1986, portions of the Loess Hills (10,000) acres were designated as a National Natural Landmark (NNL) in recognition of the area's nationally significant loess deposits (the Loess Hills NNL consists of two separate tracts, the Turin site and the Little Sioux site) (Figure 1). The NNL program was established by the Secretary of Interior to identify, recognize, and encourage the protection of sites containing the best remaining examples of ecological and geological components of the nation's natural heritage.

Summary of Significance

The National Park Service has determined that the Loess Hills landform region is nationally significant as a topographic and geological combination not found elsewhere in the United States. The Loess Hills remain an outstanding example of a unique topographic form. The landform region possesses exceptional value in illustrating loess deposits, and the plant and animal communities that are supported by such material in a unique topographic setting. The landform region supports an exceptionally diverse array of biological communities, including significant remnant prairies. The landform and ecological communities retain a high degree of integrity as a true, accurate, and relatively unspoiled example of loess deposits, topography, and mixed grass prairie communities. Opportunities for scientific study are plentiful, particularly in the fields of ecology, geology, geomorphology, and archeology. The current infrastructure includes the National Scenic Byway and numerous publicly owned parks, preserves, and wildlife areas, thus offering numerous opportunities for public enjoyment.

Possible Further Significance

There are two properties in the Loess Hills landform region that may meet the criteria for National Historic Landmark designation. If, upon further study, these were found to meet the criteria for NHL designation, they would add to the national significance of the Loess Hills study area. The two sites are:

Glenwood Locality: Located in Mills County (Figure 5), this area contains a rich and diverse prehistoric archeological record that spans the last 12,000-13,000 years. Ninety percent of Nebraska Phase (a.k.a. Glenwood Culture) sites within the State of Iowa are located in the Loess Hills landform region; ninety-three percent of the Nebraska Phase sites within the Hills are clustered in the Pony and Keg Creek drainage near Glenwood in Mills County. Because the archeological record of this culture is largely confined to a relatively small segment of the landform region, the Glenwood Locality may qualify for NHL designation under Criterion D, properties that have yielded or may be likely to yield information important in prehistory or history. Further study is recommended.

The ***Jones Creek Watershed:*** Located in Monona County, the Jones Creek Watershed is a system of spillways and small impoundments erected by the Soil Conservation Service (SCS) between 1937 and 1942. In the mid-1930s, a group of engineers challenged the established practice of building large and hugely expensive dams at key points along major rivers, proposing that the erection of “little dams” along streams feeding those major waterways would be less costly and equally effective. The Jones Creek Watershed was one of a handful of projects selected by the Soil Conservation Service (SCS) to test this hypothesis. The undertaking successfully slowed the flow of water and captured silt, thus protecting farmlands in the Jones Creek drainage area and also downstream. The success of the Jones Creek project encouraged the SCS to continue the construction of little dams nationwide. The project’s pivotal role in resolving the “big dam vs. little dam” controversy may render it eligible for National Historic Landmark status under Criterion A, properties associated with events that have made a significant contribution to the broad patterns of our history. Further study is recommended.

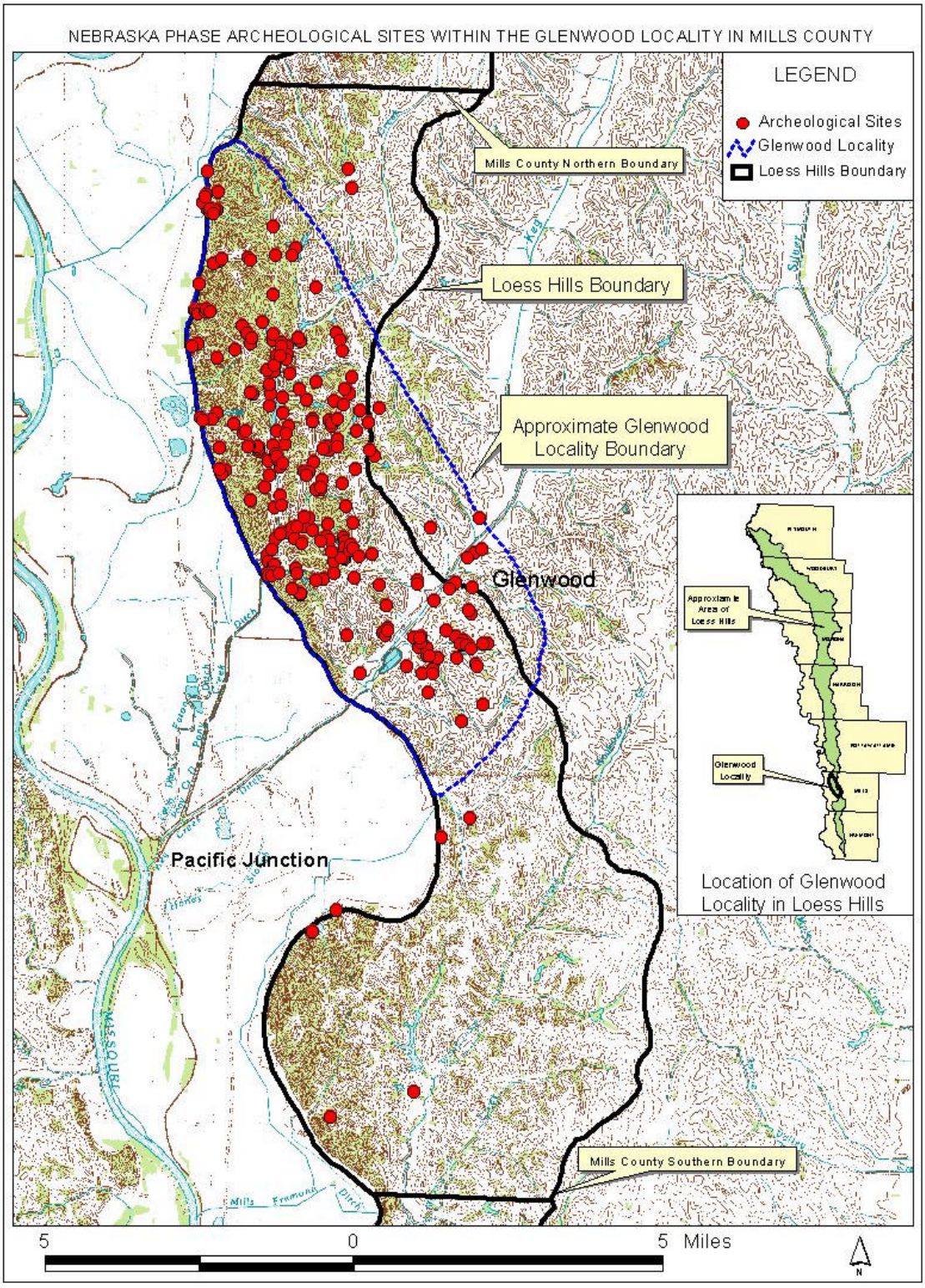


Figure 5: Glenwood Locality

There are up to 12 landscape areas in the Loess Hills landform region that may meet the criteria for National Natural Landmark Designation. Any or all of these 12 Special Landscape Areas identified by this study (Appendix D, Figure 6) may meet the criteria for National Natural Landmark (NNL) designation, as described below:

12 Special Landscape Areas: Portions of two of the Special Landscapes have already received such designation as a result of studies performed in the early 1980s (Szymkowicz and Ruhe 1981; Ruhe et al 1983). Neither of the 1980s studies leading to the designation of the two current NNLs was comprehensive with respect to the Iowa Loess Hills region. The first study was a broad survey for potential NNL sites having geologic themes within the nine-state Western Central Lowlands region; the second consisted of a brief field examination of already-known sites in the Monona-Harrison County region. Thus, although the current NNL sites do indeed display exemplary natural features of national significance, such features are not necessarily limited to these two sites. The current study identified similar features throughout the Loess Hills landform region, and these similar features were the basis for outlining the 12 Special Landscape Areas. Further study is recommended to determine the significance of these 12 special landscapes and their suitability/feasibility potential as NNLs.

DETERMINATION OF SUITABILITY

In comparing potential new additions with similar areas currently in the system, the National Park Service uses the thematic framework outlined in *Natural History in the National Park System and on the National Registry of Natural Landmarks* (1990) and *History and Prehistory in the National Park System and the National Landmarks Program* (1987). An area will be considered suitable for addition to the National Park System if it represents a natural and/or cultural type that is not already adequately represented in the National Park System, or is not comparably represented and protected for public enjoyment by other federal agencies; tribal, state, or local governments; or the private sector (National Park Service 2001).

Comparative Resource Analysis

The Loess Hills landform region is the only area in the nation that contains a combination of deep loess deposits formed and sculpted by wind and water, and important archeological, geological, historical, natural, and scenic resources and themes. The 640,000-acre Loess Hills landform region, with its loess topography, extensive prairies, rich cultural history, and numerous recreational resources, comprises a resource type that is not currently represented in the National Park System.

Loess Hills archeology, particularly the Glenwood locality, hints at the special relationships between humans and natural resources at different times in the past. American Indians have lived in, hunted in, farmed in, and traveled throughout the landform region for thousands of years. In the historic period, the Loess Hills were home to tribes that were indigenous to the region. French fur traders and missionaries discovered the Loess Hills in the early 1700s and several historically important routes crossed through and paralleled the Loess Hills landform region, including the paths taken by Lewis and Clark in 1804 and the Mormons. Nineteenth-century farmstead development and conservation projects such as the Jones Creek watershed project reflected a functional response to the terrain and its suitability for agriculture. Among the (National Park Service) themes represented here are peopling America, developing the American economy, transforming the environment, and the changing role of the United States in the world community.

In comparing just the geologic resource themes, Indiana Dunes, Pictured Rocks, and Sleeping Bear Dunes National Lakeshores, and Chickasaw National Recreational Area are other National Park System units in the same physiographic region (Central Lowlands) (NPS 1990) that also feature eolian and erosional geologic processes. Pictured Rocks National Lakeshore, located along the southern shore of Lake Superior, preserves a 40-mile stretch of sandstone bedrock cliffs. These mineral-stained outcroppings are composed of layered sedimentary rock that was originally deposited in ancient marine environments over 550 million years ago (Cambrian and late-PreCambrian age). The picturesque ramparts seen today were shaped by the relentless erosive action of waves and ice against the ancient sandstone bedrock following the last glacial retreat (about 10,000 years ago). Northern hardwood forests dominate the landscape's vegetation. The only basis for comparison of the Loess Hills with Pictured Rocks is the effect of erosional processes on the landscape. The dominant erosive agent at Pictured Rocks is the massive wave action of Lake Superior against resistant bluffs of sedimentary bedrock. In contrast, the intricate erosional sculpture of the Loess Hills is dominated by stream entrenchment along a dense drainage network as well as by mass wasting, the dislodgment of material downslope by gravity. The loess deposits undergoing erosion are vastly younger (30,000 to 12,000 years old), and the loess itself is a wind-blown deposit of highly erodible, unconsolidated silt, which contrasts sharply with the ancient, resistant sedimentary bedrock composition of Pictured Rocks.

Sleeping Bear Dunes National Lakeshore in Michigan is located along the shoreline of northeastern Lake Michigan, and Indiana Dunes National Lakeshore in northern Indiana is located along the southern-most margins of Lake Michigan. Abundant sand of glacial and beach origin along the coast and a prevailing westerly wind combined to form the dunes, beginning as the glacial period drew to a close there, about 8,000 years ago. The bulk of the dune field formed less than 3,000 years ago. This geological process continues today, as portions of the dunes are actively migrating, pushed by the wind. Sleeping Bear and Indiana Dunes are similar to the Loess Hills in that the geologic materials that compose them are derived from eolian or wind-borne processes. Also the loess in the Loess Hills and the sand at the Sleeping Bear Dunes are both by-products of glacial age (Pleistocene) activity. While the geologic agent of deposition is the same (wind), sand grains are more coarse and mobile than silt, and they produce a very different combination of topographic features. Dunes are constructional topographic features; there is little erosion involved in their shapes. The Loess

Hills are not dune forms heaped up by the wind. They are stabilized, fine-grained silt deposits that have been intricately carved by subsequent stream entrenchment, rill erosion, and mass-wasting processes into distinctly different topographic forms. The source of sand at Sleeping Bear Dunes and Indiana Dunes is tied to changing lake levels, beach and shoreline processes in adjacent Lake Michigan. The source of the silty loess in western Iowa is primarily from the adjacent Missouri River, which transported large volumes of pulverized glacial debris ("rock flour") in major meltwater floods.

Chickasaw National Recreational Area in Oklahoma is a scenic oasis of hydrologic and bedrock-dominated topographic features, combined with numerous recreational opportunities. Again, the solid sedimentary bedrock (Ordovician age) is much older geologic material and is dominated by limestone rather than sandstone. Mineral springs, travertine deposits, streams, and lakes emphasize hydrologic features of the landscape. Extensive faults and folds extend through the area and were caused by uplift of the nearby Arbuckle Mountains during Permian time. In contrast, the Loess Hills, because of their high relief and porosity, have very low water tables, no surface or subsurface hydrologic features, and indeed contain unusual desert-like ecological niches. The unconsolidated, glacial-age, wind-deposited silt of the Loess Hills offers a sharp contrast to the Chickasaw Area in terms of geologic age, material, and origin. The comparatively youthful Loess Hills are composed of wind-deposited silt particles swept from the broad expanse of the adjoining Missouri River valley primarily between 30,000 and 12,000 years ago (Quaternary/Pleistocene age). As deposition of this massive blanket of quartz silt ceased, erosion by water and mass wasting took over and the loess was sculpted into a unique array of intricately dissected hills.

While there are other areas of significant concentrations of loess in the United States, both within and outside of the Central Lowlands physiographic region, stark differences exist. The Vicksburg, Mississippi region (including Natchez Trace Parkway) is similar in topography; however, the loess is present in a significantly smaller area and the loess deposits are not nearly as deep. Additionally, forests dominate the landscape. In the Palouse District of eastern Washington, the loess is thick and widespread; however, the landscape is defined by smoothly rolling hills that lack the intricate dissected forms characteristic of the Loess Hills. Crowley's Ridge, located in Arkansas, contains a loess sequence that is not as thick and does not have the same topography as the Loess Hills. The ridge is largely a Tertiary alluvial remnant in the Mississippi Valley. Extensive areas of thick loess also occur in central and southern Nebraska, but do not have the same topographic development as in western Iowa. Although similar topography does occur in a very narrow band along the south side of the Platte River valley, it is not as wide or extensive as the Loess Hills (Dr. Bettis, personal communication).

Public Use Opportunities

Numerous opportunities for public enjoyment are present in the Loess Hills. There are over 50 outdoor recreation areas, including three state parks and two state forests, on over 30,000 acres of land in the Loess Hills landform region (Table 5). While most of these areas are open to the public, they are managed by a different agencies or entities, and were thus established for differing purposes. The majority of sites noted in Table 5 are less than 150 acres in size, only a handful exceed 2,000 acres and offer trails, exhibits, and other

educational opportunities. Designation of the Loess Hills as a unit of the National Park System would greatly expand the opportunities for interpretation, education and scientific study and provide a coordinated approach to understanding this unique landform.

Summary of Suitability

The National Park Service has determined that the Loess Hills are suitable for inclusion into the National Park System. The Loess Hills represents a resource type that is not already adequately represented in the national park system. Although there are a number of geologic landforms developed by wind deposition and wind/water erosion already represented in the System, none represent the sum of nationally significant resources and themes of the Loess Hills of Iowa. It is the entire 640,000-acre region of deep loess deposits, formed and sculpted by wind and water into a distinctive landscape of steep bluffs, sharp ridge crests, and intricate side-spurs that sets the Loess Hills landform region apart. The area's rich archeological and historical resources, combined with the extensive prairie ecosystems, contribute to the landform region's exceptional value. Likewise, while there are existing visitor-use opportunities in the Loess Hills, they are limited. Inclusion into the National Park System would expand existing opportunities for interpretation and education of this type of resource.

DETERMINATION OF FEASIBILITY

To be feasible as a new unit of the National Park System, an area must be of sufficient size and appropriate configuration to ensure sustainable resource protection and visitor enjoyment and it must be capable of efficient administration by the NPS at a reasonable cost. Ample territory for the preservation, interpretation, and administration of the area's natural, historical, and scenic values is an important feasibility factor. Feasibility factors are presented and discussed below.

Size and Configuration

An acceptable boundary for an envisioned unit of the National Park System should provide for the inclusion and protection of the primary resources; sufficient surrounding area to provide a proper setting for the resource or to interrelate a group of resources; and sufficient land for appropriate use and development. The Loess Hills are an elongated topographic region extending 200 miles through seven counties of western Iowa. The region includes approximately 640,000 acres, of which approximately 26,600 acres (four percent) are in public ownership and permanently protected (Figure 3). The largest publicly owned tract, Loess Hills State Forest, is 7,800 acres. The Nature Conservancy, a non-profit conservation organization, has fee ownership of nearly 3,000 acres and retains conservation easements on approximately 1,900 acres in the Loess Hills (Hickey, personal communication). Nearly 95 percent of the Loess Hills are in private ownership (ownership of the remaining one percent is unknown). Large, contiguous tracts of land in public ownership are absent. Rather, land ownership is in a "checker-board" pattern that includes a mix of state and county governments and private entities.

Land Use and Land Acquisition

Grassland or row crops cover 86 percent of the landform region. These land covers are greatest in the drier, northern counties, while woody plant coverage increases as one proceeds south, and is greatest in Fremont County. As of 1997 (Iowa State University Extension 1999), there were 965 active farms in the Loess Hills, with the majority located in Plymouth, Woodbury and Pottawattamie counties. The average farm size in the seven counties of the study is 448 acres. Nearly one-quarter of individual earnings are derived from farming in Monona, Harrison, and Fremont counties (Table 4).

Land values within the study area have steadily increased since the mid-1980s. Appreciation in land values within six of the seven counties of the study area has outpaced the growth in land values in the state of Iowa (five factors impacted land values during 1999: government program payments, interest rates, crop yields, the supply of land available, and demand by investors). In 1999, the average cost per acre of farmland ranged between $1,469 (Monona County) and $2, 017 per acre (Plymouth County). The average cost per acre of farmland in the seven county region was $1,633, which is slightly less then the average cost per acre ($1,785) of farmland in the state of Iowa (Iowa State University 2000).

A land protection plan would require the identification of willing sellers and of desired parcels prioritized by resource sensitivity and threats for the roughly 640,000-acre landform region. Contiguous tracts that do not fragment sensitive resources would be desirable in order to offer the greatest amount of protection. Large contiguous tracts are also important for practical management, such as the use of prescribed fires to restore native prairies. Prioritized areas would need to be integrated with the existing conservation programs that are currently being carried out by state and local organizations in the areas. Involved entities include the seven County Conservation Boards; GHRC&D; IDNR; Soil and Water Conservation Districts; NRCS; The Nature Conservancy; Iowa Natural Heritage Foundation; Loess Hills Preservation Society; and the Western Iowa Tourism Region.

Existing Impacts and Threats to the Resource

Multiple impacts and threats to the integrity of the Loess Hills exist and include erosion, quarrying, displacement of prairie (fire suppression, invasion of exotic plant species, woody plant encroachment), overgrazing, proliferation of telecommunications towers in scenic viewsheds, and degradation of archeological resources. Ironically, human efforts to stem the effects of natural erosion, usually for agricultural purposes (terracing, water impoundment dams, etc.), have taken a substantial toll on the archeological record of the Loess Hills. Unplanned growth continues to occur, especially near Sioux City, Council Bluffs, and Glenwood, which adds to archeological resource protection issues.

Under normal circumstances, the well-drained, steep-sloped loess is strong, cohesive, and stable. However, when saturated or under the weight of structures and fill dirt, loess can collapse. Although slumping is a natural tendency in the Hills, today, the frequency of slope failure has increased in response to increased water infiltration and weight associated with a variety of human activities. Construction and changes in drainage patterns often destroy the fragile stability of this area. As a result, buildings are damaged or destroyed; entire bluff faces fail, often covering structures and roads at their base, posing a safety hazard and

highway engineering expense. This is particularly a problem in areas where the high bluff tops provide scenic vistas. Despite their propensity to collapse, these areas are desirable home sites. Slope failure and landslide hazards are serious environmental and management problems.

Gully formation, another natural processes in the Loess Hills, has become a severe problem along drainage ways. In some areas, gullies can be many miles long, more than 100 feet wide, and nearly 80 feet deep. As gullies widen, bridges and roads give way, restricting farmers' access to their fields, and escalating highway maintenance costs. This slumping of road segments and bridge foundations gives the appearance of gullies actually "swallowing" up the countryside. Indeed, the term "hungry canyons" is often used to describe the landscape in the region.

Photo courtesy of Loess Hills Alliance

Erosion of loess by flowing water is another natural process that has been intensified through human use. The Loess Hills has one of the highest erosion rates in the U.S., almost 40 tons per acre per year (USGS 1999) which is three to four times greater than the state average of nine to ten tons per acre per year (Mutel 1989a). Although the Loess Hills are inherently susceptible to severe erosion because the steep slopes, high runoff rates, and fine-grained silt, removal of the protective vegetative cover in many areas has increased erosion rates. Stream sediment loads, boosted by the slumping of gully walls into streams, block ditches and impact important breeding and feeding habitats for many aquatic organisms. Trails located on steep slopes are highly susceptible to erosion. Poorly planned, constructed, and maintained trails are contributing to erosion problems in this area.

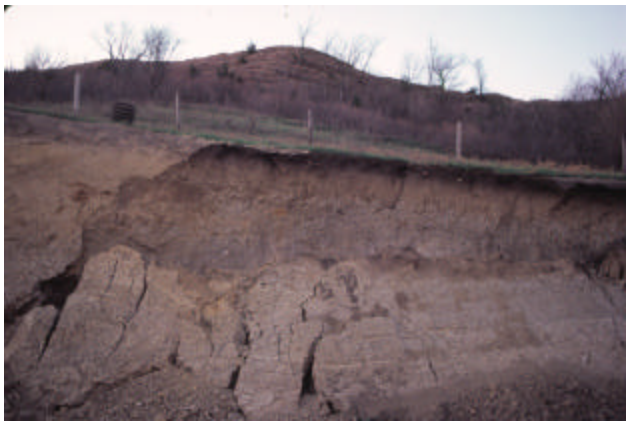


Photo courtesy of Don Poggensee

Extractive activities for earth materials are among the major threats to the Loess Hills. During the public input process, this was the most often cited concern. These activities not only visually scar the landscape, they fragment the landforms and accelerate the natural erosion process. Borrow pits for fill-dirt and road construction, quarrying of limestone bedrock, brick and tile pits, and sand and gravel pits fall into this category.

Photo courtesy of Don Poggensee

Quarrying operations date back to the 1880s when bricks were produced from small clay and shale pits in the Sioux City area. After a period of decline, extraction activities accelerated and have steadily increased during the last few decades. Aerial photographs from the 1960s indicate that mining of the western face of the Loess Hills in the area between Council Bluffs and Sioux City has accelerated. The full extent and impact of loess extraction are difficult to quantify because Iowa statute and regulation does not consider loess a mineral. Nor are all quarries and pits required to be licensed, hence, the number of these operations and amount of material removed on an annual basis is unknown. However, there are currently 27 active state-licensed operations that extract sand, gravel, limestone or aglime in the Loess Hills and 25-licensed facilities that are "closed" or inactive. Hence, over 50 licensed operations are known to have extracted materials in the Loess Hills. Most units of local government do not have ordinances that are designed to protect the loess deposits. Plymouth County, however, is working to modify its zoning ordinances to reflect protections for the Hills set forth in a recently adopted new comprehensive plan.

Invasive shrubs and exotic plants are invading throughout the Loess Hills, particularly where overgrazing has occurred and natural fires have been suppressed. Native woodland edge species are expanding into prairies at a rapid rate, and many other areas have been converted to pastures or cultivated fields. Woodlands now cover much of the Loess Hills that was previously covered by tallgrass prairie, particularly the southern Loess Hills and the sheltered north and east-facing slopes. Prairies located in the drier far-northern Loess Hills and on south-and west-facing slopes remain relatively intact. A 1982 study of aerial photographs by Heineman concluded that in centrally located Monona County, between 1940 and 1980, canopy coverage of woody species on bluffs had increased approximately 40 percent with the greatest change occurring on the lower slopes (Heineman 1982). Currently, native prairie composes three percent of the study area, whereas historically, native prairies were the dominant plant community.

Agricultural production activities are also increasing as landowners struggle to maximize profits on their land. Newly constructed terraces and more intensive grazing are becoming increasingly common in formerly steep natural areas (U.S. Department of Agriculture 1995). Areas that have been overgrazed contribute to soil compaction, reduction of native species diversity, increased presence of exotic species, and erosion.

Archeological resources in the Loess Hills face a large number of on-going threats to their integrity. Once destroyed, archeological sites and their potential contribution to scientific understanding cannot be replaced. The same natural forces that have shaped and continue to shape the Loess Hills also pose long-term threats to archeological sites in the Loess Hills. Quarrying is considered a serious threat to the archeological resources within the study area.

Although quarrying activities have resulted in the discovery of sites such as Turin and the Siouxland Sand and Gravel sites, many sites have been lost without benefit of scientific investigations. Small impoundment dams planned by the Soil Conservation Service (now the Natural Resources Conservation Service) in the Pony Creek valley in Mills County have resulted in the destruction of archeological sites (Brown 1967; Anderson 1983). Widespread agricultural practices such as grazing and cultivation also destroy archeological sites at an alarming rate, as well as modern developments such as construction of buildings, roads, and subdivisions. Expansion of communities, particularly Council Bluffs, Sioux City, Glenwood, and the larger Loess Hills communities, also consumes archeological sites. Damage to archeological sites may also result from severe erosion and gully formation.

Increased population and development in the Loess Hills have caused an increased demand for rock quarries, sanitary landfills, housing, roads and road improvements, waste treatment facilities and fill-dirt. Each of these activities affects the integrity and diversity of the scenic resources present.

Poorly planned residential developments, telecommunications towers, agricultural activities, and quarry operations visually intrude upon the landscape. Entire bluffs have been removed for construction fill, and quarry operations have cut into hillsides, both creating extensive areas of slope failure. A proliferation of housing developments along the tops of ridges continues to accelerate erosion. Road widening, surface paving, and other road improvements can impact the scenic character and alter the historic quality of the region. All of these activities place visual scars on the landscape, impair scenic vistas, and disrupt the continuity of cultural and natural landscapes.

Social and Economic Impact

Overall, the counties of the study area have a comparatively diverse economy. Manufacturing is the leading economic sector in Fremont and Plymouth counties, whereas the service industry leads in Monona, Pottawattamie, and Woodbury counties. The government sector accounts for more than one-third of total earnings in Mills County. The increased tourism that may result from federal designation of the study area could bolster the local economy; however, associated costs to local and county infrastructures to support the increased traffic may counter-balance this effect. In counties where the farming sector is a significant amount source of individual revenue, the conversion of farmlands to public ownership could have a significant impact.

Access

Access to the study area is readily available by a number of major interstate Highways (I-29, I-80, I-680) and regional airports (Sioux City, Iowa; Omaha, Nebraska), the Loess Hills National Scenic Byway, and numerous state and county roads.

Public Interest and Support

Numerous public workshops were held during the year 2000 to gather public input (Appendix E). While there is general interest and support for the preservation of the Loess Hills, many residents in the study area are concerned about the protection of their private

property rights, the potential for property values to decline, and were opposed to acquisition of land by the National Park Service. However, there is strong consensus among both landowners (own one acre or more) and the general public that not enough is being done to protect and preserve the Loess Hills. Viewpoints vary as to how to best achieve this goal. Many residents felt that current regulations do not have enough "teeth". A telephone survey (Central Surveys Inc. 2000) sponsored by the Loess Hills Alliance found that there is strong consensus among Loess Hills households that "protection of the landform can be achieved through partnerships of private landowners and private conservation groups and that the necessary level of cooperation can be achieved without government acquisition of land". While many residents favored federal land acquisition for the purpose of establishing a national park (a proposal that was rejected by most landowners), the survey also found that acquisition of land from willing sellers by the state or by private partnership groups was acceptable. Through public meetings and mail-in comments, residents in Monona County strongly advocated protection of the rights of private property owners and did not favor government ownership of land. The telephone survey results reflected these sentiments (Central Survey 2000). The survey found that the "strongest opposition to land acquisition by the National Park Service is in Monona County." The majority of landowners were opposed to the purchase of land in the region by the federal government. The results of the survey and public comments are explained in more detail in Appendix E.

Summary of Feasibility

The National Park Service has determined that the Loess Hills landform region is not a feasible addition to the National Park System. The multiple jurisdictions and extent of private property (613,400 acres or approximately 95 percent) would make it difficult for the National Park Service to effectively and efficiently manage the area. The diversity and extent of resource threats further complicate the ability of the NPS to successfully manage the region as a single unit. The primary resource threats include residential developments, quarrying, and erosion. These issues are handled by local planning boards who have the legal authority to develop appropriate zoning ordinances, grant permits, conduct design reviews, and participate in other local planning efforts. A federal land acquisition program would not be practicable for the entire landform region, even if willing sellers came forward. The average cost per acre of farmland in the seven counties in and adjacent to the region is $1,633 (Iowa State University 2000); there is approximately 613,400 acres in the Loess Hills landform region that is not currently permanently protected. Finally, public support for federal ownership of land among some population sectors and in some regions of the study area is absent.

Conclusion

Although the Loess Hills landform region is nationally significant, and is suitable for inclusion to the System, the entire area (640,000 acres) is not a feasible addition to the National Park System.

Those who live in the study area are interested in defining a balance that will preserve the integrity and character of the Loess Hills, promote economic development, and allow for

carefully managed use. A range of viable management alternatives for the long-term preservation of the Loess Hills is presented in the next section.

MANAGEMENT ALTERNATIVES

"A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. "
- *Aldo Leopold*

MANAGEMENT OBJECTIVES

A range of viable management alternatives for the Loess Hills landform region is presented below. The objective of each management alternative is to provide for the long-term preservation, protection and interpretation of the nationally significant resources that are identified in this study. Each management alternative integrates land protection programs already available in the Loess Hills, comments received from landowners and citizens living within the study area, and comments from the general public. Together, these four alternatives, while having various degrees of federal, state and local involvement, remain sensitive to private landowner concerns and complement existing conservation efforts of state, local, and private entities.

ALTERNATIVE 1 - MANAGEMENT BY LOCAL GOVERNMENT UNITS (NO FEDERAL INVOLVEMENT)

Under this management alternative, local government units (LGUs) such as cities, towns, and county governments, would continue to be responsible for resource protection. Each unit would be responsible for the development and implementation of comprehensive planning and zoning ordinances that may aid in resource preservation (comprehensive plans can provide a long-term management strategy for resource protection and sustainable growth. Already, Plymouth County has completed a Comprehensive Plan, and Woodbury and Mills counties are developing such plans).

Individual LGUs could work cooperatively with other LGUs in the Loess Hills, or could operate on an independent basis. Each LGU would be responsible for ensuring that existing state regulations, statutes, and programs that contribute to the protection of the Loess Hills are effectively applied. The Loess Hills Alliance would continue to support and enhance individual LGU efforts by continuing to implement landowner education, stewardship, and outreach programs, providing matching grants, and identifying and coordinating land protection opportunities for interested LGUs. The state or the Loess Hills Alliance could provide additional incentives to the LGUs to develop ordinances that are sensitive to the Loess Hills.

The Loess Hills Alliance, The Nature Conservancy, the Western Hills Area Education Agency, Soil and Water Conservation Districts, the U.S. Fish and Wildlife Service, various county conservation boards, and other groups are already providing grants, educational programs, and seminars that contribute to the preservation of the Loess Hills. Property owners would continue to have the option to make use of these and other programs. Conservation easements, land donations, bequests, and other land protection opportunities would continue to be made available by land trust organizations that are operating in the area. In addition to supporting these activities, the LGUs might work with state and private entities in developing Best Management Practices for certain activities, and providing technical assistance to constituents interested in stewardship programs. Federal agencies such as the Natural Resources Conservation Service, U.S. Fish and Wildlife Service, and the U.S. Department of Transportation could continue stewardship activities in the Loess Hills.

Other possibilities under this option could be the offering of Loess Hills-friendly tax incentives (property and income tax deductions) or additional points for participation in existing conservation programs such as the Conservation Reserve Program (administered by the U.S. Department of Agriculture) or Partners for Fish and Wildlife (administered by the U.S. Fish and Wildlife Service). These incentives could be offered by each LGU. Property tax credits for protective management to preserve and enhance the stated natural resource values of the Loess Hills or possible disincentives, such as property tax exemption roll-backs or differential taxation, could also be provided. Upon request, and subject to the availability of funds and staff, federal agencies such as the Natural Resources Conservation Service could assist with demonstration projects. The decision to take advantage of these and other incentive programs would rest with each individual LGU.

Any additional public land acquisition, land management decisions, and program expansion would remain at the discretion of the LGUs. No new land acquisitions, staffing, planning, or other costs would be incurred by the National Park Service.

This alternative relies heavily on the initiative of individual LGUs in the region and continued coordination of the Loess Hills Alliance. Differences in individual LGU policies, ordinances, and funding capabilities would present a number of challenges. Because natural resources do not have jurisdictional boundaries, a local commitment to preserving the integrity of the Loess Hills in a holistic manner would be essential. This option recognizes the positive steps that have already been taken by the Loess Hills Alliance, state and local governments, and other conservation groups. It encourages these efforts to continue. It does

not, however, ensure that a holistic approach will occur. Local efforts may be duplicated or, conversely, there may be gaps.

The majority of public comments that addressed this option favored its dependence on local management. However, many of those commenting on this option felt that a reliance on incentive programs without enforcement capabilities was a weakness, particularly if local interest groups exert pressure on locally elected officials. Others felt that the approach would further fragment the landform region.

ALTERNATIVE 2 - MANAGEMENT BY A JOINT POWERS BOARD

This alternative could be modeled after the successful Mississippi Headwaters project, where a Joint Powers Board (JPB) has been established to provide protection to the resources of the Upper Mississippi River in Minnesota. Chapter 28E of the Iowa Code permits state and local governments to make efficient use of their powers by enabling them to provide joint services and facilities with other agencies and to cooperate in other ways of mutual advantage. The JBP in the Loess Hills would be given the responsibility to prepare the Comprehensive Plan (CP) subject to public review, for the entire landform region. The CP should develop a long-term strategy to preserve the significant resources of the Loess Hills and provide for economic growth and development.

The Loess Hills JPB could consist of representatives from each of the seven counties located within the Loess Hills landform region, or it could be the Loess Hills Alliance. The JPB could be self-funded and would define its role, function, and scope of authority. Individual counties would be responsible for implementing the CP. The CP would provide model ordinances for the landform, which could be adopted on a voluntarily basis by member counties as part of their individual zoning codes. The National Park Service recommends that an advisory or ad-hoc committee be established to support the JPB. The advisory committee would make recommendations to the JPB and provide advice on land use management and provide a forum for public involvement. Members of the advisory committee should include the Loess Hills Alliance, Iowa Department of Natural Resources, The Nature Conservancy, landowners, developers, technical experts from universities and colleges, representatives from the Hungry Canyon Alliance, Loess Hills Preservation Society, and others as identified. Coordination with existing state regulations and county ordinances would be provided by the JPB. The NPS, upon invitation of the JPB, could serve as a non-voting member on the advisory committee until planning efforts are completed.

The CP could establish programs that would assist interested private property owners in implementing a variety of preservation or restoration goals. These programs would be managed by the JPB and could include technical assistance and educational forums, coordination of conservation easements, demonstration projects, or promoting Loess Hills-friendly incentives that encourage the preservation of prairies, woodlands, and cultural sites. The Comprehensive Plan would identify areas within the Loess Hills that are compatible

with residential and industrial growth, agricultural uses, and various forms of recreation. Sensitive resource areas in need of specific protection strategies would also be identified. The JPB could utilize the broad range of public and private partnership opportunities available in the Loess Hills and help to further promote land uses that sustain the natural and cultural resources of the Loess Hills. Possibilities include forming partnerships with landowners and various agencies and organizations already working in Loess Hill. These entities could be brought together in a coalition with the JPB for land use planning. A funding account could be established and managed by the JPB, which would be earmarked for land use planning and selected demonstration projects meeting JPB established criteria (restoration, mitigation, preservation). The funds for JPB operation and programs would come from a combination of sources (existing county funds, state appropriations, new revenue generated through existing authorities available to the JPB).

The Loess Hills Alliance, either serving as the JPB, or working with the JPB, would continue to provide education and outreach programs aimed at increasing the public's understanding and appreciation of the Loess Hills region and its resources. The Loess Hills Alliance would also continue to provide stewardship activities to assist landowners in developing best management practices, establishment of conservation incentive programs, and coordination of grants for demonstration projects.

Upon request of the JPB, federal programs such as the National Park Service's Rivers, Trails and Conservation Assistance Program (RTCA), and agencies such as the Natural Resources Conservation Service, could provide technical assistance. The U.S. Department of Agriculture (USDA) might provide a program that recognized nontraditional agricultural products and provides assistance to encourage participation. However, the ability to provide technical assistance would be contingent upon the availability of agency funding, staff, and other resources and may require additional appropriations.

This alternative combines the capabilities and resources of the local, state, and federal governments and the private sector without direct federal land acquisition and management. It builds on programs already established in the Loess Hills, and helps to streamline land use planning and zoning ordinances. The common vision for the Loess Hills landform region is readily apparent in this option, which allows for economies of scale. Counties would have to provide funding for planning and implementation, and enforcement will be based upon local initiatives.

The majority of responses to this alternative favored the strong regional presence and leadership provided by the JPB. Many voiced fears that this option did not provide sufficient protection because it assumed that the management entities would be able to secure the necessary funding and expertise to achieve the stated goals, and that non-member counties may not share the same vision as the JPB. However, the advisory committee to the JPB could be composed of persons with a variety of technical skills and professional expertise. Additionally, counties are beginning to develop long range plans on their own initiative. For example, Plymouth County has completed a new comprehensive plan and has established an overlay district in their zoning ordinances for the Loess Hills (overlay districts have more stringent zoning standards). Mills and Woodbury Counties are in the process of developing

similar plans. The Loess Hills Alliance is providing financial incentives for counties that do comprehensive planning that include overlay districts in areas with sensitive resource. Public review of the Comprehensive Plan would provide an opportunity for individual involvement into the decision making process.

ALTERNATIVE 3 - NATIONAL RESERVE

This alternative is contingent on Congress passing legislation that would designate the entire Loess Hills landform region (approximately 640,000-acres) as a National Reserve, an affiliated area of the National Park System. Affiliated areas must meet the same significance criteria as units of the NPS, but are neither federally owned nor directly managed by the NPS. A management entity is designated to provide management and oversight for the area. The management entity must manage the affiliated area in a manner that conforms to all policies, laws, and regulations that are applicable to units of the NPS. Affiliated areas have access to technical, financial, and program assistance from the NPS. Usually, the assistance provided is of a technical nature, such as for preparation of a management plan or interpretive exhibits, and is secured on a competitive basis.

There are four specific criteria that must be considered for nationally significant areas to be suitable as an affiliated unit of the National Park System:

- Meet the same standards for national significance that apply to units of the National Park System.
- The area's resources must require some special recognition or technical assistance beyond what is available through existing NPS programs.
- The area's resources must be managed in accordance with the policies and standards that apply to units of the National Park System.
- The area's resources must be assured of sustained resource protection as documented in a formal agreement between the NPS and the non-federal management entity (National Park Service 2001). Thus, it must be possible to establish and continue a standard of maintenance, operations, public service, and financial accountability consistent with requirements applicable to National Park System units.

The Loess Hills Reserve would be managed by a special entity identified in the legislation that establishes the Reserve. This management entity could be the Iowa Department of Natural Resources (IDNR), or a specially codified unit of state government. Or, the entity could be a unique organization defined by parameters specified by Congress, such as a commission composed of staff from the IDNR, The Nature Conservancy, each of the seven counties, and interested landowners. The IDNR or management commission would be responsible for the management and day-to-day operation of the Reserve, according to guidelines established in a Comprehensive Plan for the Reserve. The management entity, with NPS assistance, would prepare a collaborative Comprehensive Plan that meets NPS standards and that furthers the purposes of the Loess Hills National Reserve.

The Comprehensive Plan would be a long-term comprehensive planning document that identifies how resources, visitors, and facilities will be managed. Working with local government units and interested tribes, the management entity could craft model ordinances, and help coordinate local and regional activities with state regulations and programs. Incentive programs, grants, and conservation easements could be incorporated into this option to encourage county and city land use planning efforts towards a more sustainable direction. Development could be discouraged in sensitive areas while growth could be directed and encouraged in other areas. The responsibilities and authorities of the management entity would include comprehensive long-range planning; coordination of stewardship programs and activities; establishment of cooperative agreements; and dissemination of standards for visitor services and resource protection. The NPS may assign a staff liaison to assist with planning and program coordination during the formative stages of the project. However, this level of involvement would be phased out once the Comprehensive Plan was completed.

One of the responsibilities of the National Park Service under the Reserve concept could be to ensure the consistency of federal actions throughout the area covered by the national designation. If authorized by Congress, the NPS would review federal undertakings in the area to ensure that said undertakings were in keeping with the purposes for which the Reserve was established, and that are consistent with the Reserve's comprehensive plan. "Undertakings" would include any direct federal actions, federally permitted actions, and federally funded actions. The NPS would work with other federal entities to modify proposed undertakings found to be incompatible with the Reserve's comprehensive plan so that they would conform to said plan.

Congress could insert a clause in the enabling legislation for the Reserve that directs other federal agencies to coordinate with the NPS on activities within the Reserve. Agencies would be required to contact the NPS at the earliest opportunity to discuss the undertaking; they would provide materials necessary for the NPS to review and evaluate the undertaking. The legislation also could outline a process for resolving inconsistencies and/or reporting impasses between the NPS and other agencies.

As an affiliated area of the National Park System, the site would be included in NPS publications and brochures. There would not be federal land acquisition within the Loess Hills National Reserve. Acquisition of private property, if any, within the Reserve boundaries by the management entity would be in compliance with state policy. The management entity could facilitate land and easement purchases from willing sellers if authorized to do so. This alternative could result in increased publicity for the area, thus increasing visitation without a guarantee of resources necessary to meet the increased demand for services.

The management entity could coordinate a technical assistance program that is funded by state and federal dollars. Assistance would be provided on a competitive basis for planning, education, interpretation, preservation, recreational trail development and a variety of demonstration projects for open-space conservation. Existing visitor centers could coordinate education and outreach activities, and complement efforts such as the Loess Hills Prairie Seminar series.

Designation of the Loess Hills as a NPS affiliated area could provide valuable recognition and act as a tool to assist local and state partners in their efforts to appropriately develop, manage, and preserve the region. It would ensure that comprehensive planning is funded and coordinated throughout the entire landform. Implementation of this option would require specific management area boundaries be identified during the planning process. This designation would require a permanent NPS commitment to the Loess Hills, and would add an additional layer of management where there are already multiple entities working to preserve, protect, and promote the Loess Hills. The region's infrastructure (roads, bridges, visitor centers) may require improvements and/or additions if visitation increases in response to the Federal Reserve designation. This also may impact fragile resources, requiring focused monitoring efforts to avoid or reduce visitor impacts.

Favorable comments to this alternative identified the prospect of long-term protection and national recognition as desirable. The balance of local and federal influence, and NPS involvement were also cited strengths. The majority of comments opposed to this alternative anticipated operational difficulty in administering the entire area, expressed concerns that individual landowners and farmers' private property rights would not be adequately protected, and were generally not in favor of this level of federal involvement.

ALTERNATIVE 4 - SPECIAL LANDSCAPE AREAS

This alternative includes a management combination of National Reserve and Local Government Units. Under this alternative, 12 Special Landscape Areas (Figure 6) would be designated as a National Reserve, an affiliated area of the National Park System. Affiliated areas are neither federally owned nor directly managed by the NPS. Local government units, as in Alternative 1, would continue to manage the remainder of the landform region in a manner consistent with the local ordinances and comprehensive plans. This alternative would be contingent on the 12 Special Landscape Areas (SLAs) meeting the criteria for eligibility and on Congress passing legislation to designate the SLAs as a National Reserve.

To be eligible for affiliated area status, the 12 SLAs must:

- Meet the same standards for national significance that apply to units of the National Park System.
- Require some special recognition or technical assistance beyond what is available through existing NPS programs
- Be managed in accordance with the policies and standards that apply to units of the National Park System, and
- Be assured of sustained resource protection, as documented in a formal agreement between the NPS and the non-federal management entity (National Park Serve 2001). This option is contingent on the 12 SLAs meeting criteria for affiliated area status, and on Congress passing legislation to designate the Reserve

Collectively, the 12 SLAs encompass approximately 100,000 acres (about 15 percent of the Loess Hills) and are distributed among the seven counties along the western edge of the landform region from north to south. The 12 SLAs are non-contiguous clusters of exemplary geologic, topographic, and scenic features that best characterize the Loess Hills landform. These landscapes also contain significant amounts of remnant prairie communities, rare plants and animals, and important archaeological sites (Appendix D). Approximately 17,000-acres, or 17 percent, of the land within the SLAs already have some form of existing protection: they are owned by state or county governments or by The Nature Conservancy. The remaining 82,000 acres (83 percent) are in private ownership. The Loess Hills National Natural Landmark (NNL) sites (Turin and Little Sioux) are included in the SLAs. Ownership of NNL lands is a combination of private and public ownership.

A management entity, identified in the legislation that establishes the Reserve, would provide management and oversight to the Reserve. This management entity could be the Iowa Department of Natural Resources (IDNR), or a specially codified unit of state government. Or, the entity could be a unique organization defined by parameters specified by Congress, such as a commission composed of staff from the IDNR, The Nature Conservancy, each of the seven counties, and interested landowners. The IDNR or management commission would be responsible for the management and day-to-day operation of the Reserve, according to guidelines established in a Comprehensive Plan for the Reserve. The level of federal involvement also could be specified as part of the authorizing legislation, and could include National Park Service (NPS) planning. The NPS could provide assistance in developing educational programming in accordance with existing NPS standards, and would assist in defining standards for resource protection and visitor services in the Reserve. The Loess Hills National Scenic Byway could evolve as the "thread" that winds its way through the region, tying the Reserve together. A centralized visitor center, operated by the management entity, could be established to provide visitors with orientation and interpretative opportunities. This education center could work cooperatively with other existing visitor centers in the Loess Hills and help to coordinate programs, publications, and events. The center could include a research and technical assistance component that serves landowners, developers, and others as interested.

As with Alternative 3, the National Park Service could ensure consistency of federal actions throughout the area covered by the national designation. If authorized by Congress, the NPS would review federal undertakings in the area to ensure that said undertakings were in keeping with the purposes for which the Reserve was established, and are consistent with the Reserve's Comprehensive Plan. Implementation of this option will require specific management area boundaries be identified during the planning process.

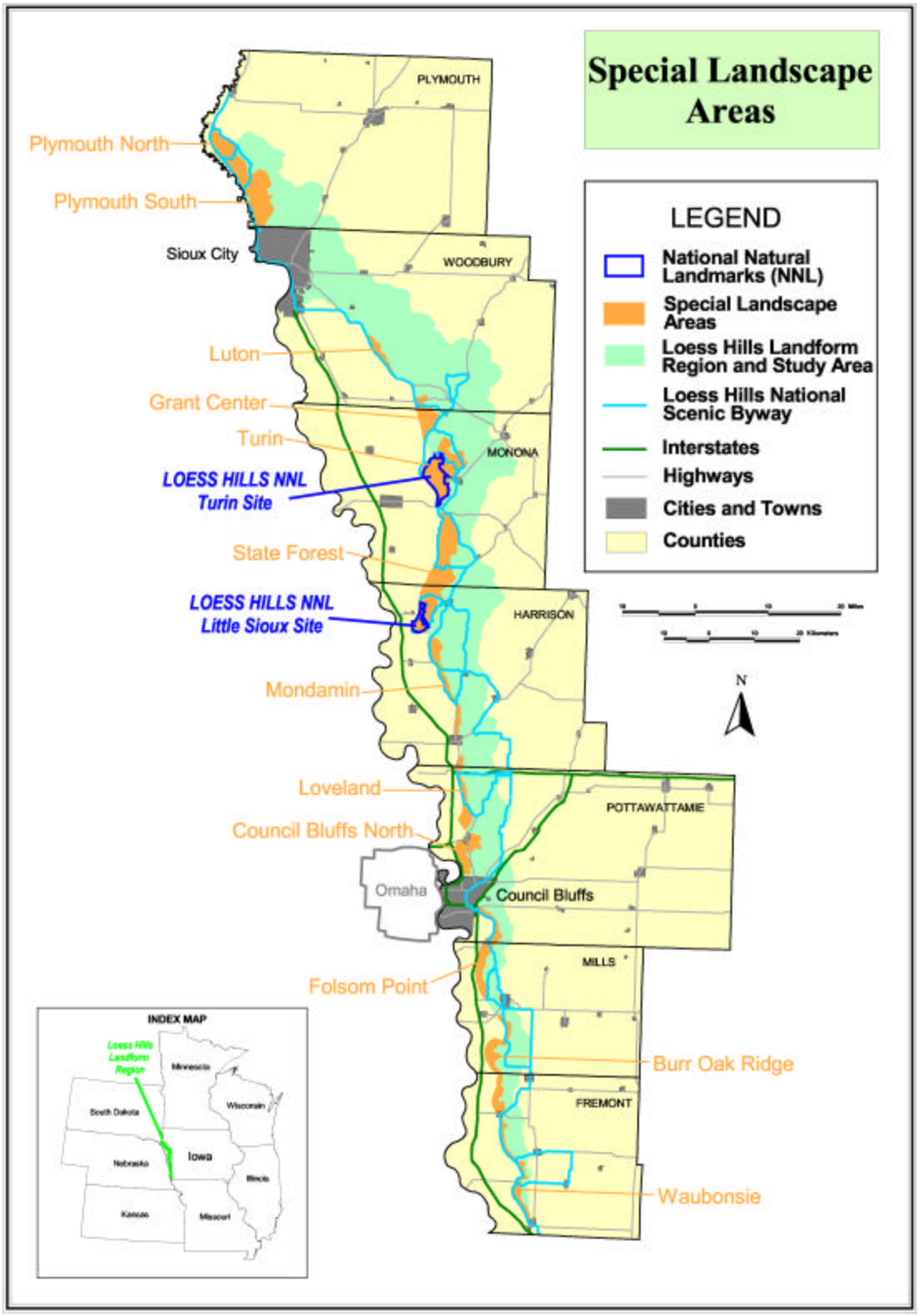


Figure 6: Special Landscape Areas

The remainder of the landform region would be protected through the efforts of individual local government units (LGUs). Each LGU would be responsible for the development and implementation of comprehensive planning and zoning ordinances. Individual LGUs could work cooperatively with other LGUs in the Loess Hills, or could operate on an independent basis. Each LGU would ensure that existing state regulations, statutes, and programs that contribute to the protection of the Loess Hills are effectively applied. The Loess Hills Alliance would continue to support and enhance individual LGU efforts by implementing education, stewardship, and outreach programs and by coordinating land protection opportunities for interested LGUs and landowners. Additional incentives to LGUs could be provided by the state to encourage development of appropriate ordinances sensitive to the Loess Hills.

Property owners would continue to have the option to make use of existing programs. The LGUs might work with state and private entities in providing technical assistance and educational forums to constituents interested in stewardship programs or other approaches to protecting their land. Federal agencies such as the Natural Resources Conservation Service, U.S. Fish and Wildlife Service, and the U.S. Department of Transportation could continue stewardship activities in the Loess Hills.

As an affiliated area of the National Park System, the site would be included in NPS publications and brochures. This increase in publicity for the area could increase visitation without a guarantee of resources that might be needed by the local management entities to provide services necessary to meet the added demand.

This alternative identifies the most important areas within the landform region, and focuses planning and protection efforts on these 12 locations. Designation as an affiliated area could provide recognition and assist local and state agencies in their efforts to appropriately manage the resources of the Loess Hills. This alternative offers a balance between federal, state and local involvement. However, federal planning dollars are not guaranteed for the remaining landform region (approximately 540,000 acres).

The majority of comments in support of this option cited increased protection and a balanced combination of local, state, and federal resources as this alternatives' strength. Comments not in favor of this option cited too much federal involvement, insufficient federal/regulatory protection, and a concern that the “string of pearls” fragments the landform and would not link biological systems or maintain the biological diversity of the area. Since the study was begun, nine private landowners have requested that their land be removed from the National Natural Landmark program. These properties are located in one of the proposed SLAs.

Management Alternatives Considered but Rejected

National Heritage Area

A National Heritage Area is defined as "a settled landscape that tells the story of its residents. Over time the land and the local environment have shaped traditions and cultural values in the people who live there." Additionally, the "residents' use of the land has in turn created and sustained a landscape that reflects their culture."

The designation of National Heritage Area is not appropriate for the Loess Hills landform region because the region does not function as a nationally significant cultural landscape. The history of how people have interacted with their environment does not substantially differ from the history of the surrounding agricultural landscapes of Iowa and Nebraska. The same ethnic populations settled the landform region as settled the adjacent counties. Even though the properties of the loess soils lead to physical adaptations in the way people use the land, these adaptations do not appear to be exclusive to the landform region and cumulatively have not created a culturally distinctive landscape. This management option was rejected.

National Monument/National Park

The Antiquities Act of 1906 authorizes the President to declare areas located on lands already owned by the federal government as National Monuments. There are no such lands in the Loess Hills. The landform region did not meet the feasibility criteria for units of the National Park System because of land ownership patterns, configuration, and resource threats. All alternatives that included National Monument or National Park status were rejected.

National Parkway

National Parkways are ribbons of roadways flanked by land and offer a variety of interpretive opportunities while driving through areas of scenic interest. In this option, the Loess Hills National Scenic Byway, and perhaps other connecting roads, would be designated a National Parkway, a unit of the National Park System. The landform region did not meet the feasibility criteria for units of the National Park System because of land ownership patterns, configuration, and resource threats. Because the landform did not meet the feasibility criteria, this option was rejected.

National Scenic Trail

National Scenic Trails are generally long-distance footpaths winding through areas of natural beauty. This option considered development and designation of a National Scenic Trail, a unit of the National Park System. The landform region did not meet the feasibility criteria for units of the National Park System because of land ownership patterns, configuration, and resource threats. Because the landform did not meet the feasibility criteria, this option was rejected.

National Reserve/National Heritage Area

This option explored the designation of the 12 Special Landscape Areas, including the NNL, as a National Reserve, a National Park Service Affiliated Area. The remainder of the region would be designated a National Heritage Area, managed through cooperative efforts among federal, state, and local governments and private non-profit organizations. Since the region does not meet the criteria for National Heritage Area designation this option was rejected.

RECOMMENDATIONS

Three recommendations for the Loess Hills landform region are presented below. These include a recommendation for management of the Loess Hills, and two additional studies, an ethnographic study, and a landmark study.

1. Recommended Management Alternative: Alternative 5

The National Park Service concludes that the most effective and efficient approach to protecting the significant resources of the Loess Hills landform region, and providing opportunities for appropriate public enjoyment, is a combination of the management alternatives previously presented in this study. This combination includes a step-up plan consisting of local collaboration, the formation of a Joint Powers Board, the development of a Comprehensive Plan, and finally, the potential designation as a National Reserve, an affiliated area of the National Park Service. Affiliated areas are neither owned nor directly managed by the National Park Service, yet are eligible to receive technical assistance from the NPS.

The NPS evaluated the challenges and opportunities for management of the Loess Hills. The value of developing strong, locally based support and commitment to preserving the Loess Hills landform region was apparent. The NPS also recognizes the numerous federal, state, and local efforts currently underway to protect the resource values of the Loess Hills. By providing support to these efforts, the National Park Service can help to ensure that the significant resources of the Loess Hills are perpetuated for generations to come. This management strategy provides a framework that originates at the local level, and allows for state and federal assistance. This recommendation:

- Recognizes the national significance of the Loess Hills landform region.
- Encourages and enables local units of government to develop measures to protect the resources of the Loess Hills.
- Provides for Federal participation in protection of the Loess Hills at a level of involvement supported by local units of government and citizens of the region.
- Provides for recognition and technical assistance beyond what is currently available through existing National Park Service programs.

Under this three-phased strategy, Congress would pass legislation for the Loess Hills that encourages the state of Iowa or the counties within the Loess Hills to form a Joint Powers Board (JPB) to develop a Comprehensive Plan within a specified period. Such legislation would authorize and provide funding for the National Park Service to participate as a partner in the development of a Comprehensive Plan to ensure long-term protection of the Hills. The legislation also would outline a mechanism whereby the JPB and the Governor of Iowa could

petition the Secretary of Interior to designate the National Reserve, as authorized in the Loess Hills legislation.

Specifically, the three phases of this recommendation include:

Phase I: Joint Powers Board (JPB) Formation

The state of Iowa or the counties would form a JPB for the purpose of developing a Comprehensive Plan to ensure long-term protection of the Hills. At a minimum, this board would consist of a quorum of at least four of the seven counties of the Loess Hills landform region. The board would be structured in a manner that provides for participation of interested municipalities, the Iowa Department of Natural Resources, the National Park Service, and interested tribes (Otoe-Missouria, Iowa, Winnebago, and others) as non-voting, technical advisors. When and if this board is created, then Phase II may be implemented.

Phase II: Comprehensive Planning

During this phase, the JPB would initiate the development of a Comprehensive Plan for the Loess Hills. The National Park Service would be authorized and funded to provide technical assistance to the JPB in the development of the Comprehensive Plan and associated Environmental Impact Statement (EIS). The EIS would evaluate impacts of alternatives for protection of the Hills as described, including, at the board's discretion, an alternative focused on creation of a National Reserve.

The Comprehensive Plan would address all of the following:

- Resource inventories/visual assessments to identify important natural, scenic, historic and cultural assets.
- Measures to ensure that the significant resources of the Loess Hills landform region receive long-term protection.
- Measures to ensure that development in the region is sensitive to the resources, American Indian interests, and respects local character.
- Measures to ensure continued enjoyment of the Loess Hills by visitors and residents alike.
- The identification of a permanent management entity (JPB or otherwise) responsible for encouraging, monitoring, and enforcing implementation of the plan.
- If the JPB chose to include an alternative focused on creation of a National Reserve, then the National Park Service would review the Comprehensive Plan to ensure that measures for protecting the resources and for providing visitor enjoyment are consistent with NPS policies.

The JPB would recommend the geographic scope of the Reserve (including specific boundary descriptions). The Reserve could include the entire landform region or portions of the landform region, provided it is demonstrated that each portion(s) meet the standards for significance as identified in the National Park Service *Management Policies* (2001). The NPS would also evaluate the plan to ensure that the geographic scope adequately represents

the nationally significant landform region. Shortcomings in the Comprehensive Plan would be returned to the JPB for revision. Upon completion of the plan and EIS, and after NPS review and approval, the JPB could opt to formally recommend designation of the National Reserve to the Governor of Iowa.

Phase III: Designation of Loess Hills National Reserve

During this phase, steps would be taken to designate the qualifying portions of the area as a National Reserve. The Governor of Iowa would request the Secretary of the Interior approve designation of the Loess Hills National Reserve and sanction the management entity recommended in the plan. Upon approval of the Secretary, the National Reserve would become an affiliated area of the National Park System. The Reserve would be managed by the sanctioned management entity. As an affiliated area of the National Park System, the Reserve would be included in NPS publications and brochures. There would not be federal land acquisition within the Loess Hills National Reserve.

The NPS could ensure the consistency of federal actions throughout the area covered by the national designation. If authorized by Congress, the NPS would review federal undertakings in the area to ensure that said undertakings were in keeping with the purposes for which the Reserve was established, and that are consistent with the Reserve's Comprehensive Plan. The NPS would work with other federal agencies entities to modify proposed undertakings found to be incompatible with the Reserve's Comprehensive Plan so that they would conform to the Plan.

2. Recommended Ethnographic Study

Several tribal groups have lived, hunted, or led forays into the Loess Hills in historic times. A large land tract encompassing all of the Loess Hills in Iowa was ceded by several tribes that signed the Treaty of Prairie du Chien on July 15, 1830. These included the Ioway, Oto, Missouria, Omaha, and Sac and Fox peoples, as well as the Wahpekute, Wahpeton, and Sisseton divisions of the Dakota (Royce 1899). Through testimony presented to the Indian Claims Commission during the 1950s and 1960s, the federal government recognized that the Ioway, Oto, Omaha, and Sac and Fox peoples hunted or otherwise used the Loess Hills. The Commission rendered formal judgments that awarded these groups further payment for the 1830 cession of the Loess Hills and surrounding region in Iowa (Indian Claims Commission 1978 with respect to Dockets 11, 11-A, and 138). The Potawatomi, a group originally from near Lake Michigan, were settled in the central and southern portions of the Loess Hills by the federal government in the 1830s and remained there for approximately a decade before being removed to a reservation outside of Iowa (Clifton 1978, 1998; Edmunds 1978). Undoubtedly other Native American tribal groups used the hills for various purposes as well, likely including the Ponca, Yankton, and other Dakota people.

Additional research is needed to expand our understanding of these peoples' presence in the Loess Hills. A cultural affiliation study would document the historic associations of native

peoples with the Loess Hills and surrounding region via detailed review and analysis of ethnographic and historical literature, including the testimony offered in land claims cases before the Indian Claims Commission. A cultural properties survey would identify places in the Loess Hills that are important to the cultural identity, traditional cultural practices, and traditional religious beliefs of native peoples who have an historical association with the Loess Hills by way of literature reviews and interviews with tribal members. Both of these studies would provide specific information regarding traditional cultural properties and Native American concerns that are essential for comprehensive land-management planning.

3. Recommended Landmark Evaluations

As mentioned earlier in the resource evaluation section of the study, the NPS believes the Jones Creek Watershed and the Glenwood Locality warrant additional research into their national significance. Additionally, the NPS recommends the identified 12 Special Landscape Areas be studied for consideration as National Natural Landmarks (NNL). Appendix D contains greater descriptions of the Special Landscape Areas.

INTRODUCTION

The National Park Service (NPS) has undertaken a Special Resource Study of the Loess Hills landform region in western Iowa (study area) in response to the requirements of Public Law 106-113 (1999). Special Resource Studies are designed to evaluate natural and cultural resources within a selected study area. The evaluation determines if an area is nationally significant, and whether it meets suitability and feasibility criteria for addition to the National Park System. In accordance with this legislative direction, the National Park Service has provided a range of management alternatives (options) for the long-term preservation of the Loess Hills of western Iowa.

The National Park Service, through the Secretary of the Interior, forwards the study and any recommendations to Congress.

Purpose

The purpose of the Loess Hills Special Resource Study (SRS) is to evaluate the Loess Hills landform region for possible designation as a unit of the National Park System and to determine what measures should be taken to preserve the Loess Hills in western Iowa. This environmental assessment (EA) analyzes management alternatives and their direct, indirect, and cumulative impacts to the human environment, per the requirements of the National Environmental Policy Act (NEPA) (42 U.S.C § 4379 et seq.), NEPA regulations (40 CFR 1500-1508), and NPS policies (National Park Service 2001).

Need

As previously described, the Loess Hills of western Iowa are a distinctive topographic region encompassing more than 640,000 acres and extending for nearly 200 miles in a narrow band that parallels the Missouri River valley. Exceptionally thick deposits of windblown silt form a region of unique hill forms that have been described as "the best example of loess topography not only in the Central Lowlands, but in the United States" (National Park Service 1985). The striking terrain is an outstanding example of landscapes formed by two fundamental geological processes-- the action of wind and the erosive sculpture of water.

The geologic significance of the Loess Hills has been recognized for well over a hundred years, and the biological significance for nearly as long. The area's rich archeological and historical resources, combined with the extensive prairie ecosystems, contribute to the landform region's exceptional value. Although important natural and cultural resources remain in the Loess Hills, increasing urban and suburban development, mineral extraction,

woody plant encroachment, and insensitive agricultural practices are threatening the stability and integrity of the Loess Hills.

Location and Scope

Public Law 106-113 authorized the National Park Service to study the "Loess Hills of Iowa." The study team further defined the scope of the study to include the entire natural geologic formation located in portions of Plymouth, Woodbury, Monona, Harrison, Pottawattamie, Mills, and Fremont counties (640,000 acres) (Figure 1). The metropolitan areas of Sioux City and portions of Council Bluffs are included in the study area.

Access is available from U.S. Interstate 29, which runs parallel (north-south) to the Loess Hills, U.S. Interstate 680, and from U.S. Interstate 80, which provides a major east-west artery, passing through the Loess Hills near Council Bluffs. Several U.S., state, and county hard-surface and gravel roads provide access within the landform region. Additionally, the 220-mile Loess Hills National Scenic Byway extends through the heart of the landform region.

ALTERNATIVES

Alternatives are different ways of meeting the stated purpose of the goals of the project. For the purposes of this study, the goal is to provide recommendations for the long-term preservation of the significant resources in the Loess Hills of western Iowa. To this end, five alternatives are evaluated.

The alternatives are described fully in Part I and are briefly discussed below:

Alternative 1 – Management by Local Government Units (No Federal Action Alternative)

The no-action alternative is an attempt to describe what would happen if present management practices and trends were projected into the future. Under this alternative, local government units (LGUs) such as cities, towns, and county governments, would continue to be responsible for resource protection. Each unit would continue to be responsible for the development and implementation of comprehensive planning and zoning ordinances that may aid in resource preservation. Comprehensive Plans can provide a long-term management strategy for resource protection and sustainable growth by specifying actions, controls, and strategies to maintain important resources.

As of this writing, Plymouth County has completed a Comprehensive Plan, and Woodbury and Mills counties are developing such plans. The Metropolitan areas of Sioux City and Council Bluffs are also developing Comprehensive Plans. Under this alternative, these comprehensive planning efforts would continue. Counties would continue to work together through the efforts of the Loess Hills Alliance on common concerns throughout the landform. Individual LGUs could work cooperatively with other LGUs in the Loess Hills, or could operate on an independent basis. Each LGU would be responsible for ensuring that existing state regulations, statutes, and programs that contribute to the protection of the Loess Hills are effectively applied. The Loess Hills Alliance would continue to support and enhance individual LGU efforts by implementing education, stewardship, and outreach programs, providing matching grants, and coordinating land protection opportunities for interested LGUs. The State of Iowa or the Loess Hills Alliance could provide additional incentives to the LGUs to develop ordinances that are sensitive to the Loess Hills.

The Loess Hills Alliance, The Nature Conservancy, the Western Hills Area Education Agency, County Conservation Boards, and other groups would continue to provide educational programs and seminars that contribute to the preservation of the Loess Hills. Property owners would continue to have the option to make use of these and other programs. Conservation easements, land donations, bequests, and other land protection opportunities would continue to be made available by land trust organizations that are operating in the area.

Alternative 2 - Management by a Joint Powers Board

This alternative involves the establishment of a Joint Powers Board (JPB) to provide protection to the resources, per Chapter 28E of Iowa law, which permits state and local governments to provide joint services and facilities and to cooperate in other ways of mutual advantage. The JBP in the Loess Hills could be given the responsibility to prepare a Comprehensive Plan (CP) subject to public review, for the entire landform region. The CP would specify the actions, responsibilities, controls, and strategies to maintain important resources and economic uses of the land. Individual counties would be responsible for implementing the CP.

The Loess Hills JPB would consist of representatives from each of the seven counties located within the Loess Hills landform region, or it could be the Loess Hills Alliance.
The JPB could utilize the broad range of public and private partnership opportunities available in the Loess Hills and help to further promote land uses that sustain the natural and cultural resources of the Loess Hills. Possibilities include forming partnerships with landowners and various agencies and organizations already working in the Loess Hills. These entities could be brought together in a coalition with the JPB for land use planning. A funding account could be established and managed by the JPB, which would be earmarked for land use planning and selected demonstration projects meeting JPB established criteria (restoration, mitigation, preservation).

An advisory or ad-hoc committee could be established to support the JPB. The advisory committee would make recommendations to the JPB and provide advice on land use management and provide a forum for public involvement. Members of the advisory committee could include the Loess Hills Alliance, Iowa Department of Natural Resources, The Nature Conservancy, landowners, developers, technical experts from universities and colleges, representatives from the Hungry Canyon Alliance, Loess Hills Preservation Society, interested tribes (Otoe-Missouria, Ioways, Winnebago) and others as identified. Coordination with existing state regulations and county ordinances would be provided by the JPB. The NPS, upon invitation of the JPB, could serve as a non-voting member on the advisory committee until planning efforts are completed.

Alternative 3 - National Reserve

This option is contingent on Congress passing legislation that would designate the entire Loess Hills landform region (approximately 640,000-acres) as a National Reserve, an affiliated area of the National Park System. Affiliated areas must meet the same significance criteria as units of the NPS, but are neither federally owned nor directly managed by the NPS. Rather, a management entity is designated to provide management and oversight for the area. The management entity must manage the affiliated area in a manner that conforms to all policies, laws, and regulations that are applicable to units of the NPS. Affiliated areas have access to technical, financial, and program assistance from the NPS. Usually, the assistance provided is of a technical nature, such as for preparation of a management plan or interpretive exhibits, and is secured on a competitive basis.

The Loess Hills Reserve would be managed by a special entity identified in the legislation that establishes the Reserve. The management entity, with NPS assistance, would prepare a Comprehensive Plan that meets NPS standards and that furthers the purposes of the Loess Hills National Reserve. The Comprehensive Plan would be a planning document that identifies how resources, visitors, and facilities will be managed for the next 15-20 years. Working with local government units and interested tribes (Ioways, Otoe-Missouria, Winnebago, and others), the management entity could craft model ordinances, and help coordinate local and regional activities with state regulations and programs. Incentive programs, grants, and conservation easements could be incorporated into this option to encourage county and city land use planning efforts towards a more sustainable direction. Development could be discouraged in sensitive areas while growth could be directed and encouraged in other areas. The responsibilities and authorities of the management entity would include comprehensive long-range planning; coordination of stewardship programs and activities; establishment of cooperative agreements; and dissemination of standards for visitor services and resource protection.

Alternative 4 - Special Landscape Areas

This alternative includes a management combination of National Reserve and Local Government Units. Under this alternative, 12 Special Landscape Areas (Figure 6) would be designated as a National Reserve, an affiliated area of the National Park System. Local government units, as in Alternative 1, would continue to manage the remainder of the landform region in a manner consistent with the local ordinances and comprehensive plans, as applicable. This alternative would be contingent on the 12 Special Landscape Areas (SLAs) meeting the criteria for eligibility and on Congress passing legislation to designate the SLAs as a National Reserve.

Collectively, the 12 SLAs encompass approximately 100,000 acres (about 15 percent of the study area) and are distributed among the seven counties along the western edge of the landform region from north to south. The 12 SLAs are non-contiguous clusters of exemplary geologic, topographic, and scenic features that best characterize the Loess Hills landform. These landscapes also contain significant amounts of remnant prairie communities, rare plants and animals, (Appendix D) and important archaeological sites. Approximately 17,000-acres (17 percent) of the land within the SLAs already has some form of existing protection: they are owned by state or county governments or by The Nature Conservancy. The remaining 82,000 acres (83 percent) are in private ownership. The Loess Hills National Natural Landmark (NNL) sites (Turin and Little Sioux) are included in the SLAs. Ownership of NNL lands is a combination of private and public ownership.

As in Alternative 3, a management entity identified in the legislation that establishes the Reserve would provide management and oversight to the Reserve. The level of federal involvement also could be specified as part of the authorizing legislation, and could include some combination of National Park Service (NPS) planning leadership and/or resource assessment. The NPS could provide assistance in developing educational programming in accordance with existing NPS standards, and could assist in defining standards for resource

protection and visitor services in the Reserve. The Loess Hills National Scenic Byway could evolve as the "thread" that winds its way through the region, tying the Reserve together. The remainder of the landform region would be protected through the efforts of individual local government units (LGUs) as described in Alternative 1.

Alternative 5: Joint Powers Board With National Reserve Option

Under this three-phased alternative, Congress could pass legislation for the Loess Hills that encourages the state of Iowa or the Counties to form a Joint Powers Board (JPB) to develop a Comprehensive Plan within a specified period. At a minimum, the JPB would consist of a quorum of at least four of the seven counties of the Loess Hills landform region. The board would be structured in a manner that provides for participation of interested municipalities, the Iowa Department of Natural Resources, the National Park Service, and interested tribes (Ioways, Otoe-Missouria, Winnebago, and others) as non-voting, technical advisors. Such legislation would authorize and provide funding for the National Park Service to participate as a partner in the development of a Comprehensive Plan to ensure long-term protection of the Hills.

The legislation also would outline a mechanism whereby the JPB and the Governor of Iowa could petition the Secretary of Interior to designate the National Reserve, as authorized in the Loess Hills legislation.

The JPB would initiate the development of a Comprehensive Plan for the Loess Hills. The National Park Service would be authorized and funded to provide technical assistance to the JPB in the development of the Comprehensive Plan and associated Environmental Impact Statement (EIS). The EIS would evaluate impacts of alternatives for protection of the Hills as described, including, at the board's discretion, an alternative focused on creation of a National Reserve.

If a National Reserve alternative were considered, the National Park Service would review the Comprehensive Plan to ensure that the measures for protecting the resources and for providing for visitor enjoyment are consistent with NPS policies. The Governor of Iowa would request the Secretary of the Interior approve designation of the Loess Hills National Reserve and sanction the management entity recommended in the plan. Upon approval of the Secretary, the National Reserve would become an affiliated area of the National Park System. The Reserve would be managed by the sanctioned management entity. There would not be federal land acquisition within the Loess Hills National Reserve.

A comparison of the five action alternatives is provided in Table 8.

Table 8: Comparison of Management Alternatives:

	Federal Designation	Land Acquisition	Management and Land Use Decisions	Level of NPS Involvement	Interpretation and Education	Development and Operating Costs
. **Alternative #1 Local Government Unit (LGU) (No Federal Action Alternative)**	None.	No federal acquisition of lands	Local. Individual counties could develop a Comprehensive Plan. The plan may or may not be coordinated with other counties.	Upon request, technical assistance, subject to staff availability (as is present level).	Existing local programs would continue.	Local funding.
Alternative #2 Joint Powers Board (JPB)	None.	No federal acquisition of lands.	Regional. A JPB would develop a Comprehensive Plan for the landform region.	Upon request, technical assistance, subject to staff availability.	Provided by JPB and coordinated with existing efforts.	JPB funded from existing county funds, State appropriations, and/or new revenue generated through authorities available to JPB.
Alternative #3 Entire Landform a National Reserve	National Reserve (NPS Affiliated Area).	No federal acquisition of lands.	Regional. A management entity would develop a Comprehensive Plan.	NPS technical assistance for planning efforts.	Provided by management entity and coordinated with existing efforts. *NPS technical assistance.	Management entity provides funding.
Alternative #4 12 Special Landscape Areas (SLAs) a National Reserve	**National Reserve (NPS Affiliated Area).	No federal acquisition of lands.	Regional and local. A management entity would develop a Comprehensive Plan for the SLAs. Local efforts would continue, as in Option 1 for the remaining landform.	NPS technical assistance for planning efforts.	Provided by management entity and coordinated with existing efforts. *NPS technical assistance.	Management entity provides funds.
Alternative 5 JPB; National Reserve Option (Recommended and Preferred Alternative)	Potential for National Reserve upon request of JPB and Governor.	No federal acquisition of lands.	Regional. A JPB would develop a Comprehensive Plan for the participating counties.	Same as #2. If National Reserve then NPS technical assistance in planning efforts.	Provided by JPB; Coordinated with existing efforts. *NPS technical assistance if designated a National Reserve.	If designated a Reserve, JPB provides funding.

*Technical assistance contingent upon available staff/funding.

** Upon completion of evaluation, eligible SLAs would be designated as a National Reserve

AFFECTED ENVIRONMENT

This section presents relevant resource components of the existing environment that would be affected by the alternatives if implemented. This section provides a baseline for comparisons made in the Environmental Consequences section of this appendix. A complete description of the Loess Hills natural, cultural, social, and economic environment is provided in the body of the Special Resource Study, and accompanying appendices (A-D). A generalized description is provided below.

Geology

The Loess Hills consists of large continuous tracts of deep silt deposited by the wind 30,0000 to 12,000 years ago, and sculpted into distinctive terrain during the last 12,000 years. The terrain is characterized by distinctive shapes: steep, narrow ridge crests, peaks, and saddles; numerous steep side slopes and branching spurs; and precipitous bluffs, some with sheer, nearly vertical faces rising from the adjoining Missouri River floodplain.

These massive accumulations of unconsolidated lightweight material, unlike sand dunes, normally remain remarkably firm and stable. Cohesion of the silt particles enables steep, dramatic bluffs to stand erect and intact as long as the loess remains dry and undisturbed. Normally, precipitation moves quickly off the steep slopes and the well-drained loess dries rapidly. However, if saturated or disturbed, the particles can succumb easily to forces of water and gravity. This combination of particle cohesion and high erosion potential explains the shapes that dominate this landform region. Slabs – sometimes entire bluffs – of saturated loess collapse and slump downslope; eroded loess spreads out into valley bottoms or is carried away in sediment-laden streams; dramatic gullies advance headward and deepen. The natural erosion of loess has been intensified by human activities. The frequency of slope failure has increased in response to increased water infiltration and weight associated with a variety of human activities. Quarrying operations, borrow pits for fill-dirt, housing developments particularly along ridge tops on the western edge, and removal of the vegetative cover all contribute to erosion, gully formation, and slope failure (see Part I). The maximum loess thickness and the most accessible and economically exploitable deposits lie in a narrow band nearest the Missouri Valley bluffs.

Natural Communities

Until the 1850s, native prairies dominated the Loess Hills. Eastern deciduous forest species flourished only in moist sites along creeks and at the base of sheltered slopes. A dynamic border separated the two major types of ecosystems, with frequent wildfires favoring the prairie grasslands. The post-settlement exclusion of wildfire has allowed woodlands to expand into many areas previously covered by prairie. Approximately 700 species of vascular plants – over a third of Iowa's flora – have been identified in the Loess Hills, including tall grass prairie and eastern hardwood forest species.

Approximately three percent of the landform remains as prairie (Selby 2000). These prairies cover broad expanses of the western most bluffs and sun-and wind-exposed ridgetops with their adjacent south-and west-facing slopes. Protected from intensive agricultural use by the steep topography, they have retained much of their original integrity and diversity and remain relatively large. Little bluestem and side-oats gramma dominate the dry prairies. Forbs such as skeletonweed, soapweed, and scarlet gaura are found in mid-grass communities (See Appendix C for scientific names).

Woodlands now include about 11 percent of the landform (Iowa Department of Natural Resources 1992). Bur oak is the most abundant tree species. Subdominants such as ironwood or red elm may commingle with the bur oak but the understory of bur oak woodlands is often sparse, consisting of a few common species such as Virginia creeper. Very dense eastern red cedar woodlands are present in some pastures and disturbed areas. Invasive woodlands of green ash and red elm mix with cottonwood, ironwood, or other trees to cover very disturbed hillsides. Although uncommon, older forests occupying historically wooded locations remain western outposts of the eastern deciduous forest. These are found usually as pockets in deep ravines.

Invasive shrubs and exotic plants are encroaching throughout the Loess Hills, particularly where overgrazing has occurred and natural fires are suppressed. Native woodland edge species are expanding into prairies and many other areas have been converted to pastures or cultivated fields. Eighty-six percent of the landform is composed of row crop, pastures, hayfields and other areas lacking shrubs or trees (Iowa Department of Natural Resources 1992).

Wildlife

Woodland animals include common species such as the fox squirrel, eastern cottontail, and woodchuck, as well as a diverse assemblage of birds. Larger animals such as the red fox, white-tailed deer, and coyote wander between woodlands and grasslands. A few rare species such as the hickory hairstreak butterfly and speckled kingsnake also inhabit Loess Hills forests. Forest animals in general are increasing and expanding their ranges northward as woodlands expand, often at the cost of prairie animals. For example, all increasing Loess Hills reptiles are woodland species, while prairie reptiles are declining in number (Christiansen and Mabry 1985).

Threatened and Endangered Species

Numerous state-listed species make their habitats in the Loess Hills. These species are listed in Appendix A. The following federally-listed species are known to occur in one or more of the counties that the landform is located in: Indiana Bat (*Myotis sodalis*), Bald Eagle (*Haliaeetus Leucocephalus*), Piping plover (*Charadrius melodus*), Topeka Shiner (*Notropis topeka*), Pallid Sturgeon (*Scaphirhynchus albus*), Least tern (*Sterna antilarum*, and the Western Prairie Fringed Orchid (*Platanthera praeclara*). Of these, there are two species which nest in selected areas near the Missouri River in Sioux City and Council Bluff (Howell, personal communication). There are no other known occurrences of federally listed species within the boundaries of the Loess Hills landform region (Figure 1).

Wetlands/Floodplains

Maps of the Loess Hills landform region were produced using summit heights, distinct topographic features, steepness of slope, local relief, loess thickness, and drainage density. The floodplains of rivers and streams through the Loess Hills were purposely included to provide a holistic, continuous depiction of the landform region. As such, two classes of streams are found in the Loess Hills. The first class includes the numerous small, intermittent streams originating in local Loess Hills watersheds. These have not been channelized. There are also larger streams in big valleys such as the Little Sioux, Floyd, Maple, and Boyer, which originate east of the Loess Hills, and cross through the region before joining the Missouri River. Most of these tributaries have been channelized in their lower reaches or are silt-laden and unproductive. Broad, alluvial plains are associated with the larger streams, including some oxbow lakes and backwater sloughs. Small impoundments are also scattered on lower slopes throughout the region. The natural alluvial wetlands in particular often are within the view of scenic vistas from the Loess Hills.

Prehistoric Resources

There are 827 archeological sites that have been recorded within the Loess Hills, though an extremely small percentage of the region has been subjected to intensive, systematic archeological surveys. Most of the 827 sites were discovered as the result of erosion or development activities, such as quarrying, channelization, and construction projects. These activities resulted in indirect damage to, and in many cases, destruction of, archeological resources. Two properties in the Loess Hills are listed on the National Register of Historic Places because of their archeological significance. Many other significant archeological sites exist but have not been evaluated against the criteria for inclusion in the National Register of Historic Places. Currently, there is not a comprehensive list of archeological properties that are *eligible* for the National Register of Historic Places, although several sites have been determined eligible, or are considered eligible by the State Historical Society of Iowa (Jones personal communication). Undoubtedly there are thousands more that have yet to be discovered and recorded.

Historic Resources

There are four National Historic Landmark (NHL) properties in the Loess Hills, all of which are publicly owned and accessible. The four properties, which are described further in the body of the Special Resource Study, include: 1) *Floyd Monument*: located in Sioux City, 2) *The Sergeant Floyd* survey and tug boat: located in Sioux City, 3) *Woodbury County Courthouse*: *Occupying* nearly a city block in Sioux City, and 4) *Dodge House*: a residence associated with a Civil War General, located in Council Bluffs. Over 50 properties are listed to, or are eligible for listing to, the National Register of Historic Places.

Scenic Resources

The sharply defined western edge of the region is the strongest and most scenic characteristic; the stark contrast along the bluff and the river floodplain creates the most recognizable visual “signature” of the landform. Bordering the Missouri River on the east,

the range of bluffs rises steep and, in many places almost perpendicular from two to three hundred feet in height. The range is parted by numerous narrow valleys and ravines, which descend from the adjacent uplands, but never loses its distinctive outlines. Prairies, woodlands, and fields offer diversity in color, shape, and texture, which changes with the seasons.

Human adaptations to the landform, particularly agricultural uses, contribute to the scenic quality and character of the Loess Hills. Within the interior landform, scenic views unfold along the rural byways that traverse the Loess Hills. Small towns, farms, churches, and cemeteries are dispersed throughout the landscape. Cropland or pastures that step up the terraced hillsides surround houses and barns located in valleys. From high points on the bluffs, spectacular views open up over the Missouri floodplain.

Residential developments, quarry operations, and telecommunications towers are visually intruding upon the landscape in portions of the Loess Hills. Entire bluffs have been removed for construction fill, and quarry operations have cut into hillsides. Over 50 licensed operations are known to have extracted materials in the Loess Hills, 27 of these are active operations and many are visible from Interstate 29, particularly near Sioux City and Council Bluffs. Several housing developments along the tops of ridges are also visible from the Interstate. All of these activities have altered scenic vistas and disrupt the continuity of cultural and natural landscapes.

Viewshed mapping for the Loess Hills National Scenic Byway Corridor was performed during development of *The Loess Hills Scenic Byway Corridor Management Plan* (Golden Hills Rural Conservation Development 1998). A viewshed, as defined by the Byway Plan, is a quantitative measure of distance seen from a given point on the Byway. Viewshed maps can assist with the development of land use strategies to preserve the scenic quality of the Loess Hills.

Population

The seven counties have a combined 2000 population of just over 264,000 (U.S. Census Bureau 2001). All counties within the study area lost population between the 1980 and the 1990 censuses. That trend, however, has largely reversed during the 1990s. Fremont and Monona County continued to experience a decline in population during the past decade. Mills County, because of its proximity to the Omaha metropolitan area, has realized the greatest expansion in population, growing by more than 11 percent during the 1990s. The racial composition of the study area is largely Caucasian (over 96 percent of the population). Only Woodbury and Pottawattamie Counties have non-white populations greater than one percent. Between 1990 and 2000, most of the growth in western Iowa occurred in the Omaha-Council Bluffs or Sioux City areas (U.S. Census Bureau 2001), and included an increase in Hispanics.

A number of small communities can be found throughout the hills, in addition to portions of the metropolitan communities of Sioux City and Council Bluffs. Many of these communities have seen population trends that parallel those of the county where they are located. The populations of most communities within Fremont County have declined over the past two

decades. Conversely, many of the communities in the Woodbury County, which includes Sioux City, have experienced double-digit population gains over the same period.

Economy

Agriculture has been highly important to the Loess Hills counties. However, the nature and extent of farming is in transition. Farming is experiencing trends similar to those observed in many other agricultural regions. For example, the number of farms in the study area has steadily declined over the past three decades while, concurrently, the average size of a farm has increased. As noted previously, the farm crisis of 1984 affected the state; by 1987, Iowa had 22,000 fewer farms than it had in 1973 (Schweider 1996).

Overall, the counties of the study area have a comparatively diverse economy. Manufacturing is the leading economic sector in Fremont and Plymouth Counties. The service sector is the primary sector in Monona, Pottawattamie, and Woodbury Counties. The government sector accounts for more than one-third of total earnings in Mills County. In terms of earnings, farming is the leading economic sector for one county in the study area, Harrison County. Farming accounts for approximately 23, 22, and 21 percent of the source of earnings for Monona, Harrison, and Fremont counties, respectively.

According to data from the Iowa Department of Natural Resources (IDNR 1997), there are 27 state-licensed mining operations active in the Loess Hills. An additional 25 licensed facilities within the region are listed as "closed." Almost all of these facilities extract sand and gravel; a few quarry limestone or agricultural lime. Most operations are small businesses, employing fewer than 20 people. About one dozen such businesses operate within the counties of the study area. Iowa statute and regulation does not consider loess a mineral, hence, the Iowa Division of Soil Conservation does not license or register sites working with just loess. As a result, the full extent and impact of loess extraction is difficult to quantify.

Tourism is important to the economy of western Iowa. The Loess Hills, related resources, and other nearby attractions are magnets that attract recreationists and other visitors to the region. Visitors to the area require amenities such as service stations, restaurants, and lodging. The retail and service sectors account for between 16.6 and 41.4 percent of total earnings in the seven counties of the study area (Iowa State University Extension 1997). Visitor services are well distributed through the Hills. Gasoline, diesel fuel, automobile service, lodging, and restaurants can be found in many communities. Hospitals or medical services are found in Sioux City, Moorhead, Missouri Valley, Tabor, Riverton, and Council Bluffs. Camping, both for tents and for recreational vehicles, is available in several locations.

According to *the Loess Hills Scenic Byway Corridor Management Plan* (GHRC&D 1998), there are more than 100 parks, recreation and wildlife areas, and outdoor recreation attractions in the Byway corridor (650,000 acres). These attractions cover more than 57,000 acres of land. Table 5 lists over 50 of the outdoor recreation areas along the Loess Hills Scenic Byway and within the seven-county region. The areas shown in Table 5 range between two and 9,800 acres, with the majority being less than 100 acres in size.

The DeSoto National Wildlife Refuge (9,800 acres), located along the Missouri River in Harrison County, outside of the study area, is the only federally owned and managed facility near the study area. The Lewis and Clark National Historic Trail (NHT), a component of the National Trails System, parallels the Loess Hills from the Missouri state line to Sioux City.

Other attractions not directly associated with the Loess Hills also encourage visitors to the region. Examples of places in or near the landform region that draw people to the area include the Sioux City Art Center, Siouxland Historical Railroad Museum, Western Historic Trails Center, General Dodge House, Mount Crescent Ski Area and several casinos. Attractions near Omaha, Nebraska also bring people to the area. These include the Henry Doorly Zoo, Joslyn Art Museum, and the Western Heritage Museum.

Land Ownership

Approximately 39,500 acres (six percent) of the 640,000-acre study area are within the boundaries of incorporated areas. Hence, nearly 94 percent of the study area is unincorporated. Only 4.4 percent of the landform region is in public ownership or owned by The Nature Conservancy, a private conservation organization (Figure 3). The vast majority of the region is privately owned.

Growth in residential development in the counties of the study area, as evidenced through the number of permits issued for new private housing units, has shown a generally upward trend over the past two decades. Further, the demand has accelerated during the 1990s. Between 1979 and 1990, the average number of private housing units authorized by building permits for the entire seven-county region that includes the study area was 41 412 per year.

Conservation Programs and Land-Use Planning

A number of state and federal conservation programs are contributing staff and funding for erosion control, wildlife habitat and water quality improvement, and prairie restoration programs in the Loess Hills. The Loess Hills Alliance (LHA), Fish and Wildlife Foundation, Golden Hills Resource Conservation and Development, Iowa Natural Heritage Foundation, Soil and Water Conservation Districts, The Nature Conservancy, and other groups continue to provide information and services associated with a variety of conservation programs. In 2000, the LHA provided funding and matching grant opportunities that resulted in over $750,000 of land protection or economic growth projects (Loess Hills Alliance 2000). An ongoing effort, the Whole Farm planning initiative is utilized by six of the seven counties included in the Loess Hills landform region. Designed as a matching grants program with local Soil and Water Conservation Districts (SWCD) and in cooperation with the Iowa Division of Soil Conservation, local SWCD were able to promote and complete whole farm plans on 250 acres of private land. Whole farm plans are designed to encourage landowners to make maximum use of available state and federal soil, water, wildlife, and conservation programs (Loess Hills Alliance 2000). Most recently, $250,000 has been earmarked under the Farmland Protection Program (FPP) to preserve the Loess Hills from non-agricultural development.

The Nature Conservancy, Fish and Wildlife Foundation, the U.S. Fish and Wildlife Service and the National Park Service have provided landowner assistance (funding, staff, and/or equipment) for prairie restoration, woody plant and exotic species control, and have conducted workshops on fire ecology and the use of prescribed fire.

A number of comprehensive planning and zoning efforts are currently underway. The LHA began soliciting requests for proposals to prepare a Comprehensive Plan for the seven-counties of the Loess Hills. This purpose of this plan will be to document existing studies and other land-use data and serve as a template for counties in the Loess Hills to use (Sproul 2001). Plymouth County has developed a Comprehensive Plan, and two counties, Mills and Woodbury, are developing updated Comprehensive Plans. The LHA is also developing a grant program to encourage county and city governments to undertake comprehensive planning and zoning which consider critical resource protection strategies for the Loess Hills landform. Finally, the *Loess Hills Scenic Byway Corridor Management Plan* (Golden Hills Rural Conservation Development 2000) is a useful tool available for land use planning. The *Byway Plan* identifies important resources and includes model ordinances designed to preserve the integrity of the resources in the Loess Hills.

ENVIRONMENTAL CONSEQUENCES

This section describes the probable consequences (impacts, effects) of each alternative on selected environmental resources. This section is organized by alternatives. Impacts are expressed in terms of the beneficial or negative effect on the human environment. The human environment includes biological (natural resources), historical (cultural resources), social, and economic factors. Natural resources include the land, air, water, fish and wildlife, plants, fossils, and scenic, geologic, or other natural feature(s). National Natural Landmarks are also included in this definition. Cultural resources include historic structures, landmarks, landscapes, archeological sites, National Register or National Register eligible properties, and National Historic Landmarks.

This analysis provides the basis for comparing the effects of the alternatives. In considering the impacts, the intensity, duration, and cumulative effects are assessed. Since the alternatives described in the SRS are presented in a general "brushstroke" manner, the analysis of environmental consequences also must be general. Thus, the ideas presented in this EA are conceptual. The NPS can only make reasonable projections of likely impacts.

Methodology: The NPS based this impact analysis and conclusions on the review of existing literature; information provided by experts within the NPS and other agencies; and the professional judgment of the Loess Hills Special Resource Study Team members. The National Environmental Policy Act requires that an agency evaluate environmental impacts associated with an action. For purposes of this Environmental Assessment, the action is the selection of a management alternative. For example, the formation of a Joint Powers Board in Alternative 2, or the establishment of a National Reserve in Alternative 3 would be the action. Carrying out the activities associated with each management alternative and implementing applicable Comprehensive Plan is evaluated as long-term impacts.

Assumptions: Because of the conceptual nature of the alternatives, the projections of likely impacts are based upon a number of assumptions. These assumptions are as follows:

- The management entity (individual counties, JPB, State, other) would be committed to preserving and protecting the significant resources of the Loess Hills. Comprehensive Plans would be developed and implemented.
- The management entity would represent a variety of interests and involve appropriate technical experts (geologists, ecologists, archeologists, interested tribes, etc.) as advisors in the planning process.
- Appropriate and meaningful resource inventory and monitoring data would be collected during the implementation planning and decision making process and Ethnographic resource studies would be completed.
- Specific landform boundaries would be established if Alternative 2-5 were selected.

- The Jones Creek and Glenwood sites would be evaluated for and receive National Historic Landmark status.
- For Alternatives 1 and 4, it is assumed that all of the individual counties would eventually develop an integrated land use management plan and would coordinate their management activities where feasible and practicable.
- In Alternative 2, it is assumed that all seven counties would adopt/implement the Comprehensive Management Plan developed by the JPB.
- The Loess Hills Alliance, The Nature Conservancy, Iowa Heritage Foundation, Rural Conservation Districts, and other entities identified in the SRS would continue their land conservation and education activities.
- Existing conservation programs would continue to be made available to private landowners for conservation practices.
- All management entity(s) would be fully operational, funded, and establish a process for accountability, if necessary.
- Because a significant portion of the Loess Hills are in private ownership (approximately 95 percent), it is assumed that eventually a majority of landowners would take advantage of federal, state, and local programs to protect natural/cultural resources of the Loess Hills.
- Excavation and quarry activities would be regulated to protect sensitive resources.
- For purposes of this analysis, since it is not possible to predict when/where land donations and/or purchases occur, it is assumed that the State of Iowa's current land protection plans and policies would not change.

Context: Impacts, either beneficial or negative, are discussed in terms of the effect on the resource or impact topic throughout the entire landform region (640,000-acres), unless otherwise noted.

Timing: It is impossible to predict when any of the alternatives would be adopted. As such, it is impossible to predict the timing of any impacts resulting from any of the five alternatives. Hence, the specific timing of impacts is not addressed in this EA. The timing of impacts would need to be addressed during future planning processes.

Intensity: For the purposes of this analysis, intensity or severity of the impact is defined as:

- *Negligible*-impact to the resource or socioeconomic element is barely perceptible and not measurable or is confined to a small area
- *Minor*-impact to the resource or socioeconomic is perceptible and measurable and is localized.
- *Moderate*-impact is clearly detectable and could have appreciable effect on the resource or socioeconomic environment.
- *Major*-impact would have a substantial, highly noticeable influence on the resource or socioeconomic environment.

Duration: The duration of the impacts in this analysis is defined as:

- *Short-term*-impacts are those that occur within the first three years of initiation.
- *Long-term*-impacts would extend beyond initiation of the alternative and would likely have permanent effects on the resource or socioeconomic environment.

Direct and Indirect Effects

- *Direct effects* are caused by the action and occur at the same time and place
- *Indirect effects* are caused by the action, but occur later in time or are further removed in distance, but must be reasonably foreseeable. Indirect effects may include changes in ecological processes that result in a change to the environment.

Derivation of Impact Topics

Specific impact topics were developed to focus discussion and to allow comparison of the environmental impacts of each concept. These impact topics were identified based on federal laws, regulations, and NPS *Management Policies* (2001); NPS knowledge of affected resources; and concerns expressed by the public or other agencies during scoping. A brief rationale for the selection of each impact topic is given below, as well as the rationale for deferring specific topics for future consideration and analysis.

Geologic Resources. Geologic resources include the shape of the landforms in the Loess Hills and the underlying materials, including the loess deposits. The Loess Hills, as a geologic feature were found to be nationally significant in the Special Resource Study. Because the loss of loess from erosion, mining activities, and the subsequent loss of entire bluffs were one of the primary concerns noted during public meetings, impacts to geologic resources will be analyzed in this EA.

Natural Resources: Approximately 700 species of vascular plants have are found in the Loess Hills, and numerous mammals, birds, insects, reptiles and amphibians. Most scientific interest has focused on the prairies that support a variety of rare western plants and animals. Because of the nature of the concepts, it is impossible to identify animal and plant communities that could be affected, particularly in the short term. However, some discussion is possible on the general amount of potential disturbance to these communities, particularly the prairie components. Fire suppression and/or prescribed fires have direct impacts on the composition and distribution of prairie species. The protection of prairies and the lack of fire were identified as an issue during the scoping process. Long-term impacts to vegetation are therefore discussed in this EA.

Scenic Resources: The steep bluffline that rises sharply from the Missouri River floodplain is a recognizable signature of the landform. The hills, narrow ridgecrests, "catsteps," pastures, ponds, narrow gravel roads, historic churches, and small towns, contribute to the scenic quality of the landscape. Impacts to these resources are discussed in this EA.

Socioeconomic Environment: NEPA requires an analysis of relevant impacts to the human environment. The human environment is interpreted to include the natural and physical environment and the relationship of people with that environment (40 Code of Federal Regulations 1508.14). In the short-term, local communities would be involved in the planning process in various degrees. Additionally, local communities that provide public services and receive tax revenue or benefits to their economies through retail trade could be affected by alternatives proposed. Local vs. Federal ownership of property and control of land-use decisions within the Loess Hills was a significant issue raised during the scoping process. Both short-and long-term socioeconomic impacts are therefore analyzed in this EA.

Impact Topics Considered but not further addressed in this Environmental Assessment

Threatened and Endangered Species: The Endangered Species Act 1973, as amended requires federal agencies to protect federally listed species and their habitats and requires federal agencies to consult with the U.S. Fish and Wildlife Service if their activities may affect listed species. There are seven federally listed species that are known to have been present within one or more of the seven counties that the Loess Hills are located. The U.S. Fish and Wildlife Service was contacted on May 8, 2001 and indicated that no formal consultation was necessary as this project was only a study (Mr. G. Bady, personal communication). National Park Service policies require the Service to consider impacts to state listed species. However, it is difficult to identify potential impacts to state listed species because no concept specifies a development location or a specific action, which would affect sensitive species and their habitats either negatively or positively. If and when specific development activities are proposed, an analysis of potential impacts, if any, to state and/or federally listed species would be necessary to fulfill compliance requirements.

Water Resources: The Federal Water Pollution Control Act (commonly referred to as the Clean Water Act), as amended in 1987, was enacted to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. The backbone of the Clean Water Act is its goal of eliminating the discharge of pollutants, from point and non-point sources, into the nation's waters. Individual states are responsible for the establishment of clean water standards for various bodies of water. The administration and enforcement of most of the provisions in the act are also accomplished by the states.

It is difficult to identify potential short term impacts to water resources because no concept specifies a development location or a specific action which may affect water resources either negatively or positively. If and when specific development activities are proposed, an analysis of potential impacts, if any, on water quality would be necessary to fulfill compliance requirements. Long-term impacts to water resources resulting from erosion are discussed under geologic impacts, and are presented as an indirect effect.

Wildlife Resources: Some of the public comments indicated a concern that the natural habitats in the Loess Hills are becoming fragmented and could affect wildlife movements and

genetic diversity. The planning alternatives in the Study are generalized and do not include specific development plans or other specific changes to wildlife or the habitats that they depend upon. If and when development sites were selected that could alter wildlife habitat, impacts would be properly evaluated at that time.

Wetlands and Floodplains: Executive Order 11990 ("Protection of Wetlands") requires that all federal agencies must avoid, where possible, impacts on wetlands and Executive Order 11988 ("Floodplains Management)") requires all federal agencies to avoid construction within the 100-year floodplain unless no other practicable alternative exists. It is impossible to identify potential impacts to wetlands or floodplains because no concept specifies a development location. If and when development sites were selected, a wetland determination would be done and an analysis of potential impacts, if any, to wetlands and floodplains would be completed to fulfill additional compliance needs.

Air Quality: The Clean Air Act of 1990, as amended, established a regulatory program with the goal of achieving and maintaining "national ambient air quality standards" through state or, if necessary, federal implementation plans. If and when development sites were selected, an analysis of potential impacts, if any, on air quality would be completed to fulfill additional planning and compliance needs.

Cultural Resources: The National Historic Preservation Act, as amended in 1992, calls for the consideration and protection of historic resources in planning and development proposals. This includes tangible resources such as structures as well as less tangible resources, such as cultural landscapes and ethnographic values. This act includes properties listed on or determined eligible for the National Register of Historic Places and those designated as National Historic Landmarks. There are four National Historic Landmark properties in the Loess Hills, publicly owned and all within the jurisdiction of local cities that they are located in. There are over 50 properties located in the Loess Hills that are listed in or eligible for the National Register of Historic Places. Because none of the management concepts prescribe specific actions for the management or development of land or cultural resources within the Loess Hills, historic resources will not be directly affected by adoption of any of the action alternatives identified in this Special Resource Study, and thus will not be further analyzed.

Very few systematic archeological investigations have been conducted within the Loess Hills for the purpose of identifying archeological sites, and most of those that have been conducted were small-scale in nature. Most of the 827 archeological sites currently recorded in the Loess Hills were discovered as the result of erosion or development activities, such as quarrying, channelization, and construction of roads, buildings, and water impoundments. Such activities resulted in indirect damage to, and in many cases, destruction of, archeological resources. None of the management concepts prescribe specific actions for the management or development of land or natural and cultural resources within the Loess Hills that would directly impact archeological resources. However, erosion and development activities such as cited above could result in cumulative direct and indirect impacts to archeological resources where unified, comprehensive land-use planning is absent. Increased systematic efforts to identify, evaluate, and protect significant archeological resources could result from the development of comprehensive land use plans prescribed in Alternatives 2-5.

However, it should be noted that a lack of a regional comprehensive management plan with consistent regulatory authority across the landform would continue the patterns of identified threats that could adversely impact known or potentially eligible National Register of Historic Places and National Historic Landmark properties. These impacts may include: the actual destruction of historic structures, archeological sites, and cultural landscapes during development; alteration of historic road patterns; visual intrusions into the setting of historic properties (e.g., the construction of cell phone towers or houses adjacent to a historic property); or the in-growth of woody vegetation into formerly open, historically significant agricultural fields. Direct and indirect impacts to these resources should be properly evaluated during the development of a Comprehensive Plan associated with the action alternatives.

The study recommends the completion of cultural affiliation and traditional cultural property studies to identify Native American groups that are historically or culturally affiliated with the Loess Hills, and the places within the Loess Hills that are important to those peoples. The information from these studies should, in turn, feed back into management decisions that take Native American concerns into account. At this time, however, it is difficult to predict impacts to ethnographic resources because of the generalized nature of the concepts. Prior to the implementation of one or more concepts complete consideration of impacts to ethnographic resources would be necessary to fulfill additional compliance needs.

Noise: Noise problems are those associated with day to day activities, such as traffic, construction, and manufacturing/mining activities. Noise levels are much higher in the vicinity of Sioux City and Council Bluffs (Iowa) than activities in outlying areas. Neither of the alternatives would result in positive or negative impacts to the soundscape or noise levels in the study area. Therefore, noise impacts were not analyzed in the EA.

ANALYSIS OF IMPACTS ASSOCIATED WITH EACH ALTERNATIVE

Impacts associated with Alternative 1 (No Federal Involvement)

This alternative relies heavily on the initiative of individual LGUs in the region and continued coordination by the Loess Hills Alliance to protect the significant resources of the Loess Hills. Under this approach, primary responsibility is placed in the hand of local governments to implement conservation objectives. This option recognizes the positive steps that have already been taken by the Loess Hills Alliance, state and local governments, and other conservation groups. It does not, however, ensure that a holistic, coordinated approach to land-use planning for the entire landform would occur in the near future. Rural housing development, urban and industrial expansion, highway construction, mining operations, and overgrazing are ongoing activities that could substantially impact the resources of the Loess Hills.

Assuming that individual government units would eventually develop comprehensive plans, the differences among these plans (for example in ordinances, resource focus, or funding capabilities) would present numerous challenges. Because natural resources do not have jurisdictional boundaries (loess deposits, and the plants and animal communities cross county lines), a local commitment to preserving the integrity of the Loess Hills in a holistic manner would be essential and would require coordination throughout the seven-county region. Otherwise, local efforts may be duplicated (e.g. conducting prescribed burn training in each locality, vs. conducting one or two within the region) or, conversely, there may be gaps in addressing critical resource issues (e.g. regulation of mining throughout the area).

Impacts to Geologic Resources: Highly erodible loess soils are characteristic of the entire landform region. The development of zoning ordinances, regulation of mining activities (sand/gravel/quarrying) and planning for suburban developments could help alleviate the threats identified in the Special Resource Study. However, the implementation of individual County Comprehensive Plans would likely be staggered or spread out over time. Thus, in parts of the landform, loess deposits, bluffs and other topographic features could continue to be irreversibly altered and degraded either by unregulated quarrying and borrow-pit operations, suburban developments, or removal of vegetation. This would alter normal drainage patterns, and lead to instability of slopes. As a result of unstable slopes, entire bluff faces could continue to fail and natural gully formation would be accelerated. In Counties that readily implement land management plans to address these types of problems, the impacts would be either minimized or avoided.

Similarly, in parts of the landform, severe erosion problems and increased stream sediment loads could occur as a result of slope failures. Management decisions that involve tillage or disturbing native vegetation without consideration of stabilization needs could exacerbate erosion. These impacts would extend well beyond the region because sediment loads would continue to be transported downstream to other areas.

Conclusion: Existing threats and direct impacts could continue upon selection of this alternative in areas that do not readily adopt management strategies to address these problems. Negative impacts would be prevented in other areas. This could fragment the landscape. Over time, the indirect impacts could be moderate to major, long-term and negative.

Impacts to Vegetation: Upon selection of this alternative, the immediate impacts to vegetative resources would be negligible. However, as in the above, the implementation of individual Comprehensive Plans would be staggered or spread out over time. Existing efforts by The Nature Conservancy and Rural Conservation Districts would continue, but may not necessarily be coordinated across the landform in an ecosystem approach. Financial resources and staff time may or may not be directed towards areas in critical need. Assuming that the present trends in population growth, residential development, and encroachment of woody plants persist, then the loss of native prairies would likewise continue in some portions of the landform. This would fragment remaining native prairie communities in some areas, and in other areas prairies would be lost. As individual Comprehensive Plans were

developed, assuming they addressed preservation and management of prairie and other vegetation communities, some of these impacts would be avoided or minimized, although many impacts would be irreversible.

Conclusion: Existing threats and direct impacts could continue upon selection of this alternative in some areas, and be prevented in other areas, thus fragmenting the landscape. Over time, the direct and indirect impacts would be moderate to major, long-term, and negative.

Impacts to Scenic Resources: Upon selection of this alternative, the direct impacts to scenic resources would be negligible. As growth continued, improved protection of the Hills could encourage more people to visit, thereby increasing the need for additional, fuel stations, shopping centers, restaurants, roads and road improvements (e.g. straightening/widening of country roads). This could alter the character of the landscape and impact scenic vistas. Desired landscape characteristics of some sites may deteriorate if any of the component parts are unknowingly modified in an undesirable way. As each county developed and implemented zoning ordinances or other tools with resource conservation in mind, these changes to the landscape could be reduced.

Conclusion: The existing problems and threats could continue in certain areas until all counties addressed these issues in some manner. The immediate impacts would be negligible. Over time, impacts could affect the entire landform region. The impacts from this alternative could be minor to moderate, and have long-term, negative effects.

***Socioeconomic Impacts*:** The area of the impact would be primarily the communities within or adjacent to the landform region. Economic impacts to other areas would diminish with distance from the landform region. The 1996 study by Alexander and Otto found that tourists spend about $11.8 million annually in the Loess Hills. This level of expenditure could reasonably be expected to continue under this alternative. Assuming individual counties prepared land use plans with resource conservation in mind, improved protection of the Hills could encourage more people to visit, thereby increasing tourism expenditures. Conversely, if important resources were lost, then tourism dollars could be expected to decline.

Changes in local ordinances could affect the types of land use allowed in the Hills. This could impact tax base and other revenue streams in either a positive or negative direction, depending on the controls. If implemented, property tax credits could affect the local tax base. The extent of the impact would be dependent on the structure and amount of the credits. Stricter controls on uses such as residential development and extraction activities could have negative impact on businesses that are engaged in these activities. Limitations on land uses within the landform also could suppress future growth in the tax base that might otherwise be realized as land was converted from agriculture to more intensive uses. Conversely, increased visitor service facilities could lead to increased tourism and associated benefits.

In the absence of local ordinances that address quarrying, erosion, and slope failure, gullies would continue to widen, bridges and roads could give way. This could occasionally restrict access to farm fields and could increase expenditures for highway maintenance. The

prevention of undesirable impacts to natural, cultural and scenic resources would cost less than future expenditures to mitigate or reverse these impacts.

Conclusion: Overall, there would be long-term, negligible positive impacts (barely perceptible and not measurable).

This alternative does not include federal involvement beyond what is presently occurring, nor does this alternative include federal acquisition of land. There would not be an additional cost to the federal government.

Impacts Associated with Alternative 2

This alternative emphasizes the development of a single Comprehensive Plan for the entire Loess Hills landform region and could involve NPS assistance and review of land-use plans. The Comprehensive Plan (CP) would identify areas within the Loess Hills that are compatible with residential and industrial growth, agricultural uses, and recreation. Sensitive resource areas in need of specific protection strategies would be identified and protected. The CP would provide model ordinances for the landform, which could be adopted on a voluntary basis by member counties, as appropriate. This approach would enable local governments to take a comprehensive look at the entire landscape and make decisions about environmental, development, quality of life, and economic concerns through a single, unified process. While the primary responsibility to implement conservation goals is placed in the hand of local governments, federal and state governments may play a role in setting standards and providing technical and financial assistance.

Impacts to Geologic Resources: The Joint Powers Board (JPB) would serve to provide a comprehensive, integrated strategy to protect the area's geology and lessen the negative impacts to geologic resources that are currently occurring. Assuming all of the local communities within the Loess Hills adopt the Comprehensive Plan developed by the JPB, and technical advisors from various state, federal, and local groups participate in the planning process, sensitive areas would be prioritized. Protective management strategies would be applied across the landform in a holistic manner.

Conclusion: Upon selection of this alternative, the immediate impacts would be negligible. Over time, this alternative would result in moderate, long-term, positive impacts. However, if the counties failed to participate or adopt the CP, then negative impacts could result. These impacts, as in Alternative 1, could be long term, and could have a substantial, highly noticeable influence on the resource (major, negative impact).

Impacts to Vegetation: The short-term impacts to vegetation would be negligible. In the long-term, assuming the various counties adopted a Comprehensive Plan as developed by the JPB and its advisors, an ecosystem approach to managing plant communities could provide major, long-term beneficial effects. Prairie communities and woodland habitats, particularly those that support state-listed species, could receive focused attention through landowner education and assistance programs, beyond what is presently occurring. Priority areas would

be identified based on resource condition (integrity) and threat. Native prairie preservation would be enhanced by restoration of natural processes such as fire, which combats tree invasion. Encroaching exotic plant species would also be addressed in a coordinated manner. Such efforts would continue on state lands as funding allowed.

Conclusion: Major, long-term, positive impacts would result once a CP was adopted. However, in the absence of an ecosystem management approach, including regulation of land use, negative impacts would be moderate (detectable and could have appreciable effect on the resource) to major (moderate to major, long-term, negative).

Impacts to Scenic Resources: A comprehensive planning effort could help to identify specific natural, cultural, rural landscape and agricultural resources that contribute to the scenic values in the area. Desired landscape characteristics would be identified in the CP and receive management attention. Because many of the scenic resources in the Loess Hills are strongly based in ecological and cultural themes, the impacts to scenic resources would be the same as impacts to geology and vegetation under this alternative.

Conclusion: Upon selection of this alternative, the immediate impacts would be negligible. Once a CP was adopted, major, long-term, positive impacts would result. However, in the absence of an ecosystem management approach, including regulation of land use, negative impacts would be moderate (detectable and could have appreciable effect on the resource) to major (moderate to major, long-term, negative).

Socioeconomic Impacts: The area of economic impact would be primarily the communities within or adjacent to the landform region. Economic impacts to other areas would diminish with distance from the landform region. Although there would be negligible costs associated with the formation of a JPB, costs would increase as the planning process was underway. Local communities would be engaged in the planning process, and each of the counties would need to provide a representative to serve on the JPB. Counties would provide funding for planning and implementation. These costs could be balanced by the JPB using its authorities (such as through tax or bond levees) and through participation in partnership opportunities. This could impact tax base and other revenue streams in either a positive or negative direction, depending on the how the JPB uses its authorities. If implemented, property tax credits could affect the local tax base. The extent of the impact would be dependent on the structure and amount of the credits. Stricter controls on uses such as residential development and extraction activities could have negative impact on businesses that are engaged in these activities. Limitations on Land uses within the landform also could suppress future growth in tax base that might otherwise be realized as land was converted from agriculture to more intensive uses. Additionally, with a common plan for the entire landscape, economies of scale could be realized (exact costs would vary between counties, and would depend on the level/extent of the planning effort). Also, better protection of the Hills could encourage more people to visit thereby increasing tourism expenditures. Changes in local ordinances could affect the types of land use allowed in the Loess Hills.

Conclusion: Upon selection of this alternative, the immediate impacts would be negligible. As the planning process was underway, impacts would be negligible, long-term and positive.

This alternative does not include federal acquisition of land. If the National Park Service were asked to provide technical assistance during the planning stages of the Comprehensive Plan, the federal outlay would range between $15,000 and $50,000, assuming a 2-year planning timeframe (Hanson, personal communication 2001). This estimate reflects costs associated with staff time and travel. These costs would vary, depending on the level of assistance requested and the availability of National Park Service funding.

Impacts Associated with Alternative 3 (Environmentally Preferred Alternative)

Under this alternative, the entire Loess Hills landform region would be formally designated as a National Reserve, and would operate as an affiliated area of the National Park System. Affiliated areas are neither federally owned nor directly managed by the National Park Service (NPS). Federal activities within and adjacent to the Reserve would be coordinated with the management entity to ensure significant resource values are protected. The Loess Hills would be operated by a special management entity established at the local, regional, or state level. The management entity would be responsible for the preparation of a comprehensive land management plan (CP) that meets NPS standards and furthers the purposes of the Loess Hills National Reserve. The CP would identify how natural and cultural resources, visitors, growth, and commercial/residential development are to be managed. Local and regional activities would be coordinated and land use efforts would reflect concepts in sustainability. The CP would be updated on a periodic basis, and its implementation would be assured, unlike in Alternative 2, where the development and implementation of a CP is voluntary.

***Impacts to Geologic Resources*:** There would be no immediate impacts to the geologic resources associated with selection of this alternative. Over the long term, because this alternative provides for a comprehensive, integrated approach to managing resources, actions would be taken to reduce erosion and the negative impacts of mining and excavation activities. A coordinated management approach would be applied to state and private lands where landowners expressed an interest throughout the region. The CP would continually be updated and implemented.

Inventories, resource threats, and opportunities for successful management would be identified and prioritized. Protection of the natural vegetative cover and the lessening of over grazing and excavation (mining) activities would slow erosion. Less material would be transported to streams, and the water quality (with respect to sediment loading) within the watershed would gradually improve. Although natural erosion and bluff slumping would continue to occur, over time, the total amount of erosion would be reduced, assuming local ordinances were developed to address this issue.

The designation of the landform region as a National Reserve could possibly increase scientific recognition and interest in the area, and provide funding opportunities for scientific investigations through a variety of sources. This would aid in the understanding and protection of geologic processes.

Conclusion: Upon selection of this alternative, the immediate impacts would be negligible. Upon implementation of the CP, impacts would be long term, and would have a substantial, highly noticeable beneficial influence on the resource (major, long-term, and positive).

***Impacts to Vegetation*:** The short-term impacts to vegetation would be the same as in Alternative 1. In the long-term, upon completion of a Comprehensive Plan, an ecosystem approach to managing the landscape could provide major beneficial impacts. The CP would continually be updated and implemented. Inventories, threats, and opportunities for successful management would be continually identified and prioritized. Woodland habitats, particularly those that support sensitive species, could receive additional attention. The restoration of natural processes such as fire where appropriate would benefit prairie components. Exotic species and tree invasion would be reduced over time, perpetuating native prairie habitats and improving woodland health. The designation of the landform region as a National Reserve would increase scientific recognition and interest in the area. This could possibly provide increased opportunities for scientific investigations through a variety of sources, which would aid in the understanding and protection of natural processes. The Reserve could serve as reference area for the study of ecological succession, for measuring long-term ecological change and as a control area for comparing research results, which would provide additional protection to the natural resources within.

Conclusion: Upon selection of this alternative, the immediate impacts would be negligible. Major, long-term, positive effects to vegetation would result.

Impacts to Scenic Resources: The short-term impacts would be the same as in Alternative 1. A comprehensive planning effort could help to identify specific natural and cultural resources that contribute to the scenic values in the area. Desired landscape characteristics would be identified in the CP and receive consistent management attention. The Reserve would be publicized in National Park Service tourism literature. This greater recognition and protection would likely result in increased visitation to the Hills. Increased visitation may require localized improvements to public roads (widening or resurfacing) which could alter the rural character of some roads if not carefully evaluated.

Conclusion: Upon selection of this alternative, the immediate impacts would be negligible. Once a CP was adopted, major, long-term, positive impacts would result.

***Socioeconomic Impacts*:** The area of the impact would be primarily the communities within or adjacent to the landform region. Economic impacts to other areas would diminish with distance from the landform region. The impacts described under Alternative 1 would also be expected under this alternative. In addition, the designation of the landform region as a National Reserve would bring increased recognition and identity to the Hills. The Reserve could be publicized in National Park Service tourism literature. This greater recognition would likely result in increased visitation to the Hills and, thus, increased visitor expenditures. Increased visitation may, however, require localized improvements to the area infrastructure (for example, a jump in traffic to a nature center may require that a roadway be widened or resurfaced). This could create additional expenses for local governments that may or may not be offset by increased tourism expenditures. However, opportunities to partner

with federal, state, and local agencies would increase. Limitations on land uses within the landform also could suppress future growth in tax base that might otherwise be realized as land was converted from agriculture to more intensive uses.

Conclusion: Upon selection of this alternative, the immediate impacts would be negligible. Once the CP was adopted, associated with increased visitation and partnership opportunities, would lead to positive impacts that are localized and perceptible (Minor, long-term, positive). This alternative does not include federal acquisition of land. If the National Park Service were asked to provide technical assistance during the planning stages of the Comprehensive Plan, the federal outlay would be greater than Alternatives 1 and 2 because of the increased NPS involvement. Expenditures may range between $15,000 and $60,000, assuming a 2-year planning timeframe (Hanson, personal communication 2001), and would continue into the implementation phases. Planning costs represent staff time and travel expenditures. Implementation costs would reflect staff time for technical assistance and coordination, and potential financial assistance (grants). These costs would vary, depending on the level of assistance requested and the availability of National Park Service funding.

Impacts Associated with Alternative 4

Under this alternative, 12 Special Landscape Areas (SLAs) (approximately100,000 acres or about 15 percent of the landform) would be designated as a National Reserve, provided the national significance of each SLA was determined. These 12 landscapes are clusters of exemplary geological/topographical features and prairie (Appendix D). Local government units, as in Alternative 1, would continue to manage the remainder of the landform in a manner consistent with local ordinances and comprehensive plans, if developed. Areas within the Reserve, it is assumed, would receive added protection, particularly because other federal agencies would coordinate their activities to ensure protection of resources within the Reserve, and opportunities for National Park Service technical assistance would increase. Additionally, name recognition and scientific value would be provided to those areas designated in the Reserve, which could lead to additional research and management protection (technical assistance requests and research activities would be dependent upon landowner interest, requests and funding availability).

Impacts to Geologic Resources: This alternative would focus management activities in the Special Landscape Areas, which could provide some localized long-term benefits. The deepest, most accessible, most economically exploitable loess deposits are near Sioux City and Council Bluffs and are within or adjacent to important SLAs (Plymouth South, Council Bluffs North, and Folsom Point) (Appendix D). Thus, designation as a National Reserve could provide protection from further exploitation. The greatest protection would likely be achieved on public lands within the Reserve (which comprise 17 percent of the Special Landscape Areas). Because protection efforts in this alternative would be somewhat fragmented, and would not provide for a holistic, integrated approach to managing the landscape, the long-term impacts would be somewhat less than those of Alternative 3, yet greater than the impacts to geologic resources identified in Alternative 1.

Conclusion: If this alternative were adopted, there would be a positive balance resulting in minor impacts to geologic resources. Upon implementation of a CP for the 12 SLAs, and for each county outside of the SLAs, there would be moderate, long-term beneficial impacts.

Impacts to Vegetation: The short-term impacts to vegetative resources would be negligible. As in above, once the Comprehensive Plan was implemented, an ecosystem approach to managing the prairies could provide beneficial impacts within and outside the Reserve. Management of woodland habitats, particularly those that support state-listed species could receive attention. Native prairie preservation would be enhanced by restoration of natural processes such as fire, which combats tree invasion. Exotic species and tree invasion would be reduced over time, restoring a variety of vegetative communities. Because protection efforts in this alternative would be somewhat fragmented, and would not provide for a holistic, integrated approach to managing the entire landform region, the long-term benefits would be somewhat less than those of Alternative 3, and greater than those identified in Alternative 1.

Conclusion: If this alternative were adopted, there would be no measurable negative impacts to plant communities. Upon implementation of a CP for the 12 SLAs, and for each county outside of the SLAs, there would be moderate, long-term beneficial impacts.

Impacts to Scenic Resources: Because protection efforts in this alternative would be somewhat fragmented, and would not provide for a holistic, integrated approach to managing the landscape, the long-term benefits would be somewhat less than those of Alternative 3, and greater than those identified in Alternative 1.

Conclusion: Impacts within the Reserve would be the same for those identified in Alternative 3, and outside of the Reserve, would be the same as Alternative 1. The overall impact would be moderate, long-term beneficial impacts.

Socioeconomic Impacts: The area of the impact would be primarily the communities within or adjacent to the landform region. Economic impacts to other areas would diminish with distance from the landform region. The long-term economic impacts to local communities would be similar to those identified in Alternative 3. Federal involvement in the Reserve would also be similar, despite the reduced area involved. The challenges to developing a Comprehensive Plan across seven counties would remain the same as in Alternative 3.

This alternative does not include federal acquisition of land. If the National Park Service were asked to provide technical assistance during the planning stages of the Comprehensive Plan, the federal outlay would be greater than Alternatives 1 and 2 because of the increased NPS involvement. Expenditures may range between $15,000 and $60,000, assuming a 2-year planning timeframe (Hanson, personal communication 2001), and would continue into the implementation phases. Planning costs represent staff time and travel expenditures. Implementation costs would reflect staff time for technical assistance and coordination, and potential financial assistance (grants). These costs would vary, depending on the level of assistance requested and the availability of National Park Service funding.

Impacts Associated With Alternative 5 (Preferred Alternative)

Under this alternative, which is the preferred alternative, the Loess Hills would be managed by a JPB, with the option to designate and manage the area as a National Reserve, provided the requirements as described in the Special Resource Study are fulfilled. If the JPB recommended and the requirements were met, the entire Loess Hills landform region would be formally designated as a National Reserve. The Reserve would operate as an affiliated area of the National Park System. Affiliated areas are neither federally owned nor directly managed by the National Park Service (NPS). As a Reserve, Federal activities within and adjacent to the Reserve would be coordinated with the management entity to ensure significant resource values are protected. If this alternative were adopted, it is assumed that a JPB would be formed. Therefore, the initial impacts would be similar to those described for Alternative 1 and 2, depending on how many counties adopted Comprehensive Plans.

However, if a National Reserve were approved by the JPB, then the impacts would be the same as identified in Alternative 3. To achieve National Reserve status, additional steps would be required; hence any positive impacts would likely be realized over a longer time period. If state, local and private entities did not address threats prior to the establishment of a Reserve, there is a possibility that negative impacts could occur, which would require additional effort to mitigate.

Impacts to Geologic Resources: The Joint Powers Board (JPB) would serve to provide a comprehensive, integrated strategy to protect the area's geology and lessen the negative impacts to geologic resources that are currently occurring. Technical experts from various state, federal, and non-governmental organizations would have an opportunity to provide recommendations. Assuming technical advisors from various state, federal, and local groups participated in the planning process, the impacts from this alternative would be long-term, moderate, positive impacts.

In addition, the designation of the landform region as a National Reserve would bring increased recognition and identity to the Hills. The Reserve could be publicized in National Park Service literature. Opportunities for scientific investigations would increase as a result of increased awareness and available cost-sharing programs. National designation would lead to additional protection. Federal activities within and adjacent to the Reserve would be coordinated with the management entity to ensure significant resource values are protected.

Conclusion: If the JPB and the Governor recommend designation of a National Reserve, and if the Secretary of the Interior approves that designation, the impacts, as in Alternative 3, would be long-term, and would have a substantial, highly noticeable influence on the resource (major, long-term, positive impact). If a National Reserve were not designated, impacts would be similar to alternatives 1 and 2.

Impacts to Vegetation: There would be negligible immediate impacts to the vegetation upon adoption of this alternative. In the long-term, once the JPB and its advisors completed a Comprehensive Plan, an ecosystem approach to managing the vegetation could provide beneficial impacts. Woodland habitats, particularly those that support state-listed species

could receive attention through landowner education and assistance programs. Native prairie preservation would be enhanced by restoration of natural processes such as fire, which combats tree invasion. Exotic species and tree invasion would be reduced over time, perpetuating native plant communities.

If a National Reserve were approved, the impacts would be the same as identified in Alternative 3. This alternative would require additional steps to achieve National Reserve status; hence any positive impacts would likely be realized over a longer period of time. However, an ecosystem approach to managing woodlands, native prairies, and other important landscapes could provide major beneficial impacts. Woodland habitats, particularly those that support sensitive species, could receive attention. The restoration of natural processes, such as fire, where appropriate, could be achieved, exotic species and tree invasion would be reduced over time, perpetuating native prairie habitats.

The designation of the landform region as a National Reserve could bring increased scientific recognition to the Hills and opportunities for funding scientific investigations through a variety of sources. This could aid in the understanding and protection of natural processes. The Reserve would serve as reference area for the study of ecological succession, for measuring long-term ecological change and as a control area for comparing research results, which would provide additional protection to the natural resources within. Finally, federal activities within and adjacent to the Reserve would be coordinated with the management entity to ensure significant resource values are protected.

Conclusion: If the JPB and the Governor recommend designation of a National Reserve, and if the Secretary of the Interior approves that designation, long-term, major beneficial impacts would result (major, long-term, positive). If a National Reserve were not designated, impacts would be similar to alternatives 1 and 2.

Impacts to Scenic Resources: Upon adoption of this alternative the immediate impacts to scenic resources would be negligible. Once the Joint Powers Board (JPB) was formed, it would serve to provide a comprehensive, integrated strategy to protect the areas scenic resources. Desired landscape characteristics would be identified in the CP and receive consistent management attention. If established, the National Reserve could be publicized in tourism literature. This greater recognition and protection would likely result in increased visitation to the Hills. Increased visitation may require localized improvements to public roads (widening or resurfacing) that could alter the rural character of some public roads if not carefully evaluated.

Conclusion: If the JPB and the Governor recommend designation of a National Reserve, and if the Secretary of the Interior approves that designation, the impacts, as in Alternative 3, would be long-term, and would have a substantial, highly noticeable influence on the resource (major, long-term, positive impact). If a National Reserve were not designated, impacts would be similar to alternatives 1 and 2.

***Socioeconomic Impacts*:** The area of the impact would be primarily the communities within or adjacent to the landform region. Economic impacts to other areas would diminish with distance from the landform region.

Conclusion: If the JPB and the Governor recommend designation of a National Reserve, and if the Secretary of the Interior approves that designation, impacts would be slightly more than those identified in alternatives 3 and 4. Costs would be expected to be higher because additional mitigation/restoration activities would be required in areas where degradation occurred in the interim. If a National Reserve were not designated, impacts would be similar to alternatives 1 and 2.

This alternative does not include federal acquisition of land. If the National Park Service were asked to provide technical assistance during the planning stages of the Comprehensive Plan, the federal outlay would be greater than Alternatives 1 and 2 because of the increased NPS involvement. Expenditures may range between $15,000 and $60,000, assuming a 2-year planning timeframe (Hanson, personal communication 2001), and would continue into the implementation phases. Planning costs represent staff time and travel expenditures. Implementation costs would reflect staff time for technical assistance and coordination, and potential financial assistance (grants). These costs would vary, depending on the level of assistance requested and the availability of National Park Service funding.

Cumulative Impacts

A cumulative impact is the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of who undertakes such other actions. It is the combination of these effects, and any resulting environmental degradation, that should be the focus of cumulative impact analysis. The cumulative impacts of an action can be viewed as the total effects on a resource, ecosystem, or human community of that action and all other activities affecting that resource no matter what entity (federal, non-federal, or private) is taking the actions (Environmental Protection Agency 1999).

There is a myriad of past, present, and future actions (both public and private) that affect the Hills. Some impact the Hills in a positive manner (such as The Nature Conservancy's efforts to protect land); others impact the Hills in a negative manner (such as urban sprawl). The interaction of all of these influences is dynamic. However, it seems clear that, to-date, the net result of all of the influences has been a net degradation of the outstanding qualities of the landform region. Absent a landform-wide comprehensive plan and/or focused conservation initiatives, the net impact on the Hills is likely to continue to be negative. With implementation of any one of the alternatives outlined in this study, there is good reason to believe that degradation of the resources of the Hills would be neutralized, if not reversed. As the Loess Hills is an occupied landscape, resources always will be susceptible to the actions of humans. Some cumulative impacts would be negative; some positive. Implementation of any alternative in this study should result in net aggregate positive impacts to the Loess Hills.

PRIMARY DIFFERENCES IN IMPACTS BETWEEN ALTERNATIVES

The Preferred Alternative (Alternative 5) and Alternatives 1-4 share many common elements. The alternatives also have differences. All action alternatives are intended to support the preservation and protection of the significant resources in the Loess Hills, provide for public understanding and appreciation of the Loess Hills, and avoid unacceptable impacts to local landowners and communities within the Loess Hills.

Because the alternatives share many common elements, many impacts of the alternatives would be similar. The difference in the impacts created by each alternative is related to the degree of comprehensive planning that takes place; frequently this difference can be expressed only in terms of timing or the level of intensity. That is, an impact on a resource may be similar among alternatives, but would be of slightly more or slightly less magnitude because of the emphasis on an action or the extent or level of comprehensive planning that would occur under a particular alternative and when land-use plans are implemented.

This section briefly highlights some of the notable differences in impacts between alternatives. It is also noted that the implementation of any of the action alternatives, including the preferred alternative, would result in improved protection of the landform and its resources than would result if the area continued to be managed as it is now (that is, under Alternative 1). Any of the action alternatives would also result in improved visitor experiences and increased visitor understanding of the Loess Hills.

Among the alternatives,

- Alternatives 2, 3 and the Preferred Alternative (5) would provide for greater protection of Loess deposits, bluffs, and other landscape features than any other alternative because these alternatives would place a strong emphasis on a regional, holistic approach to landscape management.
- Likewise, Alternatives 2, 3, and the Preferred Alternative (5) would provide for a greater expression of vegetative species diversity than any other alternative because these alternatives would place a strong emphasis on a regional approach to landscape management, particularly the prairie landscape and those processes documented to increase diversity.
- Alternative 1 and to a certain extent Alternative 4 (outside of the SLAs) could result in uncoordinated efforts and gaps that could result in a continuation of mining activities and/or development in sensitive areas in some or all of the affected counties.
- The Preferred Alternative and Alternative 3 would provide for the greatest understanding of natural resources and biological communities because of the emphasis on the Loess Hills landscape, prairies, and associated processes, and the emphasis on the integration of inventories, monitoring, and research activities between private and public entities.

- Alternative 4 places emphasis on selected, high-quality resource areas; hence, a triage approach is provided that directs financial resources to areas in the greatest need of attention.
- Alternative 1, and to some extent Alternative 2, enables land management planning decisions and protection responsibilities to occur at a local level, which could allow for quicker implementation of needed actions because there are fewer steps in the approval process.
- Alternative 1 does not provide for National Park Service involvement or technical assistance.
- Alternative 2 provides for a regional, holistic approach to management with local counties represented, and does not involve the NPS.
- Alternatives 3 and 5, if fully adopted, formally recognize the national significance of the entire 640,000-acre Loess Hills in Iowa.
- Alternatives that emphasize the development of a single integrated Comprehensive Plan for the entire Loess Hills landform region (i.e., Alternatives 2, 3, and 5), particularly those that involve NPS assistance and review (Alternatives 3 and 5), offer greater potential for significant resources to be fully considered during land-use planning and management decisions.
- The adoption of a regional Comprehensive Plan is voluntary in Alternative 2, and is required in Alternative 3 and 5.
- On a comparative basis, the financial costs to the federal government (for technical assistance and assuming funding/staff was available) would be the greatest for Alternatives 3 and 5, and the least for Alternative 1 (assuming federal funding/staff was available).
- None of the alternatives would result in federal land acquisition.
- Both Alternative 3 and Alternative 5 (if all phases are completed) ensure implementation of regional comprehensive plans, and therefore, offer the most comprehensive protection of resources throughout the Hills. While Alternative 5, originating at the local level, has greater opportunities for building consensus, Alternative 3 could likely be implemented sooner than 5. However, the actions that would protect the resources could still take significant time to be fall into place. Thus, Alternative 3 is the environmentally preferred alternative because it creates a slightly greater possibility for faster and more extensive federal involvement in the Hills, in addition to the available state and local resources.

Of the Alternatives, both Alternative 3 and 5 provide for national recognition of the significance of the Loess Hills, and offer the greatest opportunity for the long-term preservation of the Loess Hills. The Preferred Alternative, Alternative 5 was selected because it provides increased opportunities for consensus building, which in the long-term could prove beneficial to both the resource and communities of the Loess Hills.

Compliance with Applicable Federal and State Laws, Executive Orders, and other Regulations

In implementing any of the alternatives that included NPS involvement (Alternatives 2-5), the NPS would comply with all applicable laws and executive orders, including those listed below. Formal and informal consultation with the appropriate federal, state, and local agencies has been conducted in the preparation of this document. Results of these consultations are described below.

American Indian Religious Freedom Act, 1978: This act declared the policy of the United States to protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise their traditional religions, including, but not limited to, access to sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rights. Federal purchase of land is not provided for in any of the alternatives. None of the alternatives presented would limit the rights that are currently available to American Indians.

Notification letters were sent to tribes that have or may have a cultural affiliation with the Loess Hills on April 3, 2000, and again on January 16, 2001. These letters invited tribal participation in the study evaluation and identified methods to participate. Consultation with the Otoe-Missouria Tribe of Oklahoma and the Winnebago Tribe of Nebraska occurred on 4/11/2001 and 4/25/2001, respectively. These tribes indicated a desire to participate as advisors if and when comprehensive plans are developed. American Indians with cultural affiliation to the Loess Hills would be meaningfully involved in ongoing decisions regarding planning, interpretation, and resource management for alternatives that result in direct federal involvement.

Clean Air Act (including 1990 amendments): Section II 8 of the Clean Air Act, as amended, requires all federal facilities to comply with federal, state, and local air pollution control laws and regulations. Under the Clean Air Act, federal actions must conform to all applicable state implementation plan requirements and purposes, and these actions must not cause or contribute to any violation. Because none of the management alternatives prescribe specific actions for the development of land or natural and cultural resources within the Loess Hills, air quality would not be affected. Development projects that involve federal funding or staff would be subject to review for compliance with this act.

Clean Water Act of 1972, as amended: The purposes of the Clear Water Act are to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters". To enact this goal, the U.S. Army Corps of Engineers has been charged with evaluating federal actions that result in potential degradation of waters of the U.S. and issuing permits for actions consistent with the act. Because none of the management alternative prescribes

specific actions for the development within the Loess Hills, water resources will not be affected. Development projects that involve federal funding or staff would be subject to review for compliance with this act.

Endangered Species Act: The Endangered Species Act of 1973, as amended, requires federal agencies to protect federally listed species and their habitats and requires federal agencies to consult with the U.S. Fish and Wildlife Service if their activities may affect listed species. The U.S. Fish and Wildlife Service was contacted on May 8, 2001 and indicated that no formal consultation was necessary as this project was only a study (Mr. G. Bade, personal communication). As such, the National Park Service has met the requirements of the Endangered Species Act of 1973. However, if any of the management concepts are implemented, further consultation will become necessary.

Environmental Justice: Executive Orders 12250, 12898, and 12948 require agencies to consider the impact of their actions on disadvantaged human populations. The alternatives presented in this SRS/EA would have no such adverse effect. The alternatives would not result in any known effect, positive or negative, specific to any minority or low-income community. People of all races and income status have had opportunities to participate in the public involvement processes conducted with this plan. Notification and/or Consultations were conducted with American Indian tribes that may have an interest in the Loess Hills area; no adverse effects were identified that disproportionately affect these groups.

Farmlands Protection Policy Act of 1984: The purpose of the Farmland Protection Policy Act is to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses, and to assure that Federal programs are administered in a manner that, to the extent practicable, will be compatible with State, unit of local government, and private property programs and policies to protect farmland. Development projects that involve federal funding or staff would be subject to review for compliance with this act. If the protective efforts of Alternatives 2-5 prove successful, they would further the purposes of the Act.

National Historic Preservation Act of 1966, as amended through 1992: Section 106 of this act requires that impacts to significant historic or archeological resources be considered during planning for actions that are undertaken by the federal government, or are federally funded or assisted, or are federally permitted or licensed. This requires consultation with the appropriate State Historic Preservation Officer and often involves affording the Advisory Council on Historic Preservation an opportunity to comment on the proposed action. Because non of the management alternatives prescribe specific actions of this nature for the development or management of land within the Loess Hills, historic and archeological resources are not directly affected. However, development projects that involve federal funds, assistance, or permits/licenses would be subject to review for compliance with this act.

Section 110(f) of the act requires that Federal agencies exercise a higher standard of care when considering undertakings that may directly and adversely affect NHLs. The law requires those agencies "to the maximum extent possible, undertake such planning and actions as may be necessary to minimize harm to such landmarks." Consultation with the

Iowa State Historic Preservation Office (SHPO) was completed on June 13, 2001. The Special Resource Study and management alternatives were determined to have no adverse effect on Historic Properties; therefore this study is in compliance with Section 110(f) of the Historic Preservation Act. If and when a Comprehensive Plan is developed, future consultations with the Iowa SHPO office may be required.

Public Health and Safety: Neither of the alternatives would result in positive or negative impacts to public health or safety. Implementation of any of the management options would necessarily comply with state and federal regulations, including laws pertaining to public health and safety.

Wetlands/Floodplains: Executive Order 11990 ("Protection of Wetlands") requires that all federal agencies must avoid, where possible, impacts on wetlands and Executive Order 11988 ("Floodplains Management)") requires all federal agencies to avoid construction within the 100-year floodplain unless no other practicable alternative exists. It is impossible to identify potential impacts on wetlands because no concept specifies a development location. If and when development sites are selected, a wetland determination would be conducted and an analysis of potential impacts, if any, on wetlands would be completed to fulfill additional compliance needs. This study has fulfilled the requirements of Executive Orders (EOs) 11990 and 11988. Development projects that involve federal funding or staff would be subject to review for compliance with these two EOs.

Public Involvement Process

Public meetings were held in the seven-county study area during the week of February 28, 2000, and a public workshop was held on May 12, 2000, to inform the public of the project and gather input. During the week of November 13, 2000, additional workshops were held to solicit public input, respond to questions, identify issues and concerns, and document viable management alternatives (Appendix E). Subsequent discussions and meetings were held to evaluate NPS designations as well as other viable approaches to preservation. Newsletters about the project and management alternatives and inviting the public to comment were distributed to over 4,000 residents in the study area and within Iowa in May 2000, October, 2000 and January 2001.

As part of the Council on Environmental Quality Regulations on the National Environmental Policy Act, the National Park Service is making the draft Special Resource Study/Environmental Assessment available for public review for 30 days. Any revisions to the draft will be based on substantive public input and on evolving knowledge about the Loess Hills and its resources. Substantive comments are defined as comments that: (a) question the accuracy of information, (b) question the adequacy of environmental analysis, (c) present reasonable alternatives other than those presented in the document, or (d) cause changes or revisions in the proposal.

Appendix A: Special Species of the Loess Hills

This appendix lists the large number of Loess Hills species that are distinguished by their patterns of distribution or rarity. The landform's large amount of remaining natural habitat constitutes a fertile biological crossroads for species of eastern deciduous forests and western mixed-grass prairies, many of which reach their farthest outposts in or close to the Loess Hills.

Twelve animals and 28 plants are near the western edge of their distribution range in the Hills. These eastern deciduous forest species are found in the moister forested areas of the Loess Hills and extend their range a short distance farther west into Nebraska.

A similar number of organisms (28 vascular plants; 8 animals, mostly reptiles and amphibians), nearly all of which are prairie species, stretch their ranges eastward just into western Iowa. About a third of these are restricted in Iowa to the Loess Hills. These species (for example soapweed and skeletonweed) are classic indicators of Loess Hills dry mid-grass prairies. They are joined by rusts and other fungi and by soil lichens that are typical of western arid regions.

Western species demonstrate numerous adaptations that allow them to thrive in the harsh, desert-like environment of Loess Hills prairies. Many animals spend sunny days underground in burrows. The plains spadefoot toad, with a center of distribution in our nation's southwestern deserts, carries this trait to an extreme. The toad comes to the ground surface for only a few weeks each spring to complete its breeding cycle. The plains pocket mouse, a relative of the desert-dwelling kangaroo rat, can manufacture its required water entirely from the food it eats. Although its largest populations exist in the Loess Hills, this western mouse also is found sporadically to the east of the Hills on dry loess and sandy soils.

Western plants display numerous traits that aid in preventing desiccation – low stature, small leaves, thick waxy cuticles, reflective silvery surface hairs, and deep roots. The leaves of skeletonweed, for example, have been reduced to mere slivers, while soapweed stores water in its fleshy silver-green leaves. Forty-foot-deep roots have been measured in loess soils for soapweed, a plant that rarely exceeds 4 feet in height.

Western species extending into the Loess Hills exhibit unusual distribution patterns. Many, like soapweed, seem to have migrated along the Missouri River's dry bluffs and sand dunes and today extend from the Great Plains eastward into the Loess Hills along a long, thin corridor that follows this river's course. Others, such as cowboy's delight, are truly disjunct species that are separated from larger populations by a hundred miles or more. These are likely to be relicts of populations that were widespread long ago when hot, dry climates nudged western prairie communities eastward.

Table A-1 lists the special species and their distribution among Special Landscape Areas of the Loess Hills. Special Landscape Areas are described in Appendix D.

Table A-1: Special Species

					Special Landscapes[3]											
Common Name	**Scientific Name**	**Habitat**	**Affinity**[1]	**Official Iowa Status**[2]	*Plymouth North*	*Plymouth South*	*Luton*	*Grant Center*	*Turin*	*State Forest*	*Mondamin*	*Loveland*	*Council Bluffs*	*Folsom Point*	*Burr Oak*	*Waubonsie*
BUTTERFLIES																
Arogos skipper	*Atrytone arogos*	prairies	W	S		*D*										
Dusted skipper	*Atrytonopsis hianna*	prairies		S	*D*	*D*	*P*	*P*	*P*	*D*	*P*	*D*	*P*	*D*	*P*	*N*
Wild indigo duskywing	*Erynnis baptisiae*	prairies	E	S		*N*	*P*	*P*	*D*							
Sleepy duskywing	*Erynnis brizo*	woodlands	E	S											*D*	
Olympia marble	*Euchloe olympia*	prairies		S	*D*	*D*	*P*	*P*	*P*	*D*	*P*	*P*	*P*	*P*	*P*	*D*
Zebra swallowtail	*Eurytides marcellus*	woodlands	E	S												*D*
Leonard's skipper	*Hesperia leonardus*	prairies		S	*D*	*D*	*P*	*P*	*D*	*D*	*D*					
Ottoe skipper	*Hesperia ottoe*	prairies		S	*D*	*P*	*P*	*D*	*D*	*D*	*D*	*D*	*N*	*D*	*P*	*D*
Hickory hairstreak	*Satyrium caryaevorum*	woodlands	E	S	*D*	*P*	*P*	*P*	*P*	*D*	*P*	*P*	*P*	*P*	*P*	*D*
Regal fritillary	*Speyeria idalia*	prairies		S	*D*	*P*	*P*	*P*	*D*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
AMPHIBIANS AND REPTILES																
American toad	*Bufo americanus*	woodlands	E		*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Great Plains toad	*Bufo cognatus*	prairies	W		*D*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Woodhouse's toad	*Bufo woodhousii*	prairies	W		*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Western worm snake	*Carphophis amoenus*	woodlands		T									*N*	*P*	*P*	*P*
Prairie racerunner	*Cnemidophorus sexlineatus*	prairies	W					*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Prairie rattlesnake	*Crotalus viridis*	prairies	W	E	*D*	*D*										
Great Plains skink	*Eumeces obsoletus*	prairies	W	E												*D*
Speckled kingsnake	*Lampropeltis getulus*	woodlands		E												*P*
Plains spadefoot	*Scaphiopus bombifrons*	prairies	W		*D*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Massasauga	*Sistrurus catenatus*	wetland		E												*D*
Ornate box turtle	*Terrapene ornate*	prairies, edges		T										*D*	*P*	*P*

BIRDS																
Least Flycatcher	*Empidonax minimus*	woodland edges		S												
Bald Eagle	*Haliaeetus leucocephalus*	woodland		E*											*D*	
Kentucky Warbler	*Oporornis formosus*	woodlands	E													*D*
Summer Tanager	*Piranga rubra*	woodlands	E													*D*
Louisiana Waterthrush	*Seiurus motacilla*	woodlands	E													*D*
MAMMALS																
Southern flying squirrel	*Glaucomys volans*	woodlands	E		*P*	*P*		*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Bobcat	*Lynx rufus*	woodlands		E										*D*	*D*	
Woodland vole	*Microtus pinetorum*	woodlands	E										*N*	*N*	*D*	*D*
Northern grasshopper mouse	*Onychomys leucogaster*	various		T		*N*	*P*	*P*	*D*	*P*	*N*					
Plains pocket mouse	*Perognathus flavescens*	prairies	W	E	*D*	*P*	*P*	*P*	*D*	*D*						
Southern bog lemming	*Synaptomys cooperi*	prairies	E	S					*P*	*P*	*P*	*P*	*P*	*P*	*P*	*D*
Eastern chipmunk	*Tamias striatus*	woodlands	E					*N*	*D*							
PLANTS																
White baneberry	*Actaea pachypoda*	woodlands	E													*P*
Ohio buckeye	*Aesculus glabra*	woodlands	E					*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Rock cress	*Arabis shortii*	woodlands	E					*P*	*P*	*P*	*P*	*P*	*P*			
American spikenard	*Aralia racemosa*	woodlands	E		*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Green dragon	*Arisaema dracontium*	woodlands	E										*P*	*P*	*P*	*P*
Three-awned grass	*Aristida purpurea*	prairies	W		*P*	*P*	*P*									
Eared milkweed	*Asclepias engelmanniana*	prairies	W	E						*D*	*P*	*P*	*P*	*D*		
Narrow-leaved milkweed	*Asclepias stenophylla*	prairies	W		*P*	*P*										
Paw paw	*Asimina triloba*	woodlands		S												*D*
Lotus milk vetch	*Astragalus lotiflorus*	prairies	W		*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Missouri milk vetch	*Astragalus missouriensis*	prairies	W	S	*D*	*P*	*D*	*P*	*P*							
Prairie moonwort	*Botrychium campestre*	prairie edge		S	*D*	*D*	*P*	*P*	*D*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Blue grama	*Bouteloua gracilis*	prairies	W		*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Bearded short-husk	*Brachyelytrum erectum*	woodlands	E					*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Buffalo grass	*Buchloe dactyloides*	prairies	W		*P*	*P*										
Rocky Mountain sedge	*Carex saximontana*	woodland edge	W	S	*D*	*D*	*P*	*P*	*P*							
Blue cohosh	*Caulophyllum thalictroides*	woodlands	E					*P*	*P*	*P*						

Nodding thistle	*Cirsium undulatum*	prairies, pastures		S												*D*
Spring beauty	*Claytonia virginica*	woodlands	E													*P*
Stinking clover	*Cleome serrulata*	prairies	W		*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Fall coral-root	*Corallorhiza odontorhiza*	woodlands	E							*N*	*P*	*P*	*P*	*P*	*P*	*D*
Prairie tea	*Croton monanthogynus*	prairies		S					*D*	*P*	*P*					
Yellow lady's-slipper	*Cypripedium calceolus*	woodland	E													*P*
Nine-anther prairie clover	*Dalea enneandra*	prairies	W		*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Bracted tick-trefoil	*Desmodium cuspidatum*	woodlands	E													*P*
Broad-leaved panic grass	*Dichanthelium latifolium*	woodlands	E													*P*
Yellow yam	*Dioscorea villosa*	woodlands	E													*P*
Purple coneflower	*Echinacea angustifolia*	prairies	W		*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Mat spurge	*Euphorbia stictospora*	prairies	W				*P*	*P*	*P*	*P*	*P*	*P*	*P*			
Showy orchis	*Galearis spectabilis*	woodlands	E						*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Scarlet gaura	*Gaura coccinea*	prairies	W		*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
American pennyroyal	*Hedeoma pulgeoides*	various														*P*
Appendaged waterleaf	*Hydrophyllum appendiculatum*	woodlands	E							*P*	*P*	*P*	*P*	*P*	*P*	*P*
Dottted blazing star	*Liatris punctata*	prairies	W		*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Michigan lily	*Lilium michiganense*	woodlands, prairies	E		*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Stiff flax	*Linum rigidum*	prairies	W		*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Biscuitroot	*Lomatium foeniculaceum*	prairies	W	E												*D*
Skeletonweed	*Lygodesmia juncea*	prairies	W		*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Cut-leaved goldenrod	*Machaeranthera spinulosa*	prairies	W		*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Wild crab	*Malus ioensis*	woodlands, prairies	E					*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Ten-petal blazing star	*Mentzelia decapetala*	prairies	W	S	*D*	*P*	*P*	*P*	*P*	*P*	*D*	*P*	*P*	*P*	*P*	
Indian pipe	*Monotropa uniflora*	woodlands	E													*P*
Black-seeded rice-grass	*Oryzopsis racemosa*	woodlands	E			*D*										
Locoweed	*Oxytropis lambertii*	prairies	W		*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Ginseng	*Panax quinquefolius*	woodlands	E										*P*	*P*	*P*	*D*
Tall forked chickweed	*Paronychia canadensis*	woodlands	E									*P*	*P*	*P*	*P*	*P*
White beardtongue	*Penstemon albidus*	prairies	W	S	*P*	*P*	*P*	*P*	*P*							
Cobaea penstemon	*Penstemon cobaea*	prairies		S												*P*
Slender beardtongue	*Penstemon gracilis*	prairies	W							*P*	*D*					
Sycamore	*Platanus occidentalis*	woodlands	E												*P*	*P*

Mayapple	*Podophyllum peltatum*	woodlands	E													*P*
Hairy mountain mint	*Pycnanthemum pilosum*	woodland edge	E													*P*
White oak	*Quercus alba*	woodlands	E										*P*	*P*	*P*	*P*
Hooked buttercup	*Ranunculus recurvatus*	woodlands	E		*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*			
Tumblegrass	*Schedonnardus paniculatus*	prairies	W	S	*D*	*D*	*P*	*P*	*P*	*P*	*D*	*P*				
Sensitive briar	*Schrankia nuttallii*	prairies		S									*P*	*P*	*P*	*P*
Silver buffaloberry	*Shepherdia argentea*	prairie edge	W	T	*P*	*P*	*P*	*P*	*P*							
Zig-zag goldenrod	*Solidago flexicaulis*	woodlands	E													*P*
Scarlet globemallow	*Sphaeralcea coccinea*	prairies	W	T	*D*	*P*	*P*	*P*	*P*	*D*	*D*	*P*	*P*	*D*	*P*	
Needle-and-thread grass	*Stipa comata*	prairies	W	S			*P*	*P*	*P*	*P*	*D*					
Green needlegrass	*Stipa viridula*	prairies	W		*P*	*P*	*P*	*P*	*P*	*P*	*P*					
Rock elm	*Ulmus thomasii*	woodlands	E					*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Frost grape	*Vitis vulpina*	woodland edge		S										*P*	*P*	*P*
Soapweed	*Yucca glauca*	prairies	W		*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*

*1) Affinity: **W**, Species with western affinities that reach their eastern range limits in far-western Iowa. Some of these are isolated from their centers of population far to the west. **E**, Eastern species near the western edge of their distribution range in the Loess Hills.*

*2) Official Iowa Status: **E**, endangered; **T**, threatened; **S**, special concern. Note: "Endangered" is defined as "likely to become extinct in the state in the foreseeable future". "Threatened" means "likely to become endangered in the state in the foreseeable future." "Special Concern" means suspected to be rare or declining in the state, but more information is needed to assess the status of these species.*

*3) Special Landscape Areas (as described in appendix D): **D**, species documented within Landscape; **N**, species documented nearby Landscape; **P**, species predicted to occur in general vicinity of Landscape*

** The Bald Eagle is federally listed as Threatened in the lower 48 states.*

Appendix B: Scientific Names of Loess Hills Plants and Animals

ANIMALS

Common Name	Scientific Name
Badger	*Taxidea taxus*
Bobcat	*Lynx rufus*
Coyote	*Canis latrans*
Eastern cottontail	*Sylvilagus floridanus*
Fox squirrel	*Sciurus niger*
Great Plains skink	*Eumeces obsoletus*
Hickory hairstreak butterfly	*Satyrium caryaevorum*
Ottoe skipper	*Hesperia ottoe*
Plains pocket mouse	*Perognathus flavescens*
Plains spadefoot toad	*Scaphiopus bombifrons*
Prairie rattlesnake	*Crotalus viridis viridis*
Red fox	*Vulpes vulpes*
Regal frittilary	*Speyeria idalia*
Speckled kingsnake	*Lampropeltis getula*
White-tailed deer	*Odocoileus virginianus*
Woodchuck	*Marmota monax*
Zebra swallowtail	*Eurytides marcellus*

PLANTS

Common Name	Scientific Name
Bur oak	*Quercus macrocarpa*
Cottonwood	*Populus deltoides*
Eastern redcedar	*Juniperus virginiana*
Green ash	*Fraxinus pennsylvanica*
Ironwood	*Ostrya virginiana*
Little bluestem	*Andropogon scoparius*
Paw paw	*Asimina triloba*
Plains muhly	*Muhlenbergia cuspidata*
Prairie moonwort	*Botrychium campestre*
Red elm	*Ulmus rubra*
Scarlet gaura	*Gaura coccinea*
Side-oats grama	*Bouteloua curtipendula*
Seletonweed	*Lygodesmia juncea*
Soapweed	*Yucca glauca*
Virginia creeper	*Parthenocissus quinquefolia*

Appendix C: Human Occupation and Use of the Loess Hills

***Paleoindians*.** Humans arrived shortly after the formation of this unique landscape in the late Pleistocene epoch of the Cenozoic era. As the glaciers receded, the winds blew the fine quartz-like soil into mounds and the earliest Paleoindians,[1] small bands of foragers who led a nomadic existence, searched the hills and plains in search of mammoths, mastodons, and early forms of bison (Benchley et al. 1997; Alex 2000). These people are represented in the archeological record by highly distinctive chipped stone projectile points called fluted points, which served as spear tips or hafted cutting tools such as knives.[2]

As the Pleistocene big game herd animals became extinct due to climatic changes and/or hunting, Late Paleoindians (circa 10,500 B.C.-8500 B.C., and possibly later in some regions) exploited fauna of types that exist today, primarily modern bison (Benchley et al. 1997; Alex 2000). The tool kit of these later hunters and foragers was more diversified. A variety of projectile point forms were used, as well as chipped stone scrapers, choppers, knives, and ground stone adzes.

***Archaic*.** The next archeological period represented in the Loess Hills is the Archaic.[3] As the climate became warmer and drier following the recession of the glaciers and the deposition of loess, the economy of Archaic peoples became increasingly reliant on hunting and foraging of more diverse food resources than those exploited during Paleoindian times. Bison hunting continued, but a wide range of other animals were also exploited, such as elk, deer, wolf, fish, turtle, and shellfish. Small family groups moved about seasonally in search of food resources. Although still highly mobile, Archaic peoples made greater use of semi-permanent base camps as well as smaller seasonal camps. The first evidence for plants serving as a dietary supplement appears in the Archaic period. Although ground stone adzes are known from late Paleoindian times, Archaic peoples made use of a wider variety of ground stone tools for the chopping, grinding, and crushing of plant foods. Projectile points diversified considerably in type, and many bear single notches in each side to facilitate hafting to a

[1] Circa 11,000 B.C.-10,500 B.C.

[2] Paleoindian archeological sites are rarely found, primarily due to geological factors. Many landforms in which Paleoindian campsites would be found have either been eroded or deflated, removing the sedimentary context and many of the artifacts themselves, or are deeply buried and seldom encountered for that reason (Thompson et al. 1984; Alex 2000). In the Loess Hills, Paleoindian projectiles have been found as isolated artifacts in several locations, but no habitation or game kill/processing sites are known. One of these isolated finds, a Clovis point made of Knife River Flint, a translucent tan chalcedony from western North Dakota, was recently found on the surface of a ridge in Stone State Park in Woodbury County (Molyneaux 1998a, 1998b). Most other specimens from the Loess Hills are in the collections of avocational archeologists (Rowe 1951; Morrow and Morrow 1993; Billeck 1998). Paleoindian projectiles of Clovis, Folsom, Dalton, and Meserve forms have been reported from findspots in the Loess Hills (Benchley et al. 1997). The Office of the State Archaeologist (OSA) GIS data reflect only 12 recorded sites in the Loess Hills where artifacts of the Paleoindian tradition have been found on the ground surface, ten of them fluted points. None of these sites are known to be habitation or game kill sites.

Although evidence of the Paleoindian period in the Loess Hills is meager, the possibility remains of future discoveries of Paleoindian artifacts associated with the remains of extinct proboscideans (mammoths, mastodons) and bison, which were among the large game animals hunted during Paleoindian times. Anderson and Williams (1974) have cataloged sites throughout Iowa where fossil proboscidean remains have been found. Their tabulation included eight locations in Plymouth County, nine in Woodbury, 11 in Monona, 13 in Harrison, four in Pottawatamie, seven in Mills, and one in Fremont County. Clearly, the potential for future discoveries of proboscidean and bison remains associated with ancient man is present.

[3] Circa 8500 B.C. to approximately 800 B.C. or later.

spear shaft or wooden handle. Artifacts interpreted as weights attest to the use of a dart-throwing device known as an atlatl, which served to effectively lengthen arm leverage for throwing spears farther than possible with the unaided arm. Archaic people sometimes heated lithic raw material to improve its flaking qualities for making chipped stone tools. They used the same locations repeatedly when burying their dead. The remains were sometimes accompanied by red ochre powder and personal possessions such as shell beads or tools, attesting to group-held beliefs about territoriality and the afterlife.

Throughout the approximately 8,000-year span of the entire Archaic period, small mobile groups, probably based on nuclear or extended families, engaged in hunting and gathering as primary economic pursuits. However, through time the resources exploited became gradually more diversified, groups became less mobile as greater use was made of seasonal resource exploitation base camps, band composition became larger and more cohesive, and people came together repeatedly to bury their dead in given localities and with more variety of burial artifact accompaniments. These changes were gradual and are difficult to perceive in the archeological record because Archaic-age archeological sites are few and generally little investigated, particularly in the Loess Hills. The eventual transition to what archeologists call the Woodland period is marked not so much by changes in lifestyle as by the introduction or elaboration of new ways for obtaining food and burying the dead.

Early Archaic[4] remains are likely to be found buried in Corrington Member alluvial fans in the larger river valleys that cut through the Loess Hills.[5] During the Early Archaic there was a shift toward exploitation of smaller forms of animals as the Pleistocene large game became extinct. Early Archaic sites are usually identified by distinctive projectile forms that serve as temporal hallmarks of the time period.

[4] Approximately 8500 B.C. to about 5500 B.C. (Alex 2000).

[5] A highly important Archaic bison kill site was discovered deeply buried in the Corrington Member of the DeForest Formation during construction of municipal sewage facilities just east of the Loess Hills near Cherokee, Iowa, in 1973 (Anderson and Shutler 1978; Anderson and Semken 1980). Once thought to contain components of both the Paleoindian and Archaic traditions, all three of the components present at the Cherokee Sewer site (13CK405) are now considered to be Archaic in age (Alex 2000). At the Cherokee Sewer site, the lowest of three cultural layers, Horizon III, was Early Archaic. It yielded lanceolate and stemmed projectiles in association with the bones of three bison that were probably killed in the early winter (Whittaker 1998). Horizon III is interpreted as a bison kill site with a campsite probably located nearby. It dates to approximately 7600-7200 B.C. (Alex 2000) and is the oldest game kill component known in Iowa. Horizon II, dating to about 6200-5900 B.C., also represents an Early Archaic late fall-early winter kill site and processing station (Alex 2000). Horizon I represents a Middle Archaic game kill site. Together, all three components at the Cherokee Sewer site present a rare opportunity to compare long-term "economic and adaptive strategies...in the light of detailed climatic and environmental studies" (Anderson and Shutler 1978).

Only two Early Archaic sites are known in the Loess Hills (GIS data from the OSA). Others undoubtedly exist but they are buried and difficult to detect without the use of some form of deep subsurface archeological survey method such as coring. Probably the better known of the Loess Hills Early Archaic sites is the Hill site (13ML62) in Mills County, which was discovered in 1958 when it was exposed during channel work along Pony Creek as part of a county road construction project. The site was investigated by W.D. Frankforter of the Sanford Museum in Cherokee, Iowa, who published several summaries (Frankforter 1959a,b; Frankforter and Agogino 1959 a-c) and a report about the site (Frankforter 1958-1959). No detailed description of the site's investigation has been published. The site was observed as four cultural strata exposed in the Pony Creek bank 17 feet below the surface. It is interpreted as a campsite evidenced by two cultural strata. A radiocarbon assay and projectile forms place the site's occupation in the Early Archaic period (Anderson and Semken 1980; Alex 2000). In addition to five side-notched and one unnotched projectile points, the lithic assemblage from the site comprised a variety of chipped stone knives, scrapers, modified and unmodified flakes, and a ground stone mano, the last of which suggests processing of plant remains. Bison, deer, mole, bird, and turtle bones were found at the site. It is doubtful that any of the site deposit remains intact (Frankforter and Agogino 1959c). The other Loess Hills Early Archaic site, the Pisgah site (13HR2), yielded a side-notched projectile point recovered from a partial bison skeleton. The point resembles projectile points from Zone 7 at the Simonsen site and Horizon II at the Cherokee Sewer site, which infers a similar Early Archaic age (Frankforter 1961; Anderson and Semken 1980; Alex 2000).

During the Middle Archaic[6] period, the trends toward more permanent base camps and specialized resource exploitation that began during the Early Archaic continued (Benchley et al. 1997). Much of this period also corresponds with an extended period of dry weather conditions known as the Hypsithermal (also called the Altithermal), which extended drier, Plains-like conditions eastward into the Prairie Peninsula. Middle Archaic foragers responded to these conditions by seeking campsites near permanent water sources (streams and marshes) where stands of timber survived (Alex 2000).[7]

During Late Archaic times,[8] the appearance of ossuaries[9] implies a larger population base and a more sedentary existence, probably allowed by seasonal harvesting of increasingly diverse and abundant faunal and floral resources fostered by the return of cooler, more moist climatic conditions (Schermer et al. 1995; Alex 2000). Fourteen sites attributed to the Late Archaic period have been recorded in the Loess Hills (GIS data from the OSA). Little is known of Late Archaic settlement or subsistence patterns in the Loess Hills, though it is presumed that the economy remained highly focused on bison hunting and gathering of wild plant foods, a continuation of the Early and Middle Archaic pattern.

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[6] Approximately 5500 B.C. to about 3000 B.C. (Alex 2000).

[7] Horizon I at the Cherokee Sewer site, the uppermost cultural level, represents the remains of a Middle Archaic bison kill and processing site dating to approximately 5500-5200 B.C. (Anderson and Semken 1980; Alex 2000). Together, the three cultural levels at the Cherokee Sewer site document a subsistence pattern that persisted for perhaps 2,500 years, from Early Archaic times into the Middle Archaic period. The Cherokee Sewer site is important not only for this reason, but it hints at the existence of similar resources deeply buried in the alluvium in the larger valleys, both within and outside the Loess Hills. Middle Archaic components have been identified at three and possibly four sites in the Loess Hills, one each in Monona and Mills counties and one or possibly two in Plymouth County (GIS data from the OSA).

Two Middle Archaic sites within the Loess Hills have received substantial investigation. One is the Lungren site (13ML224) in the Pony Creek watershed near Glenwood in Mills County. The Smithsonian Institution partially excavated it in 1963 (Brown 1967). Observed as a thin cultural stratum exposed in an eroded gully cutbank about 10 feet below the surface, excavations revealed a hearth and associated midden. A variety of scraping, cutting, and chopping tools were recovered, as well as several hammer stones and a side-notched projectile point similar to ones found in the Middle Archaic (Horizon I) component at the Cherokee Sewer site (Anderson and Semken 1980). The Lungren site is interpreted as a campsite (Brown 1967; Anderson and Semken 1980; Alex 2000).

The most publicized Archaic site in the Loess Hills is a burial site discovered in 1955 in a quarry near Turin in Monona County. At first it was thought to be the remains of individuals from the Paleoindian period, which would represent a find of exceptional rarity. However, a radiocarbon date for the bones of one of the interred individuals indicated a Middle Archaic age instead. Initially called the "Turin Man," the discovery received national publicity in *Life Magazine* (*Life Magazine* 1955), and was summarized in print a number of times (Anderson 1957; Frankforter 1955; Frankforter and Agogino 1959a-c; Johnston 1996; Smith 1961; and Wormington 1955). The most recent and most comprehensive description of the site is by Fisher et al. (1985).

The Turin site (13MN2). was discovered as the result of quarrying operations that eventually led to the exposure of the skeletal remains of four individuals. The first individual was an adult male buried in loess 13 to 20 feet below the ground surface. It was reported to the University of Iowa and was investigated by archeologists from that institution and the Sanford Museum in Cherokee. The second skeleton represented a young female and was found in soil that had slumped from the face of the quarry. The remains of another child and an infant were excavated in situ. The second child (skeleton 3) was buried with a side-notched projectile point similar in form to examples from other sites of Middle to Late Archaic age, as well as 18 beads made from freshwater Anculosa shells. The body of the child had been sprinkled with red ocher, similar to Late Paleoindian through Archaic and Early Woodland interments in the woodland areas of the eastern United States. Fisher et al. concluded that the individual interments in a prescribed area at Turin may represent related members of a family group (Fisher et al. 1985). It was later judged that all four individuals had been separately buried in gully fill within the Hatcher Member of the DeForest Formation (Fisher et al. 1985). The gully fill is believed to date in the 3800-3000 B.C. range (Alex 2000). Unfortunately, continued quarrying (Fisher et al. 1985) has destroyed the site of the Turin discoveries.

[8] Circa 3000 B.C. to 800 B.C.

[9] Ossuaries are burials of multiple individuals in common graves.

The Lewis Central School site is the only late Archaic site that has been excavated in western Iowa (Benchley et al. 1997), and has yielded only information of a demographic nature.[10]

Woodland Indians. The Archaic period was succeeded by the Woodland,[11] characterized by the introduction of ceramic vessels, burial of the dead in mounds, and increased reliance on wild and cultivated plant foods. All of these developments are known to some extent during Archaic times, but are not documented at Archaic sites in the Loess Hills or adjacent regions (Benchley et al. 1997). Regional differences in artifact assemblages, particularly the decoration of pottery, began to become more distinct through the Woodland period. People were more sedentary than before, living in small hamlets of substantial wattle-and-daub structures. Like the Archaic period, the Woodland period is divided into Early, Middle, and Late subperiods. The regional Woodland variation found in western Iowa, including the Loess Hills, is often termed Plains Woodland or sometimes the Mid-America Woodland tradition (Benchley et al. 1997; Benn 1986). Woodland sites of all ages are generally more abundant than Archaic sites. Woodland components have been recorded at 115 sites in the Loess Hills (GIS data from the OSA). In contrast, only 21 Woodland components have been identified in those areas of the seven counties that lie outside the Loess Hills (GIS data from the OSA), suggesting that Woodland people may have preferred resources that were available in the Loess Hills landform region.

[10] The Lewis Central School site (13PW5) was an ossuary excavated at Council Bluffs, Pottawattamie County, in 1975 (Anderson et al. 1977, 1978; Fisher 1978). The site was discovered in the course of earth removal for the construction of the Lewis Central School. Unfortunately, much of the site and the human remains it contained were destroyed before the bones were recognized as human.

The Lewis Central School site yielded the remains of an estimated 25 individuals of both sexes, ranging in age from less than two years old to over 60 (Fisher 1978). The number of individual remains inadvertently destroyed before the discovery was reported is not known. Some of the skeletal remains were correctly articulated, indicating burial in the flesh, while other bones were loose or in disarticulated groups suggesting that decomposition of the flesh had taken place elsewhere. All were believed to have been interred at the same time, suggesting cooperation between several groups or bands of people. Deliberate burial inclusions consisted of a variety of utilitarian items such as side-notched projectile points, chipped stone scrapers, a knife and bifacial tools, a chipped stone drill, unworked flakes of stone, bone awls, an antler tine and beam, and freshwater mussel shell fragments, including one cut into a rectangular shape. By agreement with Native Americans, one bone was radiocarbon dated to the period of approximately 1100 to 800 B.C. (Anderson et al. 1978; Alex 2000). Although now destroyed, the Lewis Central School site yielded a large body of data about the age, stature, pathology, nutrition, and health of an early population that will be useful for comparison with data on other groups elsewhere in Iowa and in the Plains and Prairie regions. Alex (2000) has concluded that the transport of deceased remains from other locations to the Lewis Central School site may represent "the beginning of territorialism among late Archaic hunting and gathering bands in western Iowa."

The removal of bones from the Lewis Central School site played an important role in shaping the Iowa state law under which ancient human remains are exhumed and reburied throughout the state today. At the time of discovery, tensions within the state between the archeological community and Native Americans were high as the result of disparate treatment of American Indian and non-Indian remains disinterred during road construction at the Pacific City Cemetery near Glenwood (Billeck 1993; Pearson 2000), and a violent confrontation between American Indian Movement members and individuals attempting to investigate the reported discovery of human remains near Sioux City in 1972 (Anderson et al. 1979). Initially the Omaha Tribe and other American Indian interests opposed the excavation, removal, and study of the remains at the Lewis Central School site by archeologists. However, when they learned a local undertaker would legally exhume the remains using a bulldozer, Native Americans became supportive of the gentler option of excavation being performed by archeologists. As the result of negotiations between the Native American and archeological parties involved, the remains were excavated, studied, and respectfully reburied in a cemetery created specifically for that purpose. Subsequently, the Iowa legal code governing the study of ancient human remains within the state (defined as remains over 150 years old) required conformation to the precedent set at Lewis Central School. Since passage of this law in 1976, this reburial program has been carried out in cooperation and consultation with Native Americans and today it serves as a model example of a successful program of this nature (Anderson 1985a).

[11] Approximately 800 B.C. to A.D. 1200 (Alex 2000).

The Early Woodland period[12] in western Iowa is characterized by a rather thick and crude form of pottery called Crawford ware (Benchley et al. 1997; Alex 2000). Pottery made during Middle and Late Woodland times was technologically better and more highly decorated. Early Woodland peoples further east, toward the Mississippi River and beyond, sustained higher population densities, were more sedentary, made greater reliance on plant foods, and achieved more social complexity than their neighbors in western Iowa. The Early Woodland inhabitants of Iowa generally lived in seasonally occupied camps that were moved periodically to take advantage of available plant foods such as walnuts and acorns. Cultigens raised included curcubits, sunflowers, and goosefoot. The Early Woodland period in western Iowa is viewed as a continuation of the Archaic hunting and foraging economy with the introduction of ceramics, but without evidence for the characteristic Early Woodland traits of mound burial and incipient horticulture (Tiffany 1986).

In western Iowa, the Early Woodland period is little known (Benchley et al. 1997; Tiffany 1986), and no sites of this period have been extensively excavated. Early Woodland components have been recorded at only five sites in the seven-county study area, of which four are in the Loess Hills (two each in Fremont and Woodbury counties; GIS data from the OSA). None has been extensively investigated. [13]

There were many changes during Middle Woodland times.[14] Pottery became more sophisticated in shape and decoration; societies are presumed to have become more socially stratified; mound burial became common; and goods and ideas were widely spread through what archeologists call the Hopewell Interaction Sphere (Schermer et al. 1995; Benchley et al. 1997; Alex 2000). Though this led to the creation of monumental mounds, complex earthworks, exotic artifacts widely traded, and the spread of ritual and ideology in the eastern part of the Midwest, this degree of cultural elaboration did not reach western Iowa (Alex 2000). While the Middle Woodland population of western Iowa probably increased from Early Woodland levels, it remained generally low and subsistence remained largely the same as in Archaic times, based on a mix of hunting and gathering, with some increased reliance on cultigens. There is little evidence that mound burial was widely practiced by the Middle Woodland inhabitants of the Loess Hills.[15] Middle Woodland components have been identified at only seven sites in the Loess Hills, three in Woodbury County, two in Fremont County, and one each in Harrison and Plymouth counties (GIS data from the OSA; Benn 1981, 1990a).[16]

[12] Circa 800 B.C.-200 B.C.

[13] The Benson site (13WD50) is a large, multi-component Woodland site in the Smokey Hollow drainage of Woodbury County. It was observed in 1982 in the form of deeply buried hearths, pottery, and other cultural debris visible in gully walls for a distance of 2,200 feet (Thompson and Benn 1983). Components of Late Archaic, Early Woodland, Middle Woodland, and Late Woodland age are believed to be present (Thompson 1984). Although excavations have not taken place here, the Benson site offers tremendous potential to yield information that will be important to understanding major changes in cultural adaptations to late Holocene environments (Thompson 1984). It was listed on the National Register of Historic Places in 1984.

[14] Circa 200 B.C.-A.D. 400 (Alex 2000).

[15] However, Middle Woodland ceramics have been recovered from one mound in the Terry Mound Group (13ML49) in Mills County and from excavations at a Nebraska Phase earth lodge (13ML126) that is presumed to have intruded on an earlier Middle Woodland site (Billeck 1993; Alex 2000).

[16] An important archeological site for understanding the Woodland stage in the Loess Hills is the Rainbow site (13PM91) near Hinton in Plymouth County. The Rainbow site was excavated in 1978 along a small Loess Hills tributary of the Floyd River (Benn 1981, 1990a). The excavation was conducted to mitigate the impact of construction of a small water impoundment dam planned by the Soil Conservation Service. After cultural deposits were observed in gully cutbanks, excavations were conducted to salvage information that would otherwise be destroyed. The site was found to contain evidence of several occupations dating from possibly as early as A.D. 100 to as late as A.D. 680 (Benn 1990a), but primarily spanning Middle Woodland into Late Woodland times (Alex 2000). The Middle Woodland occupation is judged to have occurred sometime between about A.D. 200 and A.D. 450 (Alex 2000).

During the Late Woodland period,[17] population continued to increase, settlements were more sedentary, cultivation of domestic plant foods intensified, and a number of technological changes occurred. These included the introduction of the bow and arrow which essentially replaced the dart and atlatl used earlier, technological refinement of pottery, and the use of pits for the storage of food (Benn 1982, 1983). Cultivated plants included squash or pumpkin, sunflower, gourd, goosefoot, marsh elder, and tobacco (Alex 2000). Burial of the dead in mounds became common and a seasonal round of gathering wild plant foods and hunting a variety of animals continued. The raising of corn intensified. Late Woodland components have been identified at 14 sites in the Loess Hills, ten in Mills County, three in Woodbury County, and one in Monona County (GIS date from the OSA; Benn 1981, 1990a).[18]

The Late Prehistoric Period. By the advent of the Late Prehistoric period[19] changes transformed Late Woodland cultures into several strikingly different regional archeological complexes centered on settled village life based largely on the raising of garden crops. Widespread cultivation of corn on an intensive scale led to the development of several distinctive regional cultures whose people lived in permanent settlements and whose economy was based on a blend of corn cultivation and hunting. These included three cultures that flourished in the Loess Hills, as well as a highly organized and ultimately widely influential culture that developed in the Mississippi River valley in western Illinois during the two centuries before A.D. 1000 (Alex 2000). These changes may have been aided by the

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The excavations yielded small quantities of squash and tobacco seeds, as well as a single corn kernel (Benn 1990a), in addition to collected native plants such as walnuts and acorns. Animal remains from the site are those of bison, deer, mollusks, and a variety of birds, fish, and small mammals, reflecting a typically diverse Woodland subsistence base. The Rainbow site inhabitants are considered representative of a network of small family-size bands that exploited a wide range of foraged plant and animal resources but which periodically or seasonally came together to maintain relations and share resources (Benn 1990a). They appear to have repeatedly occupied the bottom of small valleys, possibly to take advantage of shelter from the elements during the inclement winter months. The exchange of redundant food resources among such bands is seen as a way that vital resources were shared in times of need, such as during droughts, and served as a precursor to inter-group trading relationships among historic Plains tribes (Benn 1990a).

Information from a Middle Woodland cemetery in the Loess Hills of Harrison County, the Hanging Valley site (13HR28), has led to a differing interpretation of the relative well-being of Woodland peoples. Instead of inter-band sharing of food resources to guarantee food supplies in times of want, data from Hanging Valley suggest that a severe degree of nutritional stress was experienced by the people whose remains were excavated in 1983 (Tiffany et al. 1988). Long bones and teeth of a half dozen individuals exhibited numerous internal features that reflected repeated and sustained interruptions and inhibition of growth. This has been interpreted as due to environmental factors such as drought or cultural factors such as nearby hostile populations, or both (Tiffany et al. 1988). The contrastive ideas of 1) band aggradation and sharing of resources by Loess Hills Woodland peoples (developed from the Rainbow site data) and 2) isolation and relative destitution of those peoples because of natural or cultural causes (developed from the Hanging Valley site data) have been debated (Tiffany et al. 1989; Benn 1989) and must be resolved through future research. The skull of one of the Hanging Valley individuals exhibited cut marks suggestive of scalping, and is among the earliest known evidence of the practice of scalping in prehistoric North America (Tiffany et al. 1988; Alex 2000). The Hanging Valley site dates to between approximately A.D. 450 and A.D. 600 (Alex 2000).

[17] Circa A.D. 400-1200 (Alex 2000).

[18] The Rainbow site in Plymouth County is one of the better known early Late Woodland archeological sites in the Loess Hills, as it is also for the Middle Woodland period (Benn 1981, 1990a; Alex 2000). The Late Woodland component at the Rainbow site contained evidence of oval and circular structures defined by patterns of post holes, hearths, and interior subfloor storage pits. These were probably the remains of small structures built with wooden poles and covered with hides, bark, or reeds (Alex 2000). At Rainbow, as well as at the M.A.D. sites in Crawford County (also in western Iowa, but east of the Loess Hills), small triangular projectile points were recovered from Middle Woodland as well as early Late Woodland deposits, representing relatively early evidence for use of bows and arrows (Alex 2000). The Late Woodland component at Rainbow is believed to date in the A.D. 400-700 range (Alex 2000).

[19] A.D. 900-1000 through circa A.D. 1650 (Schermer et al. 1995; Alex 2000)

onset of the Neo-Atlantic climatic episode about A.D. 850, which brought warm, moist conditions to the region, ideal for the growing of crops like corn (Bryson and Baerreis 1968). The interrelationships among these several village cultures have been the subject of much speculation and debate. A long-time researcher in Woodland cultures of the Midwest, David Benn, has concisely outlined the changes that led to this transformation. Once increasing reliance on horticulture produced an increasing degree of sedentism:

> ...The perennial need to protect investments in crops, houses, and stored surplus leads to permanent villages and a system of defense. The crowding together of village inhabitants stimulates the enhancement of social status and individual achievement—which are expressed in exaggerated use of personal styles, exotic products, and the stockpiling of produce. Intensification of horticulture and hunting results in a proliferation of specialized tools and the reinforcement of an ideology and religion that justifies the productive system. In sum, the Plains Village adaptation can best be viewed as a *florescence* of the singular horticultural way of life initiated by Late Woodland cultures... (Benn 1983; emphasis in original).

During the Late Prehistoric period, three distinctive village complexes developed in western Iowa and are represented by archeological sites in different parts of the Loess Hills. All three (Great Oasis, Mill Creek, Nebraska Phase) were approximately coeval and their presence in the Loess Hills lasted approximately 300 years, or less, circa A.D. 1000-1300.[20] Villages of a later fourth complex (Oneota) did not exist in the Loess Hills, but were located nearby during the latter part of this time span and

[20] How long Mill Creek existed is a matter of some debate among archeologists. For many years, Mill Creek was believed to have existed for 400 to 600 years, from circa A.D. 900 to 1500 (e.g., Tiffany 1991a). Recent reassessment of the body of Mill Creek radiocarbon dates (unpublished studies by Stephen C. Lensink, cited by Alex [2000]) has resulted in a compression of this time span to about 150 years (circa A.D. 1100-1250), forcing re-evaluation of the relationship of Mill Creek with Great Oasis peoples and more distant trading partners, such as those at Cahokia near present-day St. Louis.

Cahokia was a large ceremonial and urban center that exerted marked influences on Native American cultures throughout the Midwest and through much of the Mississippi River valley. It is thought that a rigidly stratified and highly organized society ruled by an elite class dominated economic production and exchange systems over a wide area. Referred to as Mississippian culture, Cahokia itself was a city with a population estimated to range from 10,000 to 50,000 inhabitants (Tiffany 1991a; Alex 2000), the largest urban center north of Mexico. Architecture at Cahokia was dominated by monumental mounds, including Monks Mound, the largest prehistoric Native American structure in the United States. The Mississippian economy was based on intensive cultivation of maize combined with a lesser dependence on products of the hunt, much of which was presumably obtained through trade with distant cultures. Mississippian material culture was characterized by distinctive forms of pottery and other artifacts, as well as by decorative motifs suggestive of a widespread religious or ritual "cult." Some highly distinctive Mississippian artifacts such as ear spools and discoidal or "chunkey" gaming stones are rarely found at Mill Creek village sites (Tiffany 1991a).

Mississippian culture affected far-flung Native American cultures between about A.D. 1050, when Cahokia began its rise to prominence, and about A.D. 1250-1300, when it went into a decline for reasons unknown (Tiffany 1991a). During its florescence, Cahokia is believed to have influenced two of the cultures that inhabited the Loess Hills and adjacent regions, the Mill Creek culture and the Nebraska Phase. However, the nature of those influences appears to have been different with respect to each complex.

Mill Creek villagers appear to have served as suppliers of bison hides and meat to Cahokia, possibly through the means of Mill Creek trading parties that descended the Missouri River (or descended the Des Moines River to the Mississippi) to Cahokia itself (Tiffany 1991a). In exchange for these commodities, which could have been obtained in quantity directly by Mill Creek hunting forays onto the Plains to the west or by trade with western neighbors, the Mill Creek villagers are believed to have received quantities of marine and freshwater shells and pottery vessels. A variety of marine and freshwater shell artifacts, including exotic "Long-Nosed God" masks that directly attest to Mississippian influence, as well as scrap pieces of worked shell, have been found on Mill Creek sites, as have Mississippian-produced ceramics and ceramics made by Mill Creek villagers in imitation of Mississippian pottery (Tiffany 1991a). In turn, the Mill Creek people are believed to have traded exotic items such as these to related village peoples living to the west in South Dakota and along the Missouri River (Tiffany 1991a).

probably had a profound effect on the Loess Hills inhabitants. These farming cultures were influenced, to greater or lesser degrees, by dramatic cultural developments centered in the Mississippi River valley near St. Louis. With the possible exception of Great Oasis, which may not have raised much corn but may have obtained it from Mill Creek neighbors, these complexes shared a basic economy that consisted of horticulture and seasonal hunting of bison and other mammals, supplemented by the gathering of wild plant foods, mussels, and fish.

The garden crops raised during Late Prehistoric times consisted principally of corn, beans, squash, and tobacco; surpluses were stored in large subsurface cache pits and were probably exchanged with other groups. The essential commonality of the subsistence base shared by the Late Prehistoric complexes of western Iowa has been viewed as an extension of subsistence practices employed by prehistoric cultures in the woodlands east of the Mississippi River, although there seems to have been some time lag involved for these cultural characteristics to reach western Iowa. Toom (1992) concludes that "the opportunity for Plains peoples to adopt sedentism and agriculture was directly linked to parallel developments in the Eastern Woodlands, developments which reached the eastern margins of the Plains at about A.D. 900." Late Prehistoric archeological cultures differed markedly in the pottery they produced, which serves as a "hallmark" to distinguish the Late Prehistoric complexes from one another. In the northern part of the Loess Hills were two complexes known as Great Oasis and Mill Creek.[21]

Great Oasis culture is generally believed to have developed from Late Woodland cultural antecedents, although this transition is little understood at present (Henning 1967; Henning and Henning 1978). Alex (2000) concludes that Great Oasis lasted from circa A.D. 950 to 1150, though earlier writers have judged its time span as longer, lasting to possibly as late as circa A.D. 1300 (e.g., Henning 1996). Great Oasis peoples relied less on intensive horticulture and more on a diversified hunting/gathering/horticulture economic base, much like their Late Woodland cultural antecedents, and thus have sometimes been characterized as culturally "conservative" for that reason (Anderson 1975; E. Henning 1981; Tiffany 1983). Great Oasis sites are widely distributed through the northwestern quadrant of Iowa, as well as in southwestern Minnesota, southeastern to central South Dakota, and northeastern Nebraska (Henning 1971). Alex (2000) notes that Great Oasis sites in Iowa occur primarily in two clusters, one of which centers on the Big Sioux, Little Sioux, and Floyd rivers. Within the Loess Hills, they are found only in Plymouth and Woodbury counties, but they also occur in portions of those counties that are outside of the Loess Hills. In contrast, Mill Creek sites cluster in two locales: near the junction of Broken Kettle Creek and the Big Sioux River at the western edge of the Loess Hills; and along the Little Sioux River and its tributaries to the east of the Loess Hills (Anderson 1969). Great Oasis components have been identified at 34 sites in the Loess Hills, one in Woodbury County and the rest in Plymouth County (GIS data from the OSA).

Great Oasis villages are generally located on low terraces and are often found near Mill Creek villages. The larger Great Oasis villages, such as Broken Kettle West (13PM25), were comprised of rectangular semi-subterranean house structures with long external entranceways to the southeast, much like the houses of their Mill Creek neighbors (Henning and Henning 1978). Structures may have been built of wattle and daub, with no evidence of the banking of earth on the exterior, as characterized the classic earth lodges of Plains villagers in historic times (Alex 2000). Two excavated Loess Hills Great Oasis sites of the smaller campsite variety are the Cowan site (13WD88) near Sioux

[21] The relationship between these complexes–i.e., whether one developed from the other or whether they were parallel developments–has been much debated, but certainly they coexisted for a time as separate cultures, regardless of their origins. Great Oasis is generally accepted as somehow ancestral to and also contemporary with Mill Creek (Henning and Henning 1978). Villages of these two complexes are sometimes located near one another (E. Henning 1981; Henning 1996). It has been suggested that the Great Oasis culture disappeared from Iowa or changed completely into Mill Creek culture by about A.D. 1100 (Alex 2000).

City in Woodbury County and the Williams site (13PM50) along the west branch of Perry Creek in Plymouth County. Excavations took place at the Cowan site in 1998 to mitigate the impact of highway construction on the site (Doershuk and Morrow 1999). The report on this work will be forthcoming in the Office of the State Archaeologist's *Report* series. The Williams site was damaged by bulldozer activity prior to salvage excavations being undertaken there in 1971 by personnel from the Sanford Museum and volunteers (Williams 1975).[22]

Only 35 sites of the Mill Creek culture have been recorded, distributed in two very localized clusters (Alex 2000). The larger cluster is along several small tributaries of the upper Little Sioux River. The smaller cluster (seven sites) occurs in Plymouth County near the juncture of the Big Sioux River and Broken Kettle Creek. Ten Mill Creek sites have been identified in the Loess Hills, nine in Plymouth County and one in Woodbury County (GIS data from the OSA). Small tributary valleys were preferred village locations, where relatively abundant timber met the villagers' needs for fuel and building materials and adequate amounts of tillable land were available (Alex 2000). The remains of ridged and mounded agricultural fields have been recorded near some of the Mill Creek village sites (Alex 2000).[23]

[22] It is not clear whether Great Oasis peoples actually grew corn or merely consumed corn obtained from Mill Creek or other peoples (E. Henning 1981; Henning 1996). Recent research at the Great Oasis Cowan site near Sioux City, however, tends to confirm their role as horticultural corn producers (Doershuk and Morrow 1999; Alex 2000), although it may be that Great Oasis corn horticulture was not as intensive as Mill Creek. Great Oasis peoples also participated in long-distance trade that resulted in marine shells from the gulf coast and freshwater Anculosa shells from the Ohio River valley and further south being occasionally found at Great Oasis sites (E. Henning 1981; Alex 2000). Lithic raw materials were obtained from a variety of distant sources to the west, northwest, and southeast (Alex 2000). Great Oasis villagers made pottery that was particularly distinctive and neatly decorated (Alex 2000).

Whether Great Oasis villagers coexisted with Mill Creek neighbors in a symbiotic relationship–exchanging plant and animal food and other resources–or whether Great Oasis villages were abandoned by the time that nearby Mill Creek villages were constructed cannot be determined from available radiocarbon dates. However, despite considerable past debate and speculation (e.g., Alex 1981), archeologists today generally agree that Great Oasis 1) developed from Late Woodland cultures; 2) possessed a diversified economy more typical of Late Woodland predecessors, with less reliance on maize cultivation in comparison with Mill Creek villagers; and 3) was coeval with the Mill Creek culture for much of its existence. Peaceful and perhaps symbiotic relations appear to have existed between these two cultures in the far northern part of the Loess Hills.

Investigations at two Plymouth County sites raise the possibility that Great Oasis and Mill Creek may have blended into one society before both cultures disappeared from the Loess Hills. In 1973 and 1974, researchers from the Sanford Museum at Cherokee, Iowa, and the University of Nebraska-Lincoln conducted extensive archeological survey and excavations in the Perry Creek drainage in Plymouth and northern Woodbury counties (Henning 1980, 1982, 1996; Williams 1975, 1982). The most extensive excavations during this work were conducted at the Larson site (13PM61) and the Lawrence Vondrak site (13PM62). The undated Lawrence Vondrak site yielded evidence of a palisade, presumably for defensive purposes but in a seemingly disadvantageous location at the base of a slope (Henning 1996). It is the first evidence of fortifications at a Great Oasis site. The Larson site, however, yielded abundant Great Oasis and Mill Creek artifacts, and has been interpreted as evidence for an amalgamation or "fusion" of the two cultures (Henning 1996), a conclusion that has been debated (Tiffany et al. 1998; Henning 1998a). The Larson occupation is judged to date within the period circa A.D. 1200-1300 (Henning 1996), toward the end of the occupation of the Loess Hills by Late Prehistoric cultures. If this conclusion about the amalgamation of two cultural complexes is correct, then perhaps Great Oasis and Mill Creek were at least partially merged at the time (circa A.D. 1300 or somewhat later) when Mill Creek people are believed to have left northwestern Iowa. There is a precedent in historic times for Plains Indian people of different cultural traditions and languages coming together. During the mid-nineteenth century, the Siouan-speaking Mandans and Hidatsas merged with the Caddoan-speaking Arikaras to form a single village and eventually a single society as a result of military pressure from the nomadic tribes. Perhaps something of this sort happened in the Loess Hills when some of the Mill Creek and Great Oasis peoples found themselves facing a nearby hostile Oneota population.

[23] Two of the village sites in the Little Sioux cluster (Phipps and Wittrock in Cherokee and O'Brien counties, respectively) have been designated as National Historic Landmarks.

Mill Creek villages were small and compact, typically consisting of rectangular semi-subterranean earth-banked houses sometimes arranged in irregular rows. Villages were situated on midden mounds of built-up soil introduced from a variety of activities such as deliberate fill importation, refuse accumulation, storage pit digging, and repeated house rebuilding (houses are believed to have required substantial rebuilding every decade or so) (Baerreis and Alex 1974; Anderson 1985b;1986; Fishel 1996; Alex 2000). Each village contained up to perhaps 200 people (Tiffany 1991a). Later Mill Creek sites were fortified with ditches and palisades that protectively isolated them on terrace spurs (Anderson 1981, 1986; Tiffany 1991a-b). Excavations at Mill Creek villages[24] have yielded abundant pottery as well as bone and stone tools, and plant remains suggesting that maize horticulture was an economic mainstay of the Mill Creek peoples. In addition to the cultivars corn, beans, squash, sunflowers, goosefoot, little barley, knotweed, maygrass, and sumpweed, wild plants such as bulrush, plum, sumac, ground cherries, bearberries, walnuts, and hazelnuts were eaten (Alex 2000). Large game animals such as bison, elk, and deer were hunted, and smaller mammals such as beaver, dog, pocket gophers, and other rodents were eaten, as well as turtles and a variety of fish and birds (Alex 2000).

Mill Creek people employed a variety of ways to bury the dead, including ossuaries on hilltops and Loess Hills blufftops, burial mounds, and individual interments within villages, sometimes in emptied out storage pits (Alex 2000). A large Mill Creek cemetery was discovered in 1972 as a result of the quarrying of fill soil at the Siouxland Sand and Gravel site (13WD402) on the loess bluffs overlooking Sioux City. Over 100 single interments were observed in situ by a local avocational archeologist and salvage excavations[25] resulted in the recovery and reburial of the skeletal remains of at least 16 individuals (Fisher 1978; Anderson et al. 1979).

By A.D. 1250 or 1300, the Mill Creek peoples disappeared from Iowa's archeological record. Several factors could account for this, including the advent of drier climatic conditions, the depletion of essential resources such as timber, or resource competition and aggression from Oneota people who

[24] Excavations have been conducted at two villages in the Big Sioux cluster. The Broken Kettle (13PM1) site attracted the interest of local antiquarians early in the twentieth century (Stafford 1904; Powers 1910), but did not undergo professional investigation until the mid-1930s (Orr 1963). The University of Nebraska conducted extensive excavations there (as well as at the nearby Great Oasis Broken Kettle West site) in 1969, but this research has not yet been comprehensively reported (Henning 1969, 1970). More recently, the village was the location of a University of Iowa archeological field school in 1999 (Anonymous 1999). The Kimball site (13PM4), which is part of the Big Sioux cluster but lies just outside the Loess Hills on the Big Sioux River, was partially excavated by the University of Wisconsin in 1963 (Henning, ed. 1968, 1969).

Beginning in 1963 and extending into the 1970s, extensive excavations were conducted at Mill Creek village sites, and much information about Mill Creek culture is available as a result. The earliest of these investigations, starting in 1963 and conducted by researchers from the University of Wisconsin (Henning, ed. 1968, 1969), focused on defining cultural changes that may have occurred in response to changes in major climatic patterns. Mill Creek culture was believed to have spanned the transition from the warm, moist Neo-Atlantic climatic episode to the warmer, drier Pacific episode. Once considered a model of interdisciplinary investigation, later research has questioned the link between cultural change and climatic change that was postulated as a result of this research, instead suggesting cultural explanations for some of the changes previously attributed to climatic causes (Alex 2000).

[25] Among the artifacts recovered were several that identified the cemetery as being of Mill Creek origin and reflected widespread trading connections. These included a typical Mill Creek rimsherd, a Long-Nosed God shell mask (one of two known from Mill Creek proveniences), a cut wolf mandible (probably part of a mask ritual paraphernalia), and numerous Anculosa, Conus, and Busycon shell beads (Anderson et al. 1979; Duncan and Diaz-Granados 2000). Anculosa is a freshwater riverine shell from the Ohio River valley and southward, while Conus and Busycon are marine species, probably from the Gulf or East coasts. A fragment of distinctive pottery was identified as originating from the Caddoan area of Texas and western Arkansas, evidence of far-reaching trading connections, possibly through Mississippian intermediaries (Anderson and Tiffany 1987; Alex 2000). After extended negotiations and a change in the Iowa human burial law, removal of soil from the cemetery site was halted in 1978 and the surviving portion of the cemetery was preserved (Anderson et al. 1979). Extended and flexed single interments, as well as secondary (defleshed) and cremation burials, are known from a cemetery near the Broken Kettle Mill Creek site (Banks and Lilly 1968).

had arrived in northwestern Iowa by that time. Quite likely the disappearance of Mill Creek people was caused by some combination of these factors (Alex 2000). The absence of Mill Creek ceramics at Oneota sites and the absence of Oneota ceramics at Mill Creek sites, of coeval age, suggests that these peoples were not on friendly terms. There is little evidence that Mill Creek villages were destroyed and their inhabitants killed, and it has been suggested that the Mill Creek people moved westward into present-day South Dakota and joined people with a kindred lifestyle and material culture who were already settled along the James and Missouri rivers. Archeologists call these people the Middle Missouri Tradition and regard the Mill Creek culture as part of that broader cultural complex.

The third Late Prehistoric village complex that existed in the Loess Hills is variously called the Nebraska Phase[26] or the Glenwood Culture, because most of the known sites in Iowa cluster tightly on the Keg Creek and Pony Creek drainages and adjacent areas near Glenwood in Mills County. This nine-by-four mile area is known to archeologists as the Glenwood "locality" (Anderson 1961).[27] It has long been studied by avocational and professional archeologists, and a great deal of information about the prehistory of that locality is available as a result.[28]
Nebraska Phase villages were established in the Glenwood locality perhaps as early as circa A.D. 1050 (Alex 2000). The villagers practiced an economy based on intensive production of corn, beans, and squash, combined with the hunting of deer and smaller mammals, fishing, and gathering of wild plant foods and mollusks (Green 1990a; Asch and Green 1992a-b). Bison is relatively rare at Nebraska Phase sites in the Glenwood locality, suggesting that the villagers' economy focused more

[26] While the names “Nebraska Phase” and “Glenwood Culture” may be used interchangeably, the archaological complex was initially called the Nebraska Phase because most sites located prior to 1920 were located west of the Missouri River (Gradwohl 1994).

[27] If the Loess Hills can be truly said to have a "critical resource area" of archeological resources, the Glenwood locality is that place. Two hundred thirty nine Nebraska Phase archeological sites have been recorded in the Loess Hills within Mills County, most of them in the Glenwood area (GIS data from the OSA). In contrast, only 18 Nebraska Phase sites have been recorded in the Loess Hills outside of Mills County (10 in Fremont County, five in Pottawattamie, two in Harrison, and one in Plymouth), and 27 more outside the Loess Hills in the seven-county study area (16 of them in Mills County) (GIS data from the OSA). The correlation of Nebraska Phase sites with the Loess Hills in Mills County is striking--90% of the 284 recorded Nebraska Phase sites in Iowa occur in the Loess Hills and nearly 93% of the Nebraska Phase sites known to exist in the Loess Hills are in Mills County alone.

This concentration of Nebraska Phase sites in such a small area in part reflects more than 120 years of intense interest in the archeology of the Glenwood locality on the part of avocational and professional archeologists alike. About 130 lodge sites have been completely or partially excavated through past efforts of avocational and professional investigators (Billeck 1993). The concentration of Nebraska Phase occupation in the Glenwood locality was a very real phenomenon in contrast to the distribution of Nebraska Phase sites located outside the locality. As Lynn Alex, the author of the latest synthesis of Iowa archeology (2000) has noted: “The concentration of Nebraska Phase sites in Mills County is not just a reflection of the visibility of sites there or the more intense investigation of the area. The Glenwood locality in Mills County appears to have been intentionally chosen by Nebraska Phase people... .”

The Nebraska Phase is not restricted to the Glenwood locality, but is widespread to the west. Sites of this complex are scattered along the bluffs on the west side of the Missouri River from southeastern to northeastern Nebraska and for nearly fifty miles up the Platte River from its mouth. Sites are also known in the Missouri River bluffs of northwestern Missouri and probably occur across the river in northeastern Kansas. The Nebraska Phase is one taxonomic unit of a broader Plains Village cultural entity called the Central Plains Tradition. Western Iowa represents the eastern limit of Central Plains sites, and the Glenwood locality represents the densest known concentration of Nebraska Phase sites.

[28] Extensive archeological collections and notes have been made by avocational archeologists since the late nineteenth century (Dean 1883; Proudfit 1881a-b, 1886a-b; Rowe 1922, 1952a-b, 1960, 1968; Davis 1958, 1959; Davis and Rowe 1960), and extensive excavations were undertaken there in 1938 by the Iowa Archaeological Survey (Orr 1938). Between 1956 and 1993, analyses of Glenwood area data have resulted in at least six masters theses (Ives 1956,1962; Anderson 1960, 1961; Zimmerman 1971; Johnson 1972; Fulmer 1974; Bardwell 1981), four doctoral dissertations (Boylan 1973; Zimmerman 1977; Hotopp 1978a; Billeck 1993), and one undergraduate honors thesis (Tiffany 1971), a remarkable contribution to archeological knowledge of one specific locality.

on the growing of corn and other garden crops and the hunting of smaller woodland animals from the mixed woodland and prairie habitat of the Loess Hills. The houses of Nebraska Phase villagers were generally square to rectangular with rounded corners and a long extended entryway. Floors were dug a foot or so into the ground. Four large support posts surrounded a central fire hearth, smaller posts lined the walls and entryway, and rafters presumably supported some sort of covering, against which earth was laid in the fashion of the earth lodge dwellings of historic Plains village tribes.

It has been suggested that Nebraska Phase horticulture was of a swidden, or "slash and burn," nature (Blakeslee 1990; Alex 2000), meaning that untilled land would be cleared of trees to create garden plots or fields. When fields became infertile after several years of intensive use, the farmers would clear areas in other locations and start the process over again, building new domiciles in the course, perhaps sometimes on fallow fields. It has been noted that larger Nebraska Phase houses occur predominantly in upland settings further from timbered areas and smaller dwellings tend to occur in lower topographic settings closer to areas suitable for fields. The large lodges have been interpreted as structures built to house multiple families while fields are initially cleared. After the fields have been cleared, it has been postulated that families dispersed and built single-family dwellings closer to their fields (Blakeslee 1990). This repeated pattern of building houses in different locations would eventually literally dot the landscape with the remains of structures.[29]

With households being occupied for only relatively short periods of time and then moved to new locations every few years, the archeological remains of individual lodge structures constitute virtual "time capsules" of information. When excavated and interpreted by archeologists, the debris left behind in these short-term habitations provides a fascinating record of activities performed within the houses, the diet of their occupants, trade with neighboring cultures, and other aspects of the daily life of the villagers.

The settlement pattern within the Glenwood locality is very different from that in the area occupied by Mill Creek and Great Oasis peoples in the Loess Hills to the north. Sites in the Glenwood locality are typically the remains of individual house structures, presumably earth and timber lodges that housed economically self-sufficient extended families, or in the instance of the larger structures, multiple families (Blakeslee 1990; Billeck 1993). In the past, small clusters of lodges, two to seven in number, have been interpreted as hamlets occupied by several family groups at the same time (Anderson 1961), but the contemporaneity of the lodges comprising such apparent hamlets has not been demonstrated. Consequently, it is currently believed that lodges were moved every few years, on the order of a decade or so. When their condition deteriorated, families would build new lodges nearby. Over the course of several such moves in a small area such as a valley and adjacent slopes and blufftops, remains would be left that sometimes give the appearance of small lodge clusters or villages to archeologists viewing the pattern of ruined structures from a perspective of several hundred years later. Actual hamlets or villages in the Glenwood locality are rare, though Perry (1998) has recently suggested that loose aggregates of lodges strung out between the foot of hill slopes and terrace or floodplain fields, "within calling distance" of one another, may have been occupied by people who interacted on a daily basis and so may actually constitute communities or "villages." Perhaps the largest such village, comprised of up to 15 lodges, existed at the Kullbom site (13ML10) in a small valley north of Pony Creek that opens to the Missouri River floodplain (Alex 2000).

[29] It is important to note that many Nebraska Phase lodge sites are not visible on the surface of the ground. During construction of Highway 34, 14 lodges were encountered and excavated, but none of them had any surface expression; all were found during the course of construction work (Hotopp 1978a-b; Billeck 1993; Perry 1998). Consequently, many more Nebraska Phase sites undoubtedly exist in the Glenwood locality than are recorded at present.

Nebraska Phase lodges in the Glenwood locality were located in many different topographic situations, including high ground such as ridge tops and hilltops, side slopes, foot slopes, and valley terraces. Consequently, the prehistoric landscape of the Glenwood locality would literally have been dotted with small habitations interspersed among horticultural fields and timbered glades.[30] Why the Glenwood locality so attracted Nebraska Phase people is not known with certainty, although it has been suggested that the locality was relatively heavily timbered in contrast to the more northerly portion of the Loess Hills (Hotopp 1982). Timber would have provided essential fuel and construction material to the villagers. Timber, stone for making tools, and arable land have been suggested as the principal attractions of the Glenwood locality to Nebraska Phase villagers (Blakeslee 1990; Alex 2000). Whether the strategic position of the Glenwood locality opposite the mouth of the Platte River played any part in drawing Nebraska Phase people to the locality is unknown (Alex 2000).

Nebraska Phase villagers in the Glenwood locality appear to have had a peaceful relationship with the Mississippian and Oneota cultures. A few Oneota-like potsherds have been found at Nebraska Phase sites, suggesting friendly relations between the two groups, unlike the situation of the Mill Creek people. Nebraska Phase contact with Mississippians appears to have been indirect, unlike the direct trading relationship that their Mill Creek neighbors had with Cahokia. Their trade for Mississippian goods was probably conducted through neighboring peoples to the south along the Missouri River.

Why the Nebraska Phase people left the Glenwood locality is not known, but they, like their Mill Creek and Great Oasis neighbors, disappeared from the archeological record by about A.D. 1300 (Alex 2000). Other Central Plains Tradition people survived longer in other locales west of the Missouri River. Central Plains Tradition villagers are believed to have eventually migrated northward along the Missouri into present-day South Dakota, where they interacted, possibly in a conflict relationship, with village people of the Middle Missouri Tradition. Central Plains Tradition people may be the ancestors of the historic Caddoan-speaking Arikaras and Pawnees (Alex 2000).

A fourth village culture which is at least partially contemporaneous with the Plains Village complexes found in the Loess Hills is called the Oneota tradition. Oneota sites have been found throughout all or a part of 10 states (Alex 2000). Although Oneota is virtually absent from the Loess Hills (only one poorly known and questionable site is recorded in each of the Loess Hills parts of Plymouth and Woodbury counties GIS data from the OSA) large Oneota villages existed nearby.[31] Hostile Oneota interaction and resource competition with the Mill Creek villagers is believed to be one of the reasons for the withdrawal of the Mill Creek people from northwestern Iowa (Anderson 1981, 1987; Henning

[30] This does not necessarily mean that the Nebraska Phase population within the Glenwood locality was large, however. The most recent estimate of the total number of Nebraska Phase lodge sites in the Glenwood locality–including those yet to be discovered as well as those previously recorded–is 500 to 1,000 (Billeck 1993). Presuming that 500 lodges was the total that existed during the 150 to 250 years during which the locality was home to Nebraska Phase people and that individual lodges would be relocated and rebuilt approximately every 10 years, Billeck (1993) estimates that the total Nebraska Phase population in the locality at any given time was in the range of 366 to 495 individuals and that only 20 to 33 lodges would have been occupied at any one time. Another estimate, based on computer simulation studies, places the Glenwood locality Nebraska Phase population as low as about 100 persons at any one time (Zimmerman 1977).

[31] Although Oneota sites are almost unknown in the Loess Hills, Oneota sites exist nearby to the east and west. Dixon has already been mentioned. Correctionville in Woodbury County is another large Oneota village not far from the Loess Hills and may date to circa A.D. 1300 and possibly earlier (Henning 1996; Fishel 1999). In all, eight Oneota sites have been recorded to the east of the Loess Hills along the Little Sioux River in Woodbury County (GIS data from the OSA). The Leary site across the Missouri River in Richardson County, Nebraska, may date as early as the thirteenth century, and an early Oneota component exists along the Platte River near Ashland in Saunders County, Nebraska, about 25 miles from the mouth of that river (Logan 1996; Henning 1996, 1998b; John R. Bozell, personal communication, to Tom Thiessen, June 9, 2000). The Oneota people who lived at these sites may have interacted with the Loess Hills Late Prehistoric inhabitants (particularly the Nebraska Phase people at Glenwood) in different ways, possibly at the time of a widespread climatic change that may have made it more difficult for these farming peoples to survive.

1998b). Like the Plains Village cultures, Oneota is thought to have developed about A.D. 900 or 1000, although there is no evidence for Oneota presence in northwestern Iowa that early. The Dixon Oneota village (13WD8), located along the Little Sioux River in Woodbury County to the east of the Loess Hills, dates to the approximate period A.D. 1300 to 1440 and is the earliest Oneota occupation yet known in northwestern Iowa (Harvey 1979; Henning 1998b; Fishel 1999). Originally thought to have been an outgrowth of Mississippian culture (Griffin 1946), the beginnings of the Oneota tradition date as early as the beginning of Mississippian culture, which would appear to rule out that possibility (Brown 1982; Tiffany 1991b).

At about A.D. 1200 or 1250 the Pacific climatic episode began and eventually affected much of the vast Plains region for the next 200 years (Bryson and Baerreis 1968; Anderson 1981). This change resulted in a warmer, drier climate than the preceding Neo-Atlantic climatic episode, which had presented warm, moist conditions optimal for the growing of corn and other native garden crops (Bryson and Baerreis 1968). This change to a drier climate may also have induced large bison herds from the Plains to penetrate further eastward into the Prairie Peninsula in search of more adequate forage. This could have resulted in resource competition between the Mill Creek villagers and the Oneota villagers that led to warfare between the two groups. As Anderson (1981) has concluded:

> ...It appears that the Oneota, with their pattern of periodic movement and subsequent reoccupation of sites coupled with an increased emphasis on hunting (and raiding?) had a more viable and adaptable culture pattern than the Mill Creek people with their tightly knit, horticulturally based hamlets... .

Possibly the Mill Creek withdrawal or disappearance from the Loess Hills and western Iowa in general was due to a combination of Oneota hostility, worsened climatic conditions for horticulture, and local resource (e.g., timber) depletion through use. The decline of Cahokia and its far-flung trade network, which occurred at about the same time as the other changes, may also have been a factor (Anderson 1986, 1987).

By about A.D. 1300 the Mill Creek villagers are thought to have moved westward into South Dakota, where they were absorbed by other culturally related Plains Village peoples. Ultimately they may have emerged into recorded history as the Mandan or Hidatsa people, Siouan-speaking tribes that flourished along the Missouri River in present-day North Dakota, although other historic tribes have been suggested as their descendants as well (Ives 1962; Anderson 1969; Henning and Henning 1982). Great Oasis people also seem to have disappeared from the Loess Hills and adjacent region by about A.D. 1300, probably also due to Oneota resource competition and hostility, and perhaps climatic changes as well.

The relationship between the Oneota and the Nebraska Phase villagers of the Glenwood locality appears to have been of a different nature than that between the Oneota and Mill Creek peoples (Billeck 1993; Henning 1998b). Nebraska Phase sites at Glenwood have yielded Oneota-like pottery. If not obtained directly through trade with Oneota groups, this pottery was made in imitation of Oneota ceramics, probably after peaceful contacts between the two peoples.

By circa A.D. 1300, the Nebraska Phase folk--a farming people heavily dependent on maize horticulture--also disappeared from Iowa. In the absence of evidence of a hostile relationship with Oneota peoples, this abandonment of the Loess Hills in general and the Glenwood locality in particular could have been due to the advent of the Pacific climatic episode which may have brought sustained drought to the region.[32]

[32] Oneota peoples, in contrast, persisted long after the disappearance of the village complexes from the Loess Hills. Although Oneota people do not appear to have lived in the Loess Hills at any time, they were widespread elsewhere during

Early Contact. Whatever unknown circumstances caused the elimination of the Great Oasis, Mill Creek, and Nebraska Phase peoples from the Loess Hills in the 14th century, the effect was lasting. For more than three centuries, the Loess Hills were virtually devoid of human activity. Protohistoric [33] evidence indicates that by the mid-17th century occasional use of the Loess Hills, now in contact with the early French fur traders, had recurred. Although none of them have been studied thoroughly, four Native American sites of the protohistoric period have been recorded in western Iowa. One is in the Loess Hills within Harrison County; the others are located east of the Loess Hills in Woodbury, Harrison, and Fremont counties (GSI data from the OSA).

A French trader named LeSeuer heralded the beginning of the historic period in 1701 by creating the first documentary record of human activity in western Iowa, a description of an Ioway village just east of the Loess Hills near Spirit Lake (Mutel and Swander 1994). Other Ioway sites during the early historic period are known, including one in the Loess Hills in Pottawattamie County[34] (GIS data from the OSA). By 1877 the Ioways had moved eastward to an area along the Des Moines River, but they continued to roam across the region until a series of treaties increasingly restricted their movement, culminating in their relocation west of the Missouri River in 1832 (Mutel 1989a). The Otos apparently shadowed the Ioways for a time, then established themselves along the Platte River in Nebraska about 1700. The Missourias occupied the southernmost portion of the Loess Hills until they joined the Otos along the Platte River.[35] The Omahas once had a large settlement along the Big Sioux River, but they also resettled in Nebraska. The Dakota Sioux frequently traveled from their villages in southern Minnesota to hunt in the Loess Hills (Blaine 1979; and Mutel 1989a).

French fur traders and missionaries were the first Euro-Americans to discover the Loess Hills, claiming the region for their mother country. Their footprint on the land was light. The rivers provided the initial access for the traders and priests, and later for more substantial numbers of settlers. Further inland, fur traders followed the Indian trails. In the northern Loess Hills, these paths tended to follow the ridge tops; farther south, they nestled in the valleys.[36]

Following their loss of the Seven Years War in 1763, the French transferred their claim to Spain. The Spanish returned the area to France in 1800. France sold the area to the United States in 1803 as part of the Louisiana Purchase. The following year, President Thomas Jefferson sent Meriwether Lewis

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the centuries that followed A.D. 1300 and ultimately emerged into recorded history as a number of different cultural groups, including the Winnebagos, Ioways, Otos, Omahas, Poncas, and others for which the linkage to Oneota forebears is less well known (Alex 2000).

[33] "Protohistoric" is a term used by archeologists to denote sites where small quantities of Euro-American trade artifacts have been found, but for which no written documentation exists. Protohistoric time immediately follows the first direct or indirect contact with Euro-American culture but precedes the advent of the historic period for which a documentary record exists.

[34] The Ioways are known to have occupied a village below the Loess Hills bluff line near present-day Council Bluffs before Lewis and Clark passed by in 1804.

[35] The council of the Otos and Missourias with Lewis and Clark on August 3, 1804, later gave its name to the city of Council Bluffs (Mutel 1989b).

[36] Euro-Americans later used the same routes as wagon roads, and eventually they were developed as highways, such as Highway 75 from Council Bluffs to Big Sioux River, and another road in Woodbury County which used approximately the same trace as Highway 141 (Rogers 1990; and Lindgren n.d). The Sioux City Rock River Road northwest of Sioux City was initially an Indian trail (Rogers 1990). By the late 1800s many roads were realigned "where technology would permit, most often on section or quarter-section lines" (Bonney 1994), but most roads within the hills continued to follow the historic paths.

and William Clark to explore the new territory. The expedition spent much of July and August 1804 traveling the portion of the Missouri River adjacent to the Loess Hills, exploring, hunting, and documenting their beauty and bounty.[37]

Government agents and traders followed. Manuel Lisa established the first trading post, Fort Lisa, on the western side of the Missouri in 1809. In 1819 the government built a military outpost, Fort Atkinson, just north of what would become Omaha; the post was operational for eight years. With its complement of 1,000 men, Fort Atkinson was the largest and westernmost military fort of its day (Mutel 1989a).

Gradually more traders entered the region. In 1824 a fur trader by the name of Hart built a post on the bluffs above Mynster Spring; that post was within the current confines of Council Bluffs. The area was known as "La Côte d'Hart" or "Hart's Bluffs." In 1827 American Fur Company trader Frank Guittar established another post "in the timber at the foot of the bluffs" on what is now Broadway in Council Bluffs (Andreas 1875; and Tostevin 1870).

In 1833 the U.S. government relocated the Potowatomis,[38] approximately 2,000 in number, from Illinois to southwest Iowa. The largest village was near modern Council Bluffs, with smaller villages farther south. The Potowatomis lived primarily by hunting the game-laden Loess Hills, gathering native plants and planting small gardens. Periods of poor hunting and attacks by their northern Siouan neighbors resulted in hard times. Drunkenness encouraged by the white traders did not help (Mutel 1989a).
The first permanent white settler of the region was Major Stephen Cooper, an Indian agent who settled a farmstead four miles southwest of modern Sidney in 1836. Similarly, the first Euro-American settlers in Pottawattamie County were David Hardin, a farmer, and Stutely Wicks, a miller, who came in 1838 on behest of the federal government to train the area Indians in their trades (Dodge 1932[39] and Tostevin 1870). That same year, an outbreak of cholera decimated native tribes in the area (Van der Zee 1913). Other white settlers trickled into the Loess Hills area in the late 1830s and early 1840s.

The Army established Camp Kearney on the plateau of a steep bluff overlooking present-day Council Bluffs to protect the traders and maintain peace among the Indians in 1839 (Andreas 1875; Babbitt

[37] Sergeant Charles Floyd died, apparently from an attack of appendicitis, while the expedition was traveling just south of the Missouri's juncture with the Big Sioux River. Floyd was the expedition's only fatality, and the first United States soldier to die west of the Mississippi River. Lewis and Clark buried Floyd's remains high above the Missouri both to protect the burial from flood damage and to provide a landmark by which subsequent river travelers could fix their location. Years later, the wooden cross erected by Clark, together with some of Floyd's remains, began to slough from the face of the bluff. The sergeant's body was reburied slightly inland, and a substantial monument was constructed to mark the grave in 1901. The 100-foot tall Kettle River sandstone obelisk overlooking the Missouri River valley was the first property to be designated as a National Historic Landmark under the authority of the Historic Sites Act. The monument is publicly owned and available to the public.

[38] Originally from southern Michigan, the Potowatomis were forced to move several times, first to Ohio, then Illinois, on to Iowa, and finally Kansas and Oklahoma. Waubonsie, Chief of the Potowatomis, was born in Ohio and was forced to move with his tribe to northern Illinois. In 1833, the Potowatomis ceded their lands east of the Mississippi River in exchange for an area in southwestern Iowa. The tribe was moved again, this time to an area between modern Sidney and Glenwood. When the Iowa/Missouri border question was settled, the Potowatomis south of the boundary were relocated out of Missouri into Mills and Fremont Counties in western Iowa (Blackburn personal communication; Mutel 1989b). When Iowa's bid for statehood required the cession of all lands held by Native Americans in 1846, Waubonsie negotiated a two-year reprieve for his people, and permission for the aging Chief to remain in Iowa. Waubonsie's gravesite in Lyons Township, Mills County is privately owned and unavailable to the public.

[39] Dodge incorrectly fixed the date at 1828.

1925; and Bonney 1986). In 1842 the likelihood of war between the Sioux and the United Tribes[40] heightened, and the federal government responded by building another post, Fort Croghan, between the mouths of the Boyer and Mosquito rivers (also now Council Bluffs). Apparently the tension among the native tribes lessened a year later; in 1943 the government gave Fort Croghan to Father Pierre-Jean deSmet for the purpose of establishing a mission among the Potowatomis (Bonney 1986).

Although the Missouri Valley was just opening to settlement in the late 1830s, the Mississippi Valley was densely populated by this time. When Iowa Territory was separated from Wisconsin Territory on July 4, 1838, it included all of present Iowa and parts of North Dakota, South Dakota, and Minnesota. Due to heavy settlement in the eastern half of the territory, it already met the population requirement and immediately established a territorial legislature (Schweider 1996). Iowa Territory moved quickly to meet the other requirements for statehood.[41]

The first migrants came to the southern portion of the Loess Hills (what would become Fremont County) by way of the Missouri River. Thinking they were still in the State of Missouri, some brought slaves.[42] The early towns were established along the transportation routes, along the Missouri River at the base of the bluffs, or in the valleys of the Missouri's tributaries. Towns frequently developed at former fur trading or military forts. For example, Hamburg in Fremont County was built on the site where Augustus Borcher started trading with area natives in 1847. The first historic structure in what is now Council Bluffs was an American fur trading post established there in 1824. Sioux City, too, was built upon the location of Brughuier's old post.

On March 30, 1845, Congress authorized the State of Iowa; this authorization included a western boundary 40 miles west of Des Moines, and excluded the Loess Hills (Marks 1904). By the Treaty of June 5, 1846, the Potowatomis relinquished their claim to land in Iowa, and were removed to Kansas (Andreas 1875).[43] Five days after the treaty was signed, the Territorial Legislature proposed new boundaries extending to the Missouri River on the west and the St. Peter River (now in Minnesota) on the north. On August 4, 1845, Congress fixed the current boundaries of the state. A close majority ratified the proposal, and Iowa was admitted to the Union on December 28, 1846 (Marks 1904).

On the day the Great Father and Chief Waubonsie signed the treaty by which the Potowatomis relinquished their Iowa lands, the first group of Mormons made their first camps along the banks of the Missouri River. This signaled a major change in human occupation and use of the Hills.

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[40] Primarily Potowatomis , together with a small number of Chippewas and Ottawas .

[41] The Northwest Ordinance of 1787 established procedures for settling new territory : Although the Ordinance required fair treatment of Native Americans under territoriality, Natives were to relinquish claim to lands before an area could be settled. After a government survey, the lands were available for purchase by Euro-American settlers. Congress appointed a territorial governor. When the adult male population reached 5,000 in number, the territory could choose a legislature and send a non-voting delegate to Congress. Finally, the territory could apply for admission into the Union when the total population reached 60,000.

Contrary to the Northwest Ordinance, Euro-Americans entered western Iowa in great numbers before the requirements for the Indian cession of land and the official surveys could be met. In 1841, the U.S. Congress passed the Pre-Emption Act, allowing squatters the opportunity to gain title to the lands they occupied once the survey requirements were met (Sheese 1989).

[42] At the time, Missouri claimed that its northern boundary was 10 miles to the north of its current boundary, and considered the disputed area open to slavery. When the Supreme Court settled the boundary question in 1849, most slaveholders in the disputed area moved south (Bonney 1986).

[43] The Potowatomis reserved the right to remain until 1848 (Andreas 1875).

The Mormons. Joseph Smith established the Church of Christ,[44] on April 6, 1830, in Fayette, New York. Smith suffered his first arrest for his religious teachings there the following year. He left New York and established colonies of his followers, or "Saints," in Kirtland, Ohio, and Independence, Missouri. Religious tensions forced them to leave both states in 1838. The situation in Missouri was particularly intense; Governor Lillburn Boggs issued an order requiring that the Mormons be "exterminated or driven from the state if necessary." Hostilities erupted at Crooked River and at Haun's Mill. Hoping to avoid further bloodshed, several Mormon leaders, including Joseph Smith and his brother, Hiram, turned themselves in. They were imprisoned in Liberty, Missouri. Their followers searched frantically for a new home (Hill 1996).

In February 1839, Isaac Galland inquired on behalf of the Mormon Church whether Mormons would be allowed to settle in Iowa. Appalled by Missouri's mistreatment of the Mormons, Iowa Governor Robert Lucas replied that, as U.S. citizens, they would enjoy all the rights thereof in his territory. The first Mormon settlement in Iowa was in the southeast corner along the Mississippi River. At the same time they purchased part of an existing settlement across the Mississippi in Illinois and changed its name from Commerce to "Nauvoo," which means "beautiful place." Upon his release[45] from the Liberty jail, Joseph Smith settled in Nauvoo and declared it the "seat" of the Mormon Church (Bloomer 1871a).

The Church sent Brigham Young, H.C. Kimball, Orson Pratt and Perly Pratt to London as missionaries. Thereafter, many converts came from the British Isles, Scandinavia,[46] and other countries to settle in Nauvoo (Bloomer 1871a; and Hill 1996). By 1844 the once-sleepy town of Commerce had become the bustling Nauvoo with 20,000 residents, mostly Mormon. The population boom signaled a period of unprecedented prosperity. Because Mormons were likely to look within their religious community for goods and services, the gentiles in the community did not share that prosperity. The Gentiles resented the disparity, and tensions mounted.

Smith's 1843 revelation allowing polygamy fueled the anti-Mormon sentiments. In June of 1844, Joseph and Hiram Smith were ordered to report to Carthage, Missouri. Warned not to go, Joseph Smith replied that he was not afraid to die, and predicted: "I am going like a lamb to the slaughter, but I am calm as the summer morning. I shall die innocent, and it shall be said of me: 'He was murdered in cold blood.'" True to prediction, the Smiths were shot and killed by a Carthage mob on July 27, 1844 (Bloomer 1871a; and Hill 1996). The Church of Jesus Christ of Latter-Day Saints elected Brigham Young to succeed Smith as their leader.

In September 1845 the residents of Quincy, Illinois, passed a resolution ordering the Mormons out of that state. The Saints asked for and received permission to stay until Spring so that they might travel successfully. The migration began in February, and by May 1846 approximately 16,000 Mormons had passed from Illinois to Iowa. The last were forcibly removed from Nauvoo in September (Bloomer 1871a). The Mormons began what would be their final trek to Zion, the Great Salt Lake Valley in the West.[47]

[44] The faith was renamed the Church of Jesus Christ of Latter-day Saints eight years later (Hill 1996).

[45] William Hill called it an "escape." See Hill 1996.

[46] Many Danes, upon conversion to the Church of Jesus Christ of Latter-Day Saints (Mormonism). came to Iowa in the 1850s and '60s. Others came to Iowa as railroad workers. The majority of Danes settled in southwestern Iowa. The Danish community is centered in Elk Horn, Shelby County (Schweider 1996).

[47] Thus the motivation for establishment of the Mormon Trail was religious rather than economic, a major distinction from other trails of westward expansion.

Travelers gathered in groups of "fifties"—so called for the number of adult males in each group. Initially they tried different routes toward the west; the eastern portion of the trail across Iowa was more of a "braid" than a single path. As they journeyed, the Mormons set up camps and permanent settlements to accommodate their own needs and those of subsequent travelers. The first semi-permanent camp was Garden Grove, established in April in Decatur County, Iowa, where they cleared land, planted crops, and even built log homes for later emigrants. The following month they made another semi-permanent camp at Mount Pisgah in Union County, where they planted 1,000 acres and built houses, public buildings, and a church. The Mount Pisgah settlement remained until 1852 (Decision Data, Inc., and Tallgrass Historians, L.C. 1998b).

In western Iowa the trail followed the ridges of the loess bluffs. On June of 1846,[48] the first group stopped for the night at a site on Mosquito Creek that then overlooked the Missouri River. The following day, they continued to a spot just north of Peter Sarpy's trading post.[49] Noting the unfavorable swamp-like conditions at the Missouri River camp, the group returned to Mosquito Creek and made their camp where Pony Creek empties into the Mosquito[50] (Decision Data, Inc., and Tallgrass Historians, L.C. 1998b). This third settlement, which proved permanent, was called Kanesville[51] (later Council Bluffs).
Setting up their temporary headquarters on a plateau overlooking the river, the Saints camped throughout the area's hills and valleys …

> … locating themselves among the groves, and along the numerous beautiful streams of clear, pure, water [sic] that traverse western Iowa. The timber covering the bluffs and skirting the water courses, hitherto frequented only by the Indian, the elk, and deer, was … cut down could not be secured, holes and caves were dug in the hillsides, for the purpose of securing protection from the keen wind [sic] (Bloomer 1871b) and converted into log cabins for the accommodation of the newcomers; and where these THIS JUST ENDS

In August, Brigham Young and others led a portion of the group to the west side of the Missouri River, establishing "Winter Quarters" in what became Florence, Nebraska. The following Spring, Young led a small part of the Mormon contingency on to the valley of the Great Salt Lake in what would become Utah. The majority of the Mormons remained in the Missouri River valley and planted corn and other crops to provide for themselves and subsequent travelers (Bloomer 1871a).

In June of 1848 the second great wave moved to Zion. Those who remained in western Iowa were concentrated around Pigeon Creek and the Nishnabotna River. Using the 1839 army outpost as their center point, Mormon leaders constructed a church and their own residences nearby. They established a post office, calling the town Kanesville. The Mormon settlers built a large building on Harmony

[48] William Hill placed the date as June 5, 1846; Decision Data's report said it was June 13; and Dexter Bloomer said July 1.

[49] Fur trader Peter Sarpy camped at the feet of the bluffs in Pottawattamie County (Bloomer 1871b). Due to subsequent shifts in the Missouri River channel, the Sarpy post and Missouri River Camp are now on the Nebraska side of the river.

[50] Currently in an urban area, the Mosquito Creek Camp No. 2 was approximately 3/8 mile north of the modern Iowa School for the Deaf campus (Decision Data, Inc., and Tallgrass Historians, L.C. 1998b).

[51] The settlement was briefly known as "Miller's Hollow" in honor of Henry Miller, a prominent Mormon who built a log cabin and a general store at the camp. Shortly thereafter, the town was renamed "Kanesville" (Negus 1971). Kanesville would probably have been temporary, too, had it not been designated the Pottawattamie County seat and a major outfitting center for other westbound travelers. Blacksmith shops, ferry operations, construction companies and (perhaps most importantly) a Government Land Office were established there, filling needs that outlasted the Mormon migration (Decision Data, Inc., and Tallgrass Historians, L.C. 1998b; and Bonney 1994).

Street, which was used for both religious and secular purposes. On Hyde Street they built a 2-story structure that served first as a school and later a courthouse. Later they added a "mammoth tabernacle" large enough to seat 11,000. The Mormons built another large church about seven miles north of Kanesville along Pigeon Creek. Orson Hyde initiated the first newspaper in western Iowa, *The Frontier Guard*, in 1848. *The Bugle*, also a Mormon paper, was started in 1850 (Bloomer 1871a).

The entire Mormon community was hard-hit by a cholera epidemic in 1849-50. With few physicians and little medication to fight the scourge, hundreds were buried on a high bluff overlooking the Missouri River.[52] In 1850 when Pottawattamie County was separated from Monroe County, the census at Kanesville recorded 7,828 residents[53] (Bloomer 1871a).

From 1848-53, the Mormons were the predominant occupants of Pottawattamie and Mills Counties. However, they were not the only occupants, largely because their efforts to ensure safe passage of the Saints to Zion resulted in developments that were advantageous to other westward-bound migrants. The Mormon Trail was unusual among the west-bound trails in that it was actually utilized to travel both directions: Church leaders led groups to the Salt Lake Valley, then returned to guide the next group west. Sometimes described as a "village on the march" (Mutel 1989a), the Mormons built whatever they would need for their mission; in addition to camps, they constructed bridges and ferry stations, and even left mileage markers for the use of subsequent travelers on the route. The Mormon Trail was so well established that California-bound prospectors and settlers on their way to Oregon took advantage of its developments in subsequent waves west. For all of these migrations, Council Bluffs was a major outfitter for the westward migration and the California gold rush. Some gentiles stayed in the area, filling "gaps" in the local economy by establishing saloons and gambling institutions (Bloomer 1871a).

This influx of gentiles introduced conflicts of morality, and tensions began to mount. In 1852 Brigham Young called the faithful to leave what he considered to be an increasingly sinful Iowa environment and come to Utah. Gentile residents of the area were pleased to see the polygamist church leaders leave. Many gentiles personally benefited from the Mormons' call to Zion, as Mormons sold their goods and businesses to those who stayed in the area (Decision Data, Inc., and Tallgrass Historians, L.C. 1998b).
Although Young called all Mormons to Zion in 1852, the migration continued well into the 1860s,[54] and not all Mormons emigrated. Some stayed behind to ensure an adequate stock of food and provisions for the migrants. A fair number stayed to care for family members too frail to make the journey; others remained because they disapproved of Young and his doctrine of polygamy (Bloomer 1871a).[55]

[52] This burial site is now part of Fairview Cemetery.

[53] Women greatly outnumbered men, and polygamy was practiced in Iowa, but only by church leaders (Bloomer 1871a).

[54] By 1856 a new wave of Mormon migrants, converts originating from Europe or the eastern United States, were traveling as far west as they could by rail (to Iowa City), then continuing the trip with handcarts filled with "clothing, bedding, and provisions and children unable to walk" (Dodge 1932). The carts weighed an average of 90 pounds, and had to be pushed by hand over rough terrain. A typical group would have approximately 100 people with 20 carts, 5 tents, 3-4 cows, and 3 yoke of oxen. Several hundred migrated, many from England. In 1856, 420 started out from Iowa City; only 67 continued all the way to Salt Lake (Decision Data, Inc., and Tallgrass Historians, L.C. 1998b; and Dodge 1932).

More than 70,000 Saints traveled westward along the Mormon Trail between 1846 and 1868 (Decision Data, Inc., and Tallgrass Historians, L.C. 1998b).

[55] Among those who rejected Brigham Young's doctrine of polygamy was Charles B. Thompson. He stayed in western Iowa and established his own branch of the Church in Monona County. Selecting a site along Spring Grove Creek in the Soldier River valley, Thompson founded the town of Preparation in 1854. Before long, Preparation boasted several log houses, a sawmill, and a hotel. However, all was not well. Thompson demanded that his followers deed all of their property, both

Nevertheless, 1853 was a watershed year in Kanesville's history. A change in the city's name to Council Bluffs signaled the transformation of the city from a Mormon settlement to a gentile one. A great fire on November 14, 1853, destroyed 25 buildings, including the entire Council Bluffs business district. Another fire exactly one year later destroyed another 17 (Bloomer 1871b). Entrepreneurs established regular ferry service between Council Bluffs and Omaha, a new town platted across the Missouri River in Nebraska Territory in 1854. Land speculation was feverish in 1855-57, but finally settled down during the Panic of 1857. Western Iowa was largely relieved of the financial strains of the 1857 Panic; émigrés on their ways to California, Oregon, and Utah kept the outfitting center bustling with trade (Bloomer 1872).

Other Loess Hills Settlers. About the same time the Mormons established themselves in Pottawattamie and Mills Counties, farmers and entrepreneurs settled in other parts of the Loess Hills. McKissick's Grove, the first white settlement in Fremont County, was established in 1840. Dr. Ira D. Blanchard settled in Civil Bend in 1846. By 1847 there was a general store in Hamburg, and John Leeks constructed the first gristmill in the county on Plum Creek that following year (Andreas 1875). Fremont County was organized in 1850-51. Orchards of apples, cherries, and other small fruits thrived there in the 19th century, as did groves of wild grapes, raspberries, strawberries, and plums (Andreas 1875). Mills County was separated from Pottawattamie County in 1851. Coonville, originally a Mormon camp, was designated the county seat. Shortly thereafter, the Coonville's name changed to Glenwood (Andreas 1875). Daniel Brown was the first white settler in Harrison County; he arrived near present-day Calhoun in 1848 (*Atlas of the State of Iowa* 1924). When Harrison County organized in 1853, Magnolia was named county seat. Logan, settled in 1867, replaced Magnolia as county seat in 1875. Isaac Ashton was the first Euro-American in Monona County; he settled just north of present-day Onawa in 1852. The county was organized in 1854, establishing its seat at Bloomfield. The town was forced to change its name to "Ashton" when it was discovered that Iowa already had a town named "Bloomfield" (Andreas 1875). What is now Woodbury County was established as Wahkaw County in 1851. Two years later the name was changed to Woodbury and the county seat fixed at Sergeants Bluff (Marks 1904). In May 1849 Theophile Bruguier of the American Fur Company settled at the mouth of the Little Sioux River with his Indian wife (the daughter of Chief War Eagle) and their four children. War Eagle, his daughters, and Bruguier were buried on a bluff overlooking the settlement that was within the town platted as Sioux City in 1854-55 (Andreas 1875). At the time, only two log cabins stood at the town (Andreas 1875; and Marks 1904). William Thompson established a town near Sergeant Floyd's grave; the first African-American settler in the region, John Brazo, settled in Thompsontown in 1850 (Lindgren n.d.).

One of the most interesting early settlements in Fremont County was the Congregationalist settlement of Tabor. The Congregationalists (like the Baptists and Methodists more common in eastern Iowa) were anti-slavery, and Tabor's proximity to slave-holding Kansas gave residents ample opportunity to practice their abolitionist beliefs. A group moved to Fremont County from Oberlin, Ohio, in 1848, hoping to establish a Congregational College in western Ohio. George Gaston, Rev. John Todd, and William Brooks originally settled with ten other families in Percival along the Missouri River, but Todd's cattle wouldn't eat slough grass, so they moved south. Gaston, Todd, and Brooks established Tabor College in 1852 on 20 acres given to them by Gaston's neighbor, Ira Blanchard, a close associate of the infamous abolitionist, John Brown. Blanchard, Todd, and the others formed a network among their colleagues to assist African Americans in leaving the slave territory of Kansas for freedom in the North. Sources indicate seven landowners in Mills County and 33 in Fremont

real and personal, to him. Hugh Lytle led a group in protest of Thompson's policy; Lytle's group left Preparation and sought recovery of their property rights in court. Although the initial lawsuit failed, objections to the religious leader' policy spread, and Thompson left Preparation in 1858 (Rogers 1990).

County were actively involved in the Underground Railroad. Todd's house was the focal point of the network's southwest Iowa anti-slavery activities, and John Brown's secret headquarters in Iowa.[56] Crossing the Missouri River from the west, African Americans hid in the slough grass along the Missouri and Nishnabotna rivers, or in the hills (Department of Cultural Affairs 1999). "The usual route of the underground railway followed the valley. It crossed the river at Nebraska City, followed the old river bend around to the Rickett's place, crossed it, and continued up past Lester Platt's to Dr. Blanchard's, then past Rube Williams', Joe Treat's, and on to [John Todd's house in] Tabor" (Ricketts n.d; Blackburn, personal communication).

While most who came to establish businesses came by river, those who came to farm generally arrived over land (Dodge 1932). "Settlement was limited to river valleys because they were wooded, and the rivers provided dam sites for flour mills as well as a ready means of transportation" (Conard and Cunning 1990). Early migrants settled at the base of the hills, avoiding the creek beds for fear of disease. Like prehistoric peoples, they settled on the south faces of the bluffs, which gave them the advantage of the sun for warmth and protection from cold north winds in winter. It was a relatively simple matter to carve out caves for shelter until more suitable housing could be constructed (Reese 1994). As more settlers came, they farmed the shallow valleys and used the hills for grazing livestock.

The first steamboats began running the Missouri River to serve the fur traders in 1831. Gradually the market changed and agricultural supplies and residential goods became the primary cargoes. In the 1850s and '60s, most of those coming to Council Bluffs traveled by land to St. Louis or Jefferson City, Missouri, then by steamboat up the Missouri River (Holt 1925). For more than a quarter-century, Council Bluffs was the boats' northernmost regular stop. The first chartered steamboat reached Sioux City in 1856 (Rogers 1990). Regular steamboat service to Sioux City was established in 1859 (Holt 1925); and by 1860 Sioux City's market dominated the Missouri River traffic. In the 1860s, five steamboats visited Sioux City annually (the most famous of which was the *Omaha*) carrying groceries, farm implements, mining tools, and passengers (Holt 1925).

Early roads went north-south along the base of the bluffs, and east-west along river valleys when feasible. By 1851 the South Tier State Road crossed Iowa's southernmost tier of counties from Bloomfield on the east to East Nebraska City (also called Eastport) on the west. Dirt roads connected the farmers to towns, and before long one was established the length of the Loess Hills at the base of the bluffs from Hamburg north to Sioux City (Bonney 1994). By the 1850s stagecoach service was available along Iowa's western border, and post offices were established in most towns along the routes (Rogers 1990). Additional stagecoach roads traversed the hills; the trace from Glenwood to Tabor is still easily visible along the ridge tops (Blackburn personal communication). Nevertheless, development of the Loess Hills region was sparse until railroads came in the 1860s and '70s,[57] permitting settlement further away from the waterways (Rogers 1990).

The Railroads. "Railroad companies were the largest landowners in the West after the land grants of the 1850s, and … the key to continued extension of the railroads west was the disposal of unused lands for cash" (Conard and Cunning 1990). Some railroads had land agents on their payrolls; others controlled local real estate agencies. They offered discounts and/or low interest as inducements to

[56] Brown used Todd's house to conceal arms and ammunition that Brown later used in confrontations in Kansas and for the 1859 insurrection at Harper's Ferry, West Virginia. The John Todd House in Tabor, Fremont County, is listed on the National Register of Historic Places for its historical and architectural significance.

[57] The first railroads crossed the state in 1867. These provided a year-round access to eastern markets, and transportation to areas inland from the rivers and streams. In 1869 the first transcontinental railroad was completed; the Western Stage Company went out of business that same year.

settlers in the 1870s. Land sales boomed along the rail lines, and so did land prices.[58] The railroads established towns 5-15 miles apart.[59] More towns meant more money for the railroads.[60]

The railroads provided the land, and access to the land. In many instances, they also provided the population. "Railroads needed laborers to build the roads, and they needed settlers to assure passengers and freight on the new lines. To solve the problem they went to Europe to encourage immigration, met arrivals at eastern seaports to bring settlers west" (Conard and Cunning 1990). Beginning in the 1850s railroads printed brochures praising the Midwest, even reminding eastern women of the large number of unmarried men in the West. "Once the companies published their routes, towns from which construction would begin did a bush business as tradesmen and laborers flocked there in search of [jobs] on the railroad" (Conard and Cunning 1990). Hotels were established. Women made money as laundresses and bakers, and rented rooms to boarders.

Most early railroads focused on the southern half of the state, extending lines toward Council Bluffs where they could tie into river traffic, and later to the transcontinental railroad (Conard and Cunning 1990). The first such route was planned in 1858 when a meeting convened in Council Bluffs to discuss the potential for year-round rail connections with St. Louis and St. Joseph, which they hoped would enable traffic to continue even when the Missouri River was not navigable.[61] Unfortunately, the Civil War interrupted those plans (Halma 1974). The St. Joseph & Council Bluffs Railroad reached Bartlett in Fremont County, Iowa, in January 1867, and was extended to Council Bluffs in August of the following year (Halma 1974).

The St. Joe & Council Bluff was not the greatest railroad plan in the works. Grenville M. Dodge, then of Iowa City, first visited Council Bluffs while surveying for the Chicago & Rock Island Railroad in 1853. Immediately aware of the city's potential, Dodge established his residence in Council Bluffs.[62]

[58] Early land speculation associated with the railroads was a major cause of the financial Panic of 1857. Although Iowa prohibited the issuance of state paper money, Nebraska bills were common in western Iowa. The failure of Benton's Bank in 1857 signaled the beginning of the Panic in Council Bluffs. According to Sidney Halma, "Council Bluffs residents were literally without money for some time." Stores issued their customers coupons worth five to fifty cents toward purchases, and farmers burned corn for fuel. Nevertheless, the emigrant trade protected Council Bluffs from the full impact of the Panic. The 1858 discovery of gold near Pikes Peak in Colorado stimulated a revival in the outfitter trade. Although the rush lasted only one year, the positive effects for Council Bluffs endured. The rush stimulated a boom in the Bluffs, witnessed by the construction of hotels, initiation of a "horse railroad" from the city to the landing, and the establishment of the city's first pork packing plant in 1859 (Halma 1974; Bloomer 1872).

As the Colorado gold rush waned, settlement of the trans-Missouri west burgeoned, and Council Bluffs was ready to outfit the new wave of farmers. Newspapers publicized the Mormon Trail as the "natural highway" to the west. The Council Bluffs Nonpareil published maps of the overland trail following the Platte River across Nebraska and into Colorado, marking every ferry stop, bridge, and station along the way. At least one of these maps falsely depicted Council Bluffs as being closer to the emigrants' destination than it actually was. By April of 1860, fifty wagons left Council Bluffs daily for the west, and another "1,000 emigrants arrived by steamers, wagons, or stage" daily. Four out of five of those emigrating from Iowa, Illinois, Indiana, and points northeast came to Council Bluffs. Many of those who arrived with intentions to travel further chose, instead, to stay and participate in the profitable outfitters' business (Halma 1974).

[59] The towns grew around the railroads following a rhythmic pattern : first depots and grain storage facilities, then businesses, and finally homes (Bonney 1994; Conard and Cunning 1990). The pattern is still evident in most railroad towns in the Hills.

[60] Most new towns in western Iowa were founded in the last quarter of the 19th century, following the introduction of railroads.

[61] River travel was dangerous due to hairpin turns prior to channelization, and it was only possible 7-8 months per year. (Rogers 1990).

[62] The Grenville M. Dodge House was designated a National Historic Landmark in 1964 for its association with General Dodge, a Civil War hero and railroad tycoon.

In 1859 Dodge used his personal connections with Republican Presidential candidate Abraham Lincoln to promote a transcontinental railroad through Council Bluffs and along the 42nd parallel. Dodge argued that the 42nd parallel was the practical, economical, and logical continuation of existing routes from Chicago west. Besides, Council Bluffs was already well established as an outfitting town. Lincoln, who himself owned 17 lots in the city, readily supported Dodge's proposal (Halma 1974).

Once the South seceded in 1861, Lincoln had no trouble warming Congress to the concept of a transcontinental railroad as a military necessity. The cost was relatively small in the context of the war effort. The federal government formed the Union Pacific Corporation, gave it ten sections of land, and promised $16,000 for every mile of track laid.[63] The President summoned Dodge to Washington to discuss possible sites for the eastern terminus of the Union Pacific, and Dodge apparently convinced him to place it at Council Bluffs. However, Lincoln's proclamation was unclear and mentioned Omaha instead. When asked to clarify the situation, Lincoln issued a new proclamation, this time establishing the eastern terminus at "the western boundary of the State of Iowa." Thus, Omaha/Council Bluffs became the western terminus for the country's first transcontinental railroad (Halma 1974).

Grenville Dodge used his influence to bring the Chicago & Northwestern to Council Bluffs in 1866. The Sioux City & Pacific joined Council Bluffs and Sioux City in 1868. On May 12, 1869, the Chicago & Rock Island reached the city. The Burlington & Missouri Railroad arrived in Council Bluffs the following December (Halma 1974). Because of its location on the Missouri River and its status as terminus of several railroad lines, Council Bluffs became a major trade center.

So, too, did Sioux City. Sioux City was platted at the confluence of the Missouri and Big Sioux Rivers in 1854. Within a year, it was added to the stage coach stops and a post office was established. In 1855 the federal government placed a land office there and Woodbury County moved its seat from Sergeants Bluff[64] to Sioux City, setting the stage for a thriving settlement (Bonney 1994; Rogers 1990). In 1856 Sioux City had two small stores, one operating out of a tent. That's when James A. Jackson, a partner in the mercantile firm of Tootle and Jackson, chartered the steamboat *Omaha* for $24,000, and loaded it with $70,000 in goods including "sawmill … equipment, furniture, dry goods, hard-ware and groceries"[65] (Marks 1904). Jackson hired Samuel Holland to run his store. Holland

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[63] The payment increased to $32,000 for track laid in hills, and $48,000 for every mile laid in mountainous terrain.

[64] Early records show the town's name as "Sergeants Bluff," but later the Post Office recorded the name without the "s" and it has since been "Sergeant Bluff." (Lindgren n.d.).

[65] Along the rivers, early African American migrants sought work in river towns such as Sioux City and Council Bluffs. The men worked as laborers loading and unloading steamboat cargoes; chopping wood for fuel; and as porters and waiters. Women became domestic servants, such as laundresses, housekeepers, and cooks (Schweider 1996).

Although white-owned business sometimes recruited African Americans for menial labor jobs, in the 1840s Iowa was "inhospitable, if not hostile" to the Negroes (Schweider 1996). The white majority instituted "Black codes" restricting the rights of citizenship, including the franchise, service in the legislature; and barring black children from the public schools. The 1851 legislature went so far as to pass a law forbidding further Black immigration, but allowing those already in the state to stay. A requirement that all new laws be published in *the Mount Pleasant True Democrat* ensured that this law never went into effect however; the *True Democrat*'s editor refused to publish it (Schweider 1996).

Gradually, Iowans became more tolerant. In 1858 the Assembly provided for the construction of separate schools for Blacks except where whites unanimously voted to let them attend existing white schools. Separate schools were built in only three eastern Iowa cities : Keokuk, Dubuque, and Muscatine. The rest of the state opened its school doors to all students (Schweider 1996). In 1868, 1874, and 1875 the Iowa Supreme Court outlawed the concept of "separate but equal" schools twenty years ahead of the United States Supreme Court (Schweider 1996).

subsequently ordered lumber to be shipped from St. Louis, and built Sioux City's first frame building at Second and Pearl Streets. The sawmill erected on Water and Second Streets was a major factor in Sioux City's growth. "The residences were chiefly above Fifth street [sic], as the ground was much higher and drier there" (Marks 1904). Before the streets were graded to level them out,[66] there was a natural "bench" at Fifth Street that offered protection against flooding and provided good wells (Marks 1904).

The first railroad route to Sioux City was authorized in 1856, but the financial Panic of '57[67] and the Civil War interrupted construction of the line from Dubuque. It was finally built in 1868-69. In the interim, the price of town lots rose steeply in anticipation of the railroad (Marks 1904). The entry of railroad service to Sioux City changed it from a small town to a booming metropolis. It enabled Easterners to bypass St. Louis, the center of steamboat shipping, and send goods by rail directly to Sioux City, thus escaping 1,000 miles of hazardous Missouri River shipping and reaching a year-round market[68] (Sorensen and Chicoine 1982). Before long, " the railroads … entered the city from all directions, like spokes in the hub of a wheel" (Hafner 1940). The city had a population of 3,000 by 1868, and swelled to 20,000 by 1875 following the introduction of rail traffic (Hafner 1940; and Bonney 1994), providing substance to Leah Rogers' claim that "the greatest impetus to the city's growth and development was its rail connections" (1990).

By 1870, the following railroads were operating in western Iowa:

Railroad	**Route**
Burlington & Missouri	Across the second tier[69] of counties, from Burlington (east) to Pacific Junction (west)
Chicago, Rock Island & Pacific	Davenport (east) to Council Bluffs (west)

By the time the second wave of African Americans came to Iowa following the Civil War, Iowa had become one of the most egalitarian states in the Union. When it granted Black men the franchise in 1868, it was the first state outside of New England to do so (Schweider 1996). In 1884 the Assembly passed a Civil Rights Act guaranteeing African Americans full access to public facilities (Schweider 1996).

The post-Civil War period witnessed a large influx of Blacks to the Sioux City area. Many worked as steamboat deckhands or constructed roads and sidewalks. By the 1870s African Americans started businesses in Sioux City, including recreational facilities such as dance halls and gambling institutions, barbershops, and laundries. By the early 20th century, Sioux City's Blacks also worked as policemen (Schweider 1996), firefighters, and meat packers (Schweider 1996).

[66] At first, the Loess Hills extended all the way to the river at Sioux City; some early residents complained the bluffs were too steep for a horse to travel over. Before long, they leveled some of the hills to construct streets and later electric streetcars.

[67] The Panic of 1857 halted expansion in Sioux City, as "professional men tried farming and stock raising to help out their incomes, and many of those who could raise money enough left" (Marks 1904).

[68] Sioux City's centrality to rail traffic was short-lived, however; in 1873 the rail lines were extended to Yankton, South Dakota, allowing traffic to bypass Sioux City on the journey west. See Sorensen and Chicoine 1982:39-40.

[69] Iowa's counties are laid out on somewhat of a grid pattern. The "second tier" would be the second row of counties from the southern border of the state.

Chicago & Northwestern	Clinton (east) to Council Bluffs (west)
McGregor & Missouri River	McGregor (east) to Sioux City (west)
St. Joseph & Council Bluffs	Council Bluffs on the north, runs south through Pottawattamie, Mills, and Fremont Counties into Missouri, where it connects with St. Joseph, Kansas City, and St. Louis
St. Paul & Sioux City	Under construction in 1870; would later join Sioux City (south) with St. Paul, Minnesota (north)

*(*Source: Iowa Board of Immigration 1870)

With so many lines competing for business, rate wars ensued. Some of the small lines could not compete alone, and there was a move toward consolidation via purchase of small trunks or the formation of pools[70] to share traffic and revenue. By reducing or eliminating competition, the pools also enabled the railroads to raise prices. These agreements lasted into the 1880s. Small, unprofitable trunk lines were abandoned, often resulting in the withering of towns dependent upon those lines for survival. The Great Pool folded in 1882, as it became too complex to manage. The Interstate Commerce Act of 1887 and the Sherman Anti-Trust Act of 1890 were initially ineffective in eliminating the remaining pools, but As was the pattern with railroad development, land speculation resulted in "paper fortunes" among Sioux City's elite. In the 1870s, much of Sioux City's business district was owned by a distant landowner, the Boston Improvement Company (Conard and Cunning 1990).

Spanning the Missouri River. "Westward expansion accelerated demands for transportation, resulting in rapid railroad expansion, speculation in real estate, and a general scramble for quick fortunes. Speculation was particularly common in the outfitting centers that engaged in the lucrative business of supplying immigrants," particularly Council Bluffs and Sioux City[71] (Halma 1974). Once

[70] In western Iowa, the most noted were the Iowa Pool, Omaha Pool, and the Great Pool.

[71] Just as Council Bluffs was perfectly situated to outfit the early migrations west, in the 1860s and '70s Sioux City stepped forward to outfit the settlement of the Black Hills in Dakota Territory, largely due to the personal interests of Charles Collins. Collins was the editor of the *Sioux City Times* and an "ardent Finian" interested in establishing a colony of Irish-Americans on the northern reaches of the Missouri River with an eye toward eventual invasion/capture of Canada. Although a convention of Finians approved the concept in 1869, a group sent to the Black Hills found the area uninviting and the idea languished. The Black Hills region was closed to settlement until 1874. Nevertheless, Collins was determined to encourage population of the Black Hills, and published a series of articles promoting the area, many claiming the likelihood of gold in the hills. On February 27, 1872, Collins organized the Black Hills Mining and Exploring Association of Sioux City. Together with the *Sioux City Journal* editor Thomas Russell, he organized an expedition. However, the army ordered them to stay out of the Black Hills area, which was still occupied by the Sioux Indians (Erikson 1922).

In 1872, General George Custer led his troops into the Black Hills and verified the presence of gold. Following Custer's reconnaissance mission, General Philip Sheridan recommended further exploration of the area for its timber and mineral (gold, silver, and lead) resources. In 1874 copies of Custer's report were published throughout the Midwest, but nowhere more enthusiastically than in the *Sioux City Times*. Collins proposed Sioux City as the logical location for outfitting Black Hills miners and settlers. That same year, Collins and T.H. Russell recruited 11,000 men from Iowa and Illinois to go into the Black Hills. Again, the federal government forbade the trip. While Collins and Russell verbally agreed to drop their plans, they continued them in secrecy (Erikson 1922).

Sioux City's hotels filled. The overflow crowd pitched tents on Prospect Hill. One hundred dollars procured a rifle, revolver, ammunition, pick, shovel, pan, cooking utensils, blankets, and salt. "For $569.85 full equipment for a party of five could be secured, including a wagon, horse, provisions and tools." All were advised not to start out without an okay from

it was enough to bring goods to the Missouri River and then transfer them to steamboats. Later, laborers transferred cargoes from the rail cars to ferries at the Missouri River crossing, then back to rail cars on the other side. By the 1870s a bridge spanning the Missouri became vital to the health of the railroads and the outfitters.

Building a bridge across the Missouri was no easy task. According to Grenville Dodge, Chief Engineer for the Union Pacific Railroad, the Missouri River was the most formidable obstacle to travel between the Atlantic and the Pacific due to its unpredictable nature and violent channel shifts (Frasier Design 1986). Early (pre-1870) bridges were wooden. Later bridges employed the use of iron, which was less vulnerable to floods, but was very expensive. Because of the high cost of iron, many bridges were a combination of iron and wood. After the Bessemer process was developed, steel was more affordable, so it was used exclusively for strength (Roberts and Fraser 1995).

Octave Chanute was the first to construct a railroad bridge across the Missouri River. Completed in 1869, Chanute's bridge spanned the Missouri at Kansas City. The following year the Army built a bridge further north to provide access to Fort Leavenworth, Kansas. Shortly thereafter the publicly funded Atchinson and St. Joseph Bridge was constructed to link those two cities. Undoubtedly, the Union Pacific Railroad Bridge joining Omaha and Council Bluffs was the most spectacular bridge of its day. Built between 1869 and 1872 at a cost of $2.9 million, the Dodge design was one-half mile long with wrought iron trusses planted in bedrock (Fraser Design 1986).

Because Dodge's Union Pacific Bridge was the first one north of Fort Leavenworth, Kansas, other railroads clamored to use it. The Union Pacific accommodated their requests in exchange for a toll. The arrangement was challenged in the courts, and in 1876 the U.S. Supreme Court ruled against the practice. However, Congress immediately passed a law legalizing the tolls, and the practice resumed (Fraser Design 1986). Angered by the tolls, many competing railroad lines decided to build their own bridges between Iowa and Nebraska.

It was not Dodge, but rather George Morrison who standardized Missouri River bridge construction, and was instrumental in the development of the steel bridge industry in the 1880s and '90s (Fraser Design 1986). In the 1880s, Morrison built bridges across Missouri River at Plattsmouth, Blair, Omaha/Council Bluffs, Rulo, Sioux City, and Nebraska City. Each succeeding bridge reflected a change in technology, resulting in bridges that were stronger, safer, and reasonably expensive.

Morrison's first bridge across the Missouri, built in 1879-1880, crossed the river at Plattsmouth, Nebraska. Constructed for Chicago, Burlington & Quincy Railroad of steel and iron, the Plattsmouth Bridge has six long-span whipped trusses. A change in the channel at Omaha/Council Bluffs enabled

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Collins and Russell. Too anxious to wait, some ignored this advice and ventured into the Black Hills. The Army arrested them and escorted them to Fort Laramie, Wyoming, forcing Collins to go to Wyoming to retrieve them. The party returned to Sioux City to a hero's welcome (Erikson 1922).

Anxious to jump on the bandwagon, some rivals formed the Sioux City and Black Hills Transportation Company in 1875 for the purpose of outfitting and transporting settlers to the Hills. Collins, who viewed himself as the "patron" of Dakota Territory, was angry that he was not invited to join. The Sioux City and Black Hills company sent its first party to the Black Hills, but the Army intercepted them and forced them to return to Sioux City (Erikson 1922).

Aware that their ability to keep prospectors out of the Black Hills was limited, the federal government entered negotiations with the Sioux seeking permission to allow miners to enter or outright purchase. Negotiations failed, and the Army receded from the area. Now the prospectors' problem was not the Army, but the Sioux fighting to protect their hunting grounds. Major warfare followed, culminating in the Battle of Little Big Horn on June 25, 1876. The government finally achieved a treaty with the Sioux the following October. Settlers poured into the Black Hills, first overland, then by the river, and eventually by rail. Finally, the Sioux City outfitters got rich (Erikson 1922).

a shorter bridge at that location, and the Union Pacific hired Morrison to design a replacement for Dodge's 15-year-old bridge in 1887. Constructed of steel and iron, Morrison's Omaha Bridge included a cantilevered pedestrian/vehicular roadway along with the rail system. The following year Morrison built an all-steel multi-span Whipple bridge at Sioux City, and another all-steel bridge at Nebraska City. The Nebraska City Bridge accommodated trains, vehicles, and pedestrians, but not simultaneously (Roberts and Fraser 1995).[72]

Dodge and Morrison generally took advantage of the loess bluffs on either side of the Missouri River when planning the locations for their spans. The bluffs provided a measure of predictability to the river channel. When asked to design and build a bridge near Blair, Nebraska, Morrison was unable to find a bluff-protected spot. After pursuing the possibilities within a 50-mile radius, Morrison constructed the Sioux City and Pacific bridge at Blair Crossing, approximately 20 miles north of Omaha. His notes recorded his frustration at the unpredictability and volatility afforded by the unprotected location (Fraser Desing1986).

Agriculture. Indeed, the Loess Hills landform region proved both a blessing and a curse to many who chose to live in western Iowa. Certainly the soil itself was a great blessing for the settlers. Nineteenth century accounts took careful note of the landform and its suitability for agriculture.[73] Settlers built their homes and towns within the valleys of creeks and rivers because that was where they could find timber[74] and to take advantage of the water to run their mills. When they could, many farmers kept some of their land wooded for slow consumption as firewood. Where there weren't trees, farmers planted them for shelter from summer heat and winter winds. Early farmers avoided the alluvial plains because they were marshy and ill suited for farming, and because the settlers feared diseases associated with wetland areas. They adjusted their land use in accordance with what was available at any particular time, cultivating the prairie tops when the valley was too marshy; moving to the valley once the marshes were drained,[75] and all the while using the hillsides for grazing (Bettis 1994; and Sayre 1989).

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[72] All of the Morrison Bridges are listed on the National Register of Historic Places.

[73] To quote A.T. Andreas: "The soil is that of the well-known bluff deposit, descending to a very great depth, and on the surface richly mingled with vegetable mold. This entire deposit is strongly siliceous, but everywhere finely pulverized and intermingled with a slight proportion of lime, sufficient to give it the remarkable consistency for which it is celebrated. It readily absorbs moisture, so that surplus water never remains upon its surface, and its great depth enables it to retain enough to supply vegetation in case of a long absence of rain. … This peculiar soil seems to be equally well adapted to the production of wheat, corn, and grass, a combination which is extremely rare. It lies within the great wheat belt, … overlapping the belt noted for the highest production of corn. The other cereals do equally well here. Wild grasses grow luxuriantly, and tame grasses thrive, and the soil is well adapted to vegetables and fruit[73] (Andreas 1875). …The country is well watered by unfailing streams" (Andreas 1875).

[74] Farmers cut trees to build houses, darns, and fences, and for firewood (Christiansen and Sayre 1989).

[75] In the early settlement years, the alluvial plain was ill suited for crops. It was marshy and subject to frequent flooding. Initially, farmers used the marshlands for hay production only (Rogers 1990). With its passage of the Swampland Act of 1850, the federal government encouraged farmers to drain the Missouri River wetlands and farm the rich bottomlands. Counties sold swampland for $1.25 per acre later reduced to $1.00, only 20 percent of the cost of nearby prairie and woodlands (Grant 1999). As early as 1868 farmers in Monona County were draining the swamps and using the bottomlands to grow row crops, and the bluffs for pasture. Sometimes the bottomlands they purchased were miles from their farms (Reese 1994; Rogers 1990; Blackburn personal communication 2000). By the early 20th century, the Missouri River bottomlands across western Iowa were drained by tiling fields, and constructing levees and drainage channels (Rogers 1990).

While the Swampland Act was successful in claiming the bottomlands for agriculture, some ecologists consider its results to be disastrous. Draining the wetlands destroyed the natural habitat of many birds and fauna. In addition, the elimination of the swamplands meant the elimination of a natural barrier to flooding; the marshes naturally absorbed, filtered, and slowed the flow of heavy rainfalls. The loss of the wetlands and the coincidental channelization of the Missouri River into a less meandering course created a situation where each heavy rain resulted in fast-flowing, erosion-accelerating floods (Grant

"The typical farm … practiced a combination of subsistence and market agriculture. It had a large garden where the farmer's wife and children raised all the vegetables the family would need for the year: beans, potatoes, corn, squash and pumpkins, beets, carrots, cabbage, turnips, and so on. … For fruits there were strawberries, raspberries, currants, apples, pears, and melons. The surplus was canned or stored in root cellars (which doubled as shelters in tornado weather).

Horsepower ran early farms. The husband and older children and/or hired hands raised the market crop. "… A farm wife also raised chickens and, if she was particularly enterprising, geese or turkeys, selling the eggs and extra birds in town." (Sayre 1989).

Farmstead development reflected a functional response to the landform. Settlers built their homes and farmsteads close to a source of water, which could be either a creek or a spring exiting at the base of the bluff. Prior to about 1940, farmsteads were often located on the elevated terraces located at the base of the bluff edge, usually on the north side of the alluvial fan of small tributaries.[76] The main house and primary farm structures were generally oriented to the southwest or south with bluffs buffering the north winds. Cellars were built into the base of the bluff.

The Search for New Settlers. In the first two decades of settlement, farmers encouraged friends and relatives to join them in the Loess Hills communities.[77] Spelling and punctuation errors did not detract from the message written by Frederick Rector of Fremont County to his friend, Charles Shockey, on February 14, 1856:

> … [The] country layes high and rolling with the richest soil in the world. The top of the highest hill will produce a growth of grass higher than a mans head or will produce any other vegetabil … in grater perfection than your richest botom land. Their is scarcely ever a day known that the sun did not shine. We have had the butifulest winter that I ever saw … We had excellent cropps of all kinds wheat corn fruit of all kinds whare their was apel or peach trees large enough they were full. We have wild fruit in abundace of extry quality. The country bounds with plumbs strawbarrys resberrays grapes … You want to know about the mill sites. Their is excelent mill sites in this country. The streemes are verry durabel. They are suported by springs. … [sic] (Rector 1856).

By 1870 both the railroads and the State of Iowa were actively recruiting additional settlers to the region.[78] I.D. Tostevin's *Home for the Millions* told prospective settlers, "There was a vast region

1999). "In a typical year, 5,000-10,000 acres of cropland are destroyed or damaged by gullies in the west part of Iowa" (Bettis 1994).

[76] On the Missouri River bottomlands, alluvial fans at base of bluff are much richer soils and better drained, therefore easier to cultivate. Past the ends of those fans, the bottomland soil is a gumbo. The surface dries quickly to a hard crust, but layers under the surface retain moisture therefore making soil conditions deceptive and harder to work. As soon as the wet prairies on Missouri River bottom were ditched and drained, people built farmsteads out on bottomland (Blackburn interview 2000). This would have happened in the mid-1870s and later as ditch-making machines became widely available.

[77] Ethnic groups settled in some areas: Scandinavians settled in Albaton, Soldier, and Moorhead; Germans in Mapleton, Danbury, and German City; Irish and Scottish in Blencoe and Danbury; and French Canadians in Salix (Rogers 1990). Many Irish came to Fremont County to build railroads in the 1870s (Ricketts n.d.). Danish settlers entered the area south of Sergeant Bluff in the 1870s and 1880s.

[78] In 1869 Lutheran minister B.M. Halland and the Burlington Railroad entered into an agreement under which the railroad set aside one of its new towns for Swedish immigrants. Centered in Stanton, the Swedish community extended into Page, Cass and Fremont Counties (Schweider 1996). The primary occupation of the Swedes was farming; those who didn't farm worked in the coal mines. In many instances, they worked farms during the growing season, and mined in the winter months (Schweider 1996).

between the Des Moines and Missouri Rivers that awaited but the touch of civilization to change it from a desert to a garden" (Tostevin 1870).[79] The Board of Immigration pamphlet, *Iowa: The Home for Immigrants*, pointed out the attractions of the Loess Hills to prospective immigrants. The Iowa Board of Immigration mentioned the coal mines of Monroe County, limestone in the northwest, the fertile alluvial bottomlands adjacent to the Missouri River, 2000 miles of railroads within the state. It noted that farming was the primary occupation of Iowans, and that one-sixth of the state's land (mostly in the northwestern part of the state) was still available for purchase (Iowa Board of Immigration 1870). According to that pamphlet, the farms of Iowa were producing wheat, corn, oats, grains, potatoes, sorghum, flax, grasses/hay, root plants, "salad" plants, and other fruits and vegetables. In addition, Iowa was fifth in the nation in livestock production;[80] in specific categories of livestock production, Iowa ranked fourth in production of hogs; fifth in horses; and sixth in cattle and oxen; and in sheep (Iowa Board of Immigration 1870).[81]

Although the Civil War had caused a shortage in farm labor, some of the reduced manpower was balanced by the introduction of technological advances such as horse-drawn planters, reapers, mowers, and threshers (Bonney 1994). According to *The Home for Immigrants*, the equipment needed to work a 40-acre farm in 1870 included a team of oxen or horses @ $150-300; a wagon with yoke or harnesses @ $100-150; a plow @ $20-30; a cultivator and harrow @ $20-40; and other implements/tools @ $10-20; for a total cost of $300-540. For a larger farm, add a mower and reaper, which could be purchased in common with neighboring farmers.[82] The pamphlet recommended against bringing the equipment, stating it was cheaper to buy it new in Iowa and that the equipment would be better suited to the Iowa landscape. The pamphlet advised that garden seeds be brought from elsewhere. The Board of Immigration stated that lumber was easily accessible by rail, and suggested consideration of purchasing a ready-to-assemble home from one of the catalog companies in Chicago (Iowa Board of Immigration 1870). Tostevin added, "The value of a farm in this grain and stock raising region must depend on its proximity to a railroad" (Tostevin 1870). He noted that by 1870, there was not a quarter section of land more than 20 miles from the closest rail line. Land sold for $4.50-$10.00 an acre, depending upon its distance from the railroad "and the disposition of the owner" (Tostevin 1870).

The Home for Immigrants also advised prospective immigrants regarding local wage scales. In 1870, an Iowa farm laborer could expect to make $18-25/day, while an unskilled laborer in the towns or cities would make only about $2/day. Plasterers made $3.50/day; brick and stone masons $3-4/day; and carpenters $2.50-3.50/day (Iowa Board of Immigration 1870).

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[79] Tostevin's treatise virtually ignored centuries of Native American occupation of the area, and the more recent settlements by the Mormons in the 1840s, beginning the story of settlement of western Iowa with the outfitting of the 1849 California gold rush.

[80] Behind New York, Ohio, Pennsylvania, and Illinois.

[81] In the 1870s hogs were the dominant livestock in Monona County, and corn the primary crop. During that decade livestock farming superseded crop production in the northern Loess Hills, and farmers shipped their goods to Sioux City for processing and shipping (Rogers 1990). To demonstrate the tremendous growth in farm products, John Pohlman quoted these figures for Harrison County: In 1856 there were 2,644 bushels of corn raised in the county. By 1880, the figure exploded to 4,363,991 bushels, and by 1887 it was at roughly 6,000,000 bushels of corn. More than 75,000 head hogs were sent to market in 1887 (Pohlman 1992).

[82] The Carstens farmstead near Avoca in Pottawattamie County is an excellent resource for understanding regional farming over a 75-year period. Johann C. Carstens, a German national, purchased 160 acres near Avoca from a railroad company in 1871. Three generations of Carstens farmed the land. Upon his retirement in 1977, Henry Carstens, Jr., donated 80 acres and its associated agricultural collection to the Historical Society of Pottawattamie County with a stipulation that it be restored and operated as a turn of the 20th century farmstead.

Changes in the Hills. The recruitment campaigns were highly successful; additional settlers poured into the Loess Hills. Areas once sparsely settled became beehives of activity. "The changes were rapid and dramatic," according to Cornelia Mutel, "flowing both from the settlers' desire to purposefully trans-form nature and from their inadvertent alteration of natural processes." She added, "Perhaps the most obvious human alterations involved the physical reshaping of the Hills" (Mutel 1989a). First it was small in scale; horse hooves formed trails "where passage was easiest—through lowlands or along the western edge of the bluffs." Then more dramatic changes occurred: settlers built dams for water power; carved the bluffs to construct caves for storage, kilns, and stables; mined limestone, sand, gravel, shale and construction fill; leveled bluffs to make way for cities; constructed roads and railroads; and farmed the prairies. Settlers reshaped the valleys as well, straightening the meandering Missouri River and its tributaries into channels to hasten drainage,[83] and constructing dams to control flow and dikes to prevent flooding. Some impacts were inadvertent: plowing slopes for cropland accelerated erosion;[84] grazing large herds of cattle degraded the prairies, also exacerbating erosion; and baring soil for con-struction or recreational purposes. Exposing the soil to water destabilized the loess soil, rendering it unable to support its own weight. Farmers cut native woodlands for construction and fuel, and replaced them with exotic species.[85] River channelization and drainage projects destroyed formerly abundant marshlands.[86] Settlers destroyed native habitats and hunted many large mammals to local extinction; "The black bear, mountain lion, elk, pronghorn, and bison[87] all were eliminated" (Mutel 1989a; and Pohlman 1992). By the end of the 19th century, the Loess hills had been transformed.[88]

Coal Mining. There were other changes to the land. As humans sought to extract a living from the soil,[89] many did it by mining coal rather than raising wheat or corn.[90] The Loess Hills are on the

[83] Early attempts to drain water in the lowlands and straighten the meandering Indian Creek that wiggled its way through Council Bluffs proved disastrous. Heavy rains eroded the chasm with fast-flowing water that destroyed homes and bridges (Bonney 1994).

[84] The steepest bluffs were the least accessible, and therefor the least disturbed by humans.

[85] As they spread into the grasslands further away from the streams, settlers planted trees for shade and to create wind breaks, encouraged by the State Geological Society; the railroad companies, who placed stipulations requiring such planting within their land sale documents; and local governments, who granted tax advantages to those who planted trees (Bonney 1994; and Conard and Cunning 1990).

[86] Channelization projects continued to create new problems while solving others. According to Cornelia Mutel and Mary Swander: "Creeks and streams that had been straightened in the early part of the [20th] century to make way for more farmland became raging rivers trying to fight their way back to their original paths, taking chunks of land with them as they carved new channels. Major new gorges opened, collapsing bridges. Suddenly new gullies emerged in pastures and fields" (1994). Perhaps there is some truth in the saying, "A river knows its own course."

[87] The last American bison was seen in the area in 1863 (Hunt 1915).

[88] Robert Grant emphasized the significance of the changes which occurred in the Loess Hills in the last 150 years when he said, "The Loess Hills … had a 9000 year natural history of relative balance, prior to the changes wrought by European agricultural techniques" (Grant 1999).

[89] Another extractive industry was the utilization of clay, which was important in Woodbury and Monona Counties. In 1856, T.C. Clarke became the first in the area to manufacture bricks (Lindgren n.d.). Beginning in 1866, clay from Sergeant's Bluff was used to make bricks for paving, building, and drainage projects. Brick factories continue to operate at Sergeant's Bluff. Gravel pits and concrete block manufacturing are also active industries in Turin, Sergeant's Bluff, and Sioux City (Rogers 1990).

[90] The coal mines also induced many African Americans to come to western Iowa in the post-Civil War period. However, not all of the Blacks who came to the region in the post-war period worked in the mines. A cemetery for Blacks (13MN35), with burials dating from 1880s to 1907 (and a recent burial in 1988) is associated with a black settlement in Monona

western edge of Iowa's coalfields. In the Hills, mining activity was heaviest in Mills and Monroe Counties, but there was coal in all of the Loess Hills counties except Plymouth and Woodbury (Schweider 1996; and Iowa Board of Immigration 1870). The expansion of the railroads accelerated coal mining activities across the nation because the railroads were fueled by coal. As the number of miles of railroad increased, so did the number of coal mines in operation. The railroad companies frequently controlled the mines to ensure supplies adequate to meet their needs (Schweider 1996).[91]

It was the coal mines that first attracted the second wave of immigrants, the Eastern and Southern Europeans. Hailing from Italy, Croatia, Russia, Poland, and Lithuania, they came by the thousands to western Iowa. When mining waned as a viable industry, the Eastern and Southern Europeans turned their attention to the meat packing and associated industries (Schweider 1996).

The Meat Packing Industry. The simultaneous development of the meat packing industry and construction of a web of railroads established Sioux City as a major municipality in the 1870s (Rogers 1990).[92] Railroads shipped cattle and hogs to the meat packing plants in Sioux City, and shipped meat products out (Conard and Cunning 1990). The city's packing industry started somewhat serendipitously when a steamboat loaded with wheat sank in the Missouri River near the city in 1871. Merchant James E. Booge bought the water-logged wheat, only good for use as animal feed. Then he bought some hogs, raised them on the wheat, slaughtered the hogs and sold the meat. Thus the James E. Booge and Sons Packing Company was established as Sioux City's first meat packing plant (Schweider 1996). Booge and Sons eventually employed more than 350 men (Hafner 1940).

Both the Union Stock Yards and Central Stock Yards opened in 1883 to handle livestock sales; they combined as the Union Stock Yards Company one year later.[93] Chicago's Robert D. Fowler and William H. Silberhorn opened additional packing plants in 1887 (Schweider 1996; and Hafner 1940). The Sioux City Livestock Exchange formed in 1888 (Hafner 1940).

Boom and Bust. Fifteen years of rapid development fed local entrepreneurs' conviction that Sioux City could achieve anything it desired. City leaders promoted an atmosphere of confidence that the city was destined for success, and a fever developed among those wanting to share in her wealth. In 1884 there were 35 real estate firms catering to the crowds of newcomers; a year later the number of realtors had grown to 79! To quote Scott Sorensen and Paul Chicoine, "Prices for residential and business lots skyrocketed. For the second time in less than forty years, Sioux City became gripped with land-rush fever" (1982). Handsome new neighborhoods developed, and "electric and steam-powered street railway extensions to Leeds, Highland Park, and Riverside, a cable car railway to the

County. Adam Miers, a white man, was married to a black or mulatto woman named Mariah, or Big Moll. Needing assistance with farm labor, Miers encouraged other Backs and Mulattos (many related to Big Moll) to settle in the area and help work the farm. The blacks lived in dugouts on Miers' land, many of which were destroyed by Soil Conservation Service terracing and dam construction in the 1960s. The area is now in pasture. There are eight burials currently marked at the cemetery, but WPA records from the 1930s indicate as many as twenty people were buried there (Rogers 1990).

[91] In addition to the so-called "shipping mines" which supplied coal for the railroads, there were mines opened specifically to meet local needs. These local mines operated on a seasonal basis to supply coal for winter heat. Sometimes farmers worked the coal mines in winter to supplement their incomes. The local mines kept many small communities alive due to the influx of cash (Schweider 1996). Coal mining declined in Iowa in the 1920s and never recovered (Schweider 1996). After decades of decline Iowa's mines closed in the 1850s and the state began importing coal from Kentucky (Schweider 1996).

[92] While the rise of the meat packing industry spurred Sioux City's growth, it "was made possible by the expanding network of rail connections" (Rogers 1990).

[93] One of the most interesting buildings in Sioux City is the Hog Hotel situated near the stock yards. Packing companies bought livestock at the exchange; it was held at the hotel until they could shuttle it to the packing company. Like the stock yards, the Hog Hotel is now vacant.

town's hilly Northside, and an elevated railroad to Morningside … reached out to bind the city together" (Sorensen and Chicoine 1982).[94] From four rail lines active in 1886, the city boasted 11 lines either operational or on the drawing boards five years later. Boosters advertised the city's fortunes by constructing spectacular palaces of corn[95] that drew spectators from hundreds of miles away.[96]

The Chicago, St. Paul, Minneapolis and Omaha Railroad opened city's first bridge across the Missouri River in 1888, but city leaders weren't satisfied. In the giddy atmosphere of growth, they decided to avoid the railroad's high tolls by opening a second bridge, a "combination bridge" which would accommodate both rail and pedestrian traffic. Work on the second bridge started in December 1889. By 1890, there were almost 200 factories located in Sioux City (Hafner 1940). The frenzy continued; 1891 capped three years of unprecedented growth.

The beacon of prosperity first flickered early in 1892 due to an international tightening of capital funds. Suddenly the businessmen behind the construction of the combination bridge found themselves without sufficient capital to continue the project, and they turned it over to another developer. On May 18, the Floyd River flooded the stock yards and industrial district with disastrous results. Shortly thereafter, the Leeds Improvement and Land Company went into receivership. Then James E. Booge and Sons, one of the city's largest employers, went out of business (Sorensen and Chicoine 1982).[97]

The Panic of 1892 hit Sioux City hard. The population in the city decreased by half, as thousands left in search of opportunities elsewhere. Those who stayed faced the loss of jobs or major cuts in pay. When wage cuts caused the remaining meat packers to strike, the packing companies recruited African Americans from the South to come in as strike-breakers. The situation continued to worsen; the Panic of '92 became the Depression of '93. On April 25, 1893, the Union Loan and Trust and Hedges Trust Company went into receivership. Within weeks, more than one dozen businesses closed their doors (Sorensen and Chicoine 1982). Sioux City's boom was over.

Recovery was slow and painful. Some of the city's boosters, who had made and lost their fortunes in Sioux City, moved on. Others stayed, keenly aware that public confidence was shaken. But the Eastern capitalists who owned much of the city's real property were determined to make good on their investments. In 1894, they banded together to form the Credits Commutation Company for the purpose of recovering their losses. Although many were reticent to invest further funds in the ailing city, financier F.I. Eaton convinced them that the key to stimulating correction of Sioux City's

[94] Inter-urban transportation started out as streetcars pulled by horses or mules. Electrification began in 1886 in Richmond, Virginia, when Frank Sprague invented a direct current electric motor capable of pulling cars and withstanding the jarring stops and starts (Conard and Cunning 1990). The Sioux City Rapid Transit developed elevated tracks to get past swamps in the Floyd River valley. It started with steam power in 1891, and changed to electrical power shortly thereafter. Sioux City's "El" was replaced by ground-level tracks after the land was drained (1901-1903); it served as the model for Chicago's El, still in use today (Conard and Cunning 1990).

[95] Sioux City built five Corn Palaces—one each year--from 1887 to 1891. The design and construction of each Corn Palace was a major undertaking. For example, the 1887 Corn Palace required 46 men to build the wooden frame; 300 men to decorate it with corn, celery, beets, pumpkins, and squash; 300,000 feet of lumber; 15,000 bushels of yellow corn; 5,000 bushels of corn of other colors; and 1.5 tons of nails (Exhibit text, Sioux City Public Museum).

[96] According to Sorensen and Chicoine, 140,000 people came to see the 1887 Corn Palace during the 6-day event. It was then torn down, and planning began for the next year (1982).

[97] The blow was softened by a November 1892 announcement that a national packing company, Cudahy, would take over Ed Haakinson & Co. Cudahy expanded the operation to include beef and mutton as well as pork, and added the production and sale of animal by-products such as lard, soap, axle-grease, and glue (Hafner 1940).

economy was the completion of the combination bridge.[98] In addition, the Credits Commutation Company formed the Sioux City Stock Yards Company to resuscitate the city's main industry, and established the Live Stock National Bank to provide loans for area businesses. The Credits Commutation Company's successes convinced Armour and Company to buy the Silberhorn plant, thus establishing the city's second national packing company.[99] Sioux City's recovery, and that of the surrounding communities, was on its way (Sorensen and Chicoine 1982).[100]

The memory of the 1892-93 Depression lingered throughout the region. Resentment among white meat packers who had watched African Americans cross their picket lines in 1892 festered, and they retaliated by closing better jobs to Blacks.[101] The situation eased somewhat with the outbreak of the First World War, when any available labor was essential to fill positions. Nevertheless, the number of Blacks in Sioux City increased significantly in the early 20th century. According to the 1910 census, 305 African Americans lived in Sioux City. By 1920, the figure had swollen to 1,130. At that time 18 percent (18%) of the African Americans in Sioux City worked for packing companies, still mostly on the rendering and kill floors. Eastern Europeans also flocked to the packing houses, but were met with some resistance. First Blacks and then Eastern Europeans were relegated to the Bottoms area south of the packing plants, with the stench of the stock yards and the red light district. Racial and ethnic divisiveness was epitomized when the Ku Klux Klan marched in Sioux City in 1924 (Schweider 1996).

Organized Labor. The failure of the loosely-organized 1892 meat packers strike gnawed at the workers' memories as the muckrakers exposed the uncomfortable and often dangerous working conditions in the nation's packing plants. Packers noted the successes of the United Mine Workers (UMW), who organized Iowa's coal miners into the state's largest trade union in the 1890s.[102] The UMW's first major victory was the 8-hour workday. Thereafter, the union achieved higher wages, death benefits, and improved housing. Still, the meat packers were slow to follow the miners' lead. Workers in farm-related industries tended to be particularly independent and unwilling to turn their futures into someone else's hands, and management's strongly anti-union stance was well-proved by its history of hiring strike-breakers rather than negotiate with striking workers (Schweider 1996).

The passage of the National Labor Relations Act (also called the "Wagner Act") in 1935 was very important in Iowa because it legitimized unions by ensuring laborers the right to form unions and collectively bargain with management. The Wagner Act successfully ended practices aimed at stifling unions in the meat packing industry.[103] Perhaps equally important was the 1935 formation of the

[98] The bridge opened to traffic on January 21, 1896.

[99] Later Swift added operations in Sioux City (Schweider 1996:234). By the early 20th century, the Sioux City stock yards were handling livestock from Iowa, Nebraska, South Dakota, and Montana. Southern and Eastern European immigrants worked at the stock yards and lived in the Bottoms area nearby (Sorensen and Chicoine 1982).

[100] Still, even progress was painful. The development of roads in the late 19th and early 20th centuries hurt many of the small railroad towns. As dependence on the railroad declined and roads improved, larger urban areas were more accessible to farmers. By 1920, farmers' dependence had shifted from the railroad cars to automobiles and trucks. Many small railroad towns never recovered (Rogers 1990; Lindgren n.d.).

[101] Packinghouse laborers were not alone in their resentment of the recruited Black strikebreakers. Over the years, African Americans who had settled in Sioux City earlier opened barbershops, gambling halls, and restaurants. These elite Blacks had integrated social contact with the white community due to their business dealings, and they resisted any further influx of Blacks, fearing the new arrivals would destroy the balance the elite African Americans had established (Schweider 1996).

[102] The United Mine Workers remained the state's largest union until the mining industry decreased its activity in the 1920s (Schweider 1996).

[103] Earlier attempts to unionize the meat packers collapsed during the unpopular strikes of 1920-21 (Schweider 1996).

Committee of Industrial Organization (CIO)[104], a national confederation of industrial workers. Its Packinghouse Workers Organizing Committee enabled the workers to overcome their own resistance and that of the packinghouse managers; in 1943 Sioux City's 2,000 meat packers organized under the CIO umbrella (Schweider 1996).

The packers weren't alone in their decision to combine efforts for strength during the Great Depression. Western Iowa's farmers were among the first to feel the effects of the Depression, partially due to the increased production. Enabled by better technology, the farmers had geared up during the First World War when they were needed to supply food for the United States and war-torn Europe. When Europe resumed farming after the war, American farmers continued to produce record quantities, creating a glut in farm products. Prices for farm goods plummeted, and the agricultural Depression preceded the disastrous stock market crash by several years.

Many farmers chose to combine for power in the 1930s by planning a "Farmers' Holiday" during which they would keep farm products off the market. Scheduled to begin July 4, 1932, and last for about 30 days, farmers adopted a slogan of "Stay at Home—Buy Nothing—Sell Nothing." Sioux City, with its stock yards, dairies, and processing plants, was a natural focal point of the "holiday." Farmers Holiday Association members blocked roads into the city to prevent others from taking their goods to market (Schweider 1996). The situation turned (quite literally) messy just north of Sioux City in Plymouth County: "When the pickets failed, they sometimes confiscated and destroyed farmers' produce. At one point picketers stopped a truck carrying butter, and then spread the butter on a section of Highway 75 for a 200-yard stretch." This caused cars and trucks to slide off the road into a drainage ditch. For all its drama, the Farmers' Holiday had little impact on raising prices or improving the financial conditions of farmers (Schweider 1996).

During the Great Depression a lot of land changed hands, as banks or insurance companies foreclosed on loans, and neighbors bought and sold parcels as funds were available (Blackburn interview).[105] Hoping to stop the foreclosures, the governors of the Midwestern farm states met in Sioux City in September 1932 to plan a program including a moratorium on farm debts, increased credit at lower interest, and surplus controls. About 5,000 farmers were also in attendance (Schweider 1996). That November American voters, frustrated by Herbert Hoover's lack of action to bring the country out of the Depression, elected Franklin D. Roosevelt with his new philosophy: "Do anything, but do something!" In response to the call, Roosevelt looked for opportunities to put people to work.

***Conservation and Reclamation*.** Among the most visible and lasting New Deal achievements were the creation and/or improvement of public recreational facilities throughout the country. Among those accomplishments was the establishment of Stone State Park in Woodbury County. The State of Iowa purchased the land from Sioux City in 1935. From 1935-1939, the federal government stationed Civilian Conservation Corps (CCC) Company VCCC 2725 at Camp SP23 under the direction of Laurence C. Smith, a civil engineer, and landscape architect Neville Guernsey. The Civil Works Administration, Works Progress Administration, and the Iowa Conservation Commission also contributed to the project (Guernsey 1934). The CCC also made major modifications to Waubonsie State Park in Fremont County. Waubonsie State Park was established in 1926, but saw little activity until the arrival of CCC workers in 1933. CCC Company 2720 worked at Camp PE89 (Later Camp SCS17) from 1933-35; CCC Company 775 was at Camp DSES1 (later SCS1) from 1933-34. The

[104] The organization changed its name to the Congress of Industrial Organization in 1938 (Schweider 1996).

[105] During the Great Depression, the banks and insurance companies were forced to foreclose on many properties, and ended up owning lands they didn't want (Sorensen and Chicoine 1982).

men cleared trees and built a variety of structures,[106] including trails, overlooks, erosion control structures, stone steps, culvert, latrines, stone seats, shelters, and campfire rings (Bureau of Historic Preservation 1990). The Works Progress Administration built the portals in 1936.[107]

While the Stone and Waubonsie State Parks projects were important as short-term employment opportunities and long-term recreational facilities, not all CCC projects were recreation-oriented. Under the leadership of the Soil Conservation Service (SCS), the CCC was also involved in undertakings designed to control flooding and reclaim lands for agriculture. The Jones Creek Watershed project In Monona County changed the direction of the country's land reclamation efforts. Prior to Jones Creek, the SCS erected large dams at key points along major rivers in an attempt to prevent destructive floods. In the mid-1930s, some engineers challenged the established practice of building the large and hugely expensive dams, proposing that the erection of small dams along streams feeding those major waterways would be less costly and equally effective. The SCS chose the Jones Creek watershed to test the "little dam" hypothesis.

The Jones Creek watershed was first settled in the 1880s. Initially the land was used for livestock only; the rise in prices that accompanied World War I made it economically feasible to plant row crops for the first time.[108] The negative effects were clear and immediate: "Severe sheet erosion and gullying began … in 1917. By 1940 large gullies which could not be crossed had dissected the lower part of the watershed. … Each year additional areas of good land were either eroded or rendered inaccessible by gullies." In addition, the erosion was filling Jones Creek with sediment. Each heavy rain resulted in loss of crops, until finally the land was retired to pasture. Further, the sediment quickly changed from topsoil to sterile sand and subsoil, "and threatened in the future to seriously damage or destroy the fertility of the bottom lands upon which it was being deposited" (Soil Conservation Service 1950).

Using labor from the Moorhead CCC Camp and later the Denison Conscientious Objectors Camp, the SCS constructed a system of spillways and small impoundments between 1937 and 1942.[109] Workers planted 30 acres with trees; improved existing pastures; relocated one mile of fence; and built eight sediment control structures and a dam near the juncture of Jones Creek and Soldier River to control floods and contain silt. Finally, they dredged Jones Creek to remove 9,400 cubic yards of silt down-stream from the spillways. The landowners did their part as well. They changed their cultivation practices from straight row cropping to contours with some strip cropping, and improved their crop rotation routines (Soil Conservation Service 1950). The undertaking successfully slowed the flow of water and captured silt, thus protecting farmlands in the Jones Creek drainage area and

[106] The National Register district includes 43 contributing resources.

[107] Not all public works projects successfully achieved a balance between recreation and conservation objectives. Some were so focused on creating recreational opportunities that they contradicted the conservation philosophy fundamental to the programs. For example, the Works Progress Administration cut away part of a loess bluff overlooking Half Moon Lake in 1935 to create Pulaski Park recreational facilities in Woodbury County. The WPA was also involved in many road-widening projects that resulted in the destruction of loess bluffs (Sorensen and Chicoine 1982).

[108] Early in the northern hills, wheat was the main crop, but by 1880 it was clear that other regions could out-produce the Loess Hills, and the agricultural economy turned to corn and/or cattle (Rogers 1990).

[109] The Jones Creek Watershed project is listed on National Register as a property of state significance in the history of agriculture and conservation. Its pivotal role in resolving the "big dam vs. little dam" controversy may render it eligible for National Historic Landmark status. Further research is needed to assess its Landmark eligibility. The Watershed project is publicly owned; the 9-acre Jones Lake is available for recreational fishing.

also downstream.[110] The success of the Jones Creek project encouraged the SCS to continue the construction of "little dams" nationwide.[111]

Changes in the Cultural Landscape. Depression-era farmers benefited greatly from New Deal programs, better farming methods, and new technology.[112] One improvement adopted in the Loess Hills during the 1930s and '40s was the centuries-old practice of terrace farming.[113] Technological developments with durable effects included the electrification of rural areas, the genesis of hybrid seed corn, and the increased availability of farm machinery (Schweider 1996). The introduction of steam- and later gasoline-powered machinery encouraged the use of more land for market crops (Sayre 1989). Reviews of aerial photographs from 1938 to the 1970s indicated that the size of farm fields and of farms themselves increased steadily during this time period.[114]

The steady increases in production and farm- and field-size were met with a reduction in the number of farms in Iowa between 1940 and 1945.[115] Following a slow but steady trend toward urbanization that started in the 1890s,[116] the number of Iowans living in rural communities and the number living in urban areas reached a balance at about 1,360,000 each in 1956. Even for those who stayed on the farm, at least one family member was often forced to take a job elsewhere in order to make it possible (Schweider 1996). Nevertheless the general pattern, or footprint, of open land has remained relatively constant over the last three-quarters of a century.[117]

[110] In 1950 the federal government studied the effectiveness of the Jones Creek Watershed project, and discovered that it had reduced flooding for rains of 1 to 4 inches by 90 percent (90%); virtually eliminated flood damage below the dam; eliminated silting of Jones Creek; restored bottom lands to tillage; arrested gully erosion; reduced sheet erosion by 75 percent; and eliminated infertile overwash from bottomlands (Soil Conservation Service 1950).

[111] Small dams, dikes, and other erosion control features are now common in the Loess Hills landform region. In many cases, a bridge across a gully or canyon has been replaced by a dam or dike with a road crossing on the top of the dike. These dams and dikes sometimes back up ponds, but more often simply provide a shallow wetland retention area to control large storm water surges.

[112] Agricultural progress continued in the '40s; production increased each year from 1941 to 1945 in spite of the absence of many farmers gone to war. In Fremont County some of the labor shortage was met by using prisoners to shock and thresh wheat. By the end of the war, German and Japanese prisoners of war were working on Iowa farms (Schweider 1996).

[113] Terrace farming is a method of growing crops on sides of hills or mountains by planting on graduated terraces built into the slope. Though labor-intensive, the method has been employed effectively to maximize arable land area in variable terrain and to reduce soil erosion and water loss. Although some Loess Hills residents believe the practice was initiated in the Hills during the Great Depression, it was actually developed five centuries earlier by the Incas of South America.

[114] The spiral continued in recent decades. Rising farm product prices in the 1970s encouraged farmers to increase the size of their land holdings and buy more machinery, thus increasing their debt. The risk was realized in the 1980s when product prices plummeted. By 1984 the value of farmland decreased by twenty percent (20%) from the previous year. Many farmers, particularly those under the age of 35, were threatened with the potential loss of their land, precipitating what became known as the "Farm Crisis." Agriculture-related industries also suffered. By 1987, Iowa had 22,000 fewer farms than it had in 1973 (Schweider 1996).

[115] In concert with John Fraser Hart's maxims regarding patterns of land use, the number of farms decreased significantly over the last three-quarters of a century. According to Hart, the number of farms in the four Corn Belt states (Iowa, Illinois, Indiana, and Ohio) shrank from about 750,000 in 1949 to approximately 333,000 in 1992. During this same period, the size of farms, on average, doubled (Hart 1998).

[116] In 1880, 85 percent (85%) of Iowans lived in rural areas (Schweider 1996).

[117] This may result partially because former farms are being converted into residential properties. Field patterns are retained because they are used as pasture for pleasure horses, leased to adjacent farmers, or operated as part-time hobby or retirement farms.

There has been a gradual reduction in the variety of crops cultivated in the Loess Hills. In the earliest years, the farmers' first crops were wheat and oats (themselves grasses), but it wasn't long before they discovered a wide variety of crops that thrived in the rich loess soils. By 1870 the farms of Iowa were producing wheat, corn, oats, grains, potatoes, sorghum, flax, grasses/hay, root plants, "salad" plants, and other fruits and vegetables (Iowa Board of Immigration 1870). Soybean cultivation apparently started in 1919 and by 1932 had expanded to 185,000 acres in western Iowa (Christiansen and Sayre 1989). The main pasture crop was Sweet clover (Holmes and Crickman 1938). By the last half of the 20th century, many farmers rotated strictly between corn and beans (Blackburn interview 2000), with pastures planted in hay.

Historically, apple orchards and vineyards were common, particularly around Council Bluffs and Magnolia. Orchards and vineyards were (and are still) located on the upper slopes, particularly those with southern aspects, to avoid temperature extremes. An area to the west-northwest of Magnolia in Harrison County supported a large number of orchards, but their number was drastically reduced between 1938 and 1970. Today, Small's Fruit Farm is the only retail orchard left in the once-thriving Harrison County orchard region. Similarly, in the 1940s and '50s there were more than 3,000 acres of vineyards located on the east and southeast sides of Council Bluffs in Pottawattamie County. Cooperatives and companies located in downtown Council Bluff s processed the fruit. Unfortunately, grape production in the area was virtually destroyed by the impact of the insecticide 2,4-D on the vines, and the industry has not recovered. Today, Martin's Orchard carries on Council Bluffs' fruit growing tradition, but at a reduced scale and with a shift away from grapes to stone fruit and garden produce (Martin interview 2000).

Although the location and size of pasturelands shifted over time, Loess Hills farmers consistently used the least-tillable lands for livestock. Before draining the alluvial plain, livestock grazed the marshy grasslands and farmers cultivated the prairie hilltops. Once the bottomlands were drained, farmers put their livestock on the crowns of steeper hills.

By the 1950s, the ridge tops or crowns of hills were often open pastureland divided by many cross fences. On gentler slopes to the east, fields conformed more closely to the 40-acre quarters of the Government Land Office grid system. Fields in the flat creek or river bottoms followed the alignment of the drainage, but were still fairly rectangular in shape, separated by oxbows and fences constructed along section or quarter boundary lines. Over time, the removal of fencerows and oxbows created larger fields in all areas of the Loess Hills.[118] In all other parts of the landform region, field sizes on bottomlands and on the crowns of steeper hills increased in size beginning in the mid-1950s. The removal of fences in the pastures along the crowns of the hills results in a pattern of fields even more strongly aligned with the ridges.

Because of the difficulties associated with growing row crops in the Loess Hills, experts have said that Hills farms are best suited for livestock production. In the early 20th century, C.L. Holmes and C.W. Crickman identified the Loess Hills as Iowa's "Western Livestock Area" (1938). The predominant livestock operations focused on beef cattle, but hogs, dairy cattle, horses, and sheep were

[118] The only exceptions appear to be in lower Mills County and in Fremont County where the field sizes remain closer to the size apparent in 1938-40 aerial photographs. However, fields in these southernmost counties were traditionally larger than in their northerly counterparts. (Blackburn interview 2000)

also raised in the Hills.[119] In recent years, some confinement cattle and pig operations were seen in the northern parts of the landform region, but these were not common.[120]

Finally, more pastures or cultivated fields appear to be succeeding to young forest growth since the mid-1970s. According to Professor of Ecology David Glenn-Lewin of Iowa State University, overgrazing of the Loess Hills by domestic livestock resulted in the replacement of tall thick prairie grasses with short and thin grass species. The resultant lessening of the fuel load in addition to human suppression of natural fires has encouraged trees to further encroach into the valleys and ravines (Pohlman 1992).[121] This encroachment is rapid and measurable: "The overall canopy cover of the hills has increased 66% from 1953 to 1981 (Grant 1999).

Threats to the Cultural Landscape. Agricultural use has posed threats to the landscape since the first Euro-Americans entered the Loess Hills. As Robert Grant observed:

> The environment first experienced by Europeans was a mixed grass prairie featuring bison, elk, black bear, wolf, and cougar. Every one of these species was hunted or trapped to local extinction by the new settlers. Pioneers turned out domestic livestock in the hills to forage. This conversion of grazers is important. Bison, for example, graze while moving. They sweep through an area and may not return to it for months or years. Moreover, they are non-selective grazers and avoid steep slopes. European stock cattle, in contrast, spot-graze meaning they return regularly to the same place (attracted by the sweetness of new grass growth). By preferring certain grasses for forage, other species exploit their advantage by increasing in size and volume in these 'disturbed areas.' … Moreover, cattle were pastured on steep slopes unfit for tillage. They carved trails along the pre-existing grooves in the hills, called 'catsteps,' exacerbating erosion. …Varmints were eradicated, land reclaimed, productive anneal crops introduced, roads and homes were built, mills and farm ponds added. New species included cows, pigs, corn, beans, brome grass, alfalfa, cats, blue grass and Russian olive trees. Other changes were less intentional, but not perceived as problematic : the erosion of the hills was dramatically accelerated; prairies were choked off by invasive trees and weeds; and whole species were replaced with such foreigners as leafy spurge, sweet clover, goat's beard, mullein, dandelion, house mouse, Norway rat, and eastern red cedar (Grant 1999).

Cornelia Mutel added: "Most [Euro-American] settlers regarded the Hills as an obstacle, something to be reshaped into a useful and habitable landform. … Within the loess, caves were dug to serve as small stables, wine cellars, lime kilns, and the like" (Mutel 1989b). In Sioux City, residents used

[119] According to Peggy Petrzelka, Loess Hills farmers continued to be diversified, raising corn, beans and hay where they could, and cattle where they couldn't raise a crop (Petrzelka 1999).

[120] Residential land uses are also changing. Within the Loess Hills landform region, towns appear to have been developed in three different situations. (1) Some, such as Missouri Valley, Crescent, and Thurman, are sited at the base of the steep western bluffs. (2) Others are "tucked" between the Hills near creek or river tributaries near the eastern edge of the landform region, such as Glenwood and Moorhead. (3) Towns within the Loess Hills—Pisgah, Rodney, Smithland, Oto, and Castana—are often located along tributaries that cut through the Hills, which coincided with transportation corridors (first Indian trails, then stage lines, and later road and/or railroad routes). The largest two cities in the landform region, Sioux City and Council Bluffs, initially developed at the base the western bluff edges, then spread out across the Missouri River bottomland and up the hills.

[121] However, up until at least the mid-1970s, the trend was in the reduction of forest cover. Thompson and Hertel (1981) found that between the mid-1800s (i.e., 1832-1859) and 1974, forested acreage was reduced by 73% in Woodbury County, 51% in Monona County, 47% in Harrison County, 27% in Pottawattamie County, 25% in Mills County, and 24% in Fremont County. Only in Plymouth County was an increase noted; total forested acreage rose in Plymouth County from 3,640 acres (the smallest amount of all the counties) in the mid-1800s to 5,200 acres in 1974. All of the historic aerial photographs confirm a greater amount of acreage under cultivation in Plymouth County when compared with the other portions of the counties in the Loess Hills landform region.

horse-drawn graders to the level bluffs and valleys. Throughout the Hills, people quarried bedrock, cut timber, and used loess for fill (Mutel 1989b).

Quarrying and mining activities are still among the major threats to the Loess Hills landform region. Longtime Malvern resident Bill Blackburn noted that quarrying and taking loess for fill at construction sites is destroying the bluffs near Thurman (Blackburn personal communication). Aerial photographs indicate that mining of the western face of the Loess Hills in the area between Council Bluffs and Sioux City has been occurring since the 1960s, and is accelerating. Beyond the visual scar on the landscape, these activities threaten the loess deposits themselves: "Left unrepaired, excavations lead to serious soil erosion and can create safety hazards from mud flow." (*Des Moines Register* 1982). Construction of homes in the bluffs during the 1970s and '80s is a major problem, as once the soil is cut erosion becomes a significant risk *(Des Moines Register* 1982).

In addition to residential construction, much of the fill soil has been used for road construction. Starting in the 1890s, a popular movement focused on improving roads (Stilgoe 1988). Even prior to that, farmers advocated building roads along every section line to enhance farm-to-market connections. Nevertheless, many roads within the hills follow the landform rather than the section line, even today.[122]

The older roads in the Hills, intended primarily for internal transportation, were dirt-surfaced and one to one-and-a-half lanes in width. Because early road builders appreciated the vertical stability of loess soils, the oldest roads generally have very little associated ditch or backslope. However, roads cut through a hill or built into the side of a slope tend to have steep vertical walls.

By 1913, the "good roads" vision extended beyond the need for local circulation. The result was the Lincoln Highway.

> The Lincoln Highway was the first transcontinental highway in the United States … to run from New York to San Francisco. Aggressively promoted by the Lincoln Highway Association, a non-profit organization largely backed by the automotive and cement industries, this route was both a catalyst in and a product of the nationwide 'good roads' movement. Establishment and promotion of the Lincoln Highway helped focus attention on the poor condition of the nation's roads and ultimately laid the foundation for the federal highway system.
>
> Long before highways were depersonalized with numbers, they were named for heroes, cultural icons, and destination points. The Lincoln Highway . . . was the first of many named memorial highways that crisscrossed the country by the mid-1920s. …. The era of named highways ended, at least officially, in 1925 with the inauguration of a national numbering system to eliminate what had become, in little more than a decade, a confusing jumble of named interstate and numbered state highways. Two-thirds of the Lincoln Highway's length became U.S. 30 (from Philadelphia to Salt Lake City). However, colloquial reference to this route as 'the Lincoln Highway' continued until World War II.
>
> In its initial design and construction the Lincoln Highway was little more than a collection of dirt-surfaced rural roads and a few paved city streets that had been connected on a map and labeled a cross-country highway. Through subsequent improvements, it became a precursor

[122] Today, roads within the Hills are fairly evenly split between those that conform to the rigidity imposed by the Government Land Office survey and those that respond to the natural topography. Those roads in the steeper hills (generally, the west side of the landform region) are most likely to respond to the topography.

> to today's multi-lane high-speed, interstate highways. Although portions of the road in the far West would never be paved, by the early 1930s motorists could drive the Lincoln Highway on a continuous line of pavement from New York to Missouri Valley, Iowa (Decision Data, Inc., and Tallgrass Historians, L.C. 1998a)[123]

Vehicular circulation patterns in the Loess Hills region remain remarkably constant from 1937-38 through today,[124] although improvements have been added over time.[125] For many lesser-traveled roads, the improvements were limited to the addition of gravel and a reduction of the steep angle of the backslopes; surfaces of some lightly used routes are still dirt. More heavily traveled roads were altered by widening the road bed, converting to a paved surface, adding stabilized shoulders, lowering the angle of the backslopes,[126] and stabilizing the shoulders and backslopes with brome grass. Backslopes are reduced in angle so the steep banks don't shade the road in the winter.[127]

In the late 1950s, the perceived need for rapid transcontinental vehicular transport resulted in the construction of the federal Interstate Highway system. In western Iowa, Interstate 29 followed the historic north-south trace at the base of the western bluff line (Sorensen and Chicoine 1982). Interstate 80 traverses Pottawattamie County on an east-west course. The ease and speed of Interstate Highway transportation has encouraged urbanites to use the Loess Hills as a "bedroom community" while they earn their living in Sioux City, Omaha/Council Bluffs, or Glenwood. Commuters are perching huge houses on the hills to enjoy the spectacular views, and contributing to their destruction in the process by interrupting the bluffs' majestic horizon (Grant 1999; and Mutel 1989b).[128] The Loess Hills formation around Sioux City, Crescent, Council Bluffs, and Glenwood (and to a lesser extent around Missouri Valley, Thurman, and Hamburg) are threatened by sprawling expansion. Council Bluffs and Crescent, in particular, have tripled in area covered by residential and commercial development.[129]

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[123] Because Iowa state law forbade the expenditure of state funds for road construction, the Lincoln Highway in that state was initially (1914-1917) funded by county boards or municipal governments. In 1916, farmers pressured Congress to pass the first national road and highway legislation, the Federal Aid Road Act. Federally financed road improvement projects accelerated with passage of the Federal-Aid Highway Act in 1944 (Cochrane 1979).

[124] In Harrison and Monona counties, the older road patterns appear to be more intact than in other counties. They have more narrow dirt roads with sharp curves, steep grades, and steepbackslopes are evident. In Mills and Fremont Counties, roads are more likely to be improved.

[125] These improvements probably began after 1940. See Cochrane 1979.

[126] High banks along dirt roads trap snow and ice and, because they are shaded, the road surface remains wet or impassable for longer periods (Blackburn interview 2000).

[127] The growing trend to allow higher speeds on local roads has required more "improvements" (i.e., straightening of curves, paving road surface, widening shoulders, decreasing slope onbackslopes, and widening the road surface), thereby changing the historic character.

[128] However, Don Reese noted that even the concept of the Hills as a bedroom community has its historic precedents. R.T. Reese, a Welshman who arrived in Council Bluffs by way of Ohio in 1855, decided to abandon plans to go to California gold fields and settled in Iowa. He established a business in Council Bluffs as a harness and saddle maker. The following year he claimed some farmland along the Little Sioux River in Monona County. Over the years, his family ran the farm, and he commuted 70 miles every weekend from Council Bluffs to be with them. Eventually Reese left the harness-making business and established a general store in Turin, closer to the farm. Still, he continued to commute while his sons ran the farm (Reese 1994).

[129] Another disruption of the landscape is the proliferation of cell telephone towers in rural America. It has been suggested that a tower will eventually be placed on every square mile throughout western Iowa.

Improved roads have brought hundreds into the Hills to live, and thousands for recreational purposes. Loess Hills recreational tourism was popularized with construction of the Lincoln Highway in the 1910s and '20s, and has become increasingly popular as America's workforce fought for shorter work-weeks and better pay, making more time and money available for recreational pursuits. Faced with a general decline in the agricultural economy in recent years, some Loess Hills farmers have begun charging "outfitters" fees in exchange for exclusive rights to access their marginal lands. The "outfitters" assemble groups of hunters and bring them into the Loess Hills (Petrzelka 1999). The use of motorcycles and dirt bikes has become a common sight in some parts of the Hills, resulting in visual blight and severe erosion in affected areas.[130]

Sugar Clay. Intrusions, erosion, sometimes even destruction …the threats are many. Yet so is the promise. Modern perspectives on the Hills today are as varied as those of the blind men looking at the elephant. Some look at them through teary eyes, saddened, as Diane Blankenship was, "by the wounds brought on by 'progress'" (Blankenship 1994). Others focus on the differences between a healthy prairie and one deprived of fire. A few squint at a loess bluff and calculate how many bricks it will make, or how many cubic yards of fill. Not too many notice that the gas stations and golden arches now mark the Interstate highway exits as rhythmically as the grain elevators and depots once marked stops on the railroad.

And some will experience the Loess Hills as Bill Blackburn does. When Bill looks at the Hills, he sees the land to which his great-grandparents, Philip and Mary Forney, came with their parents in the 1840s. This land that was shaped by the Forneys has, in turn, shaped five generations of descendants who still make the Hills their home. Bill calls the loess "*sugar clay.*" He notes that a vertical cut is as strong as steel, but exposed horizontally, loess dissolves like sugar. It is the perfect analogy for recognizing the strength and the frailty that caused the Loess Hills to be called "Fragile Giants."[131]

[130] For example, the use of recreational vehicles near the Lewis and Clark Monument on the northern edge of Council Bluffs has eroded soil to a depth of 10-15 feet. (*Des Moines Register* 1982).

[131] "Fragile Giants" is a term coined by noted author Cornelia Mutel. Her books *Fragile Giants: A Natural History of the Loess Hills* (1989a) and *Land of the Fragile Giants: Landscapes, Environments, and Peoples of the Loess Hills* (1994) are standards for understanding and appreciating the Loess Hills.

Appendix D: Description of Natural Resources and Special Landscape Areas

Examination of existing field surveys of Loess Hills prairies, forests, and topographic features followed by application of Geographical Information System (GIS) technology allowed researchers preparing this Study to gain new insights into distribution of these resources. Their examinations also prompted the identification of 12 Special Landscapes that stood out as clusters of exemplary prairie and geological/topographic features.

Techniques Used: Studies conducted by The Nature Conservancy (White and Kerr 1981; Prior 1992; Hickey and Watson 1992; Selby 2000) were examined in depth. The studies conducted prior to 2000 sought to identify prairie complexes through the use of color-infrared aerial images and low-altitude aerial reconnaissance, followed by site visits to selected complexes. These earlier studies also considered major geological features (exemplary topographic features, unusual deposits, and the like, including those described in Szymkowicz and Ruhe's (1981) and Ruhe et al's (1983) reports on potential National Natural Landmarks). The most recent inventory (Selby 2000), which was based solely on aerial photograph interpretation, provided the first comprehensive delineation of prairies throughout the Loess Hills region. Selby's highly detailed GIS mapping provides a conservative estimate of prairie coverage; prairies indistinguishable because they are overgrazed or otherwise degraded were not mapped. Thus, total prairie coverage probably lies somewhere between Selby's calculations and an earlier, much coarser GIS mapping of total grassland coverage (Iowa Department of Natural Resources 1992), which included planted grasslands of exotic species as well as prairies. All analyses completed to date are biased toward prairies without equal consideration of high-quality mature forests.

Resulting descriptions of these 12 Special Landscape Areas (SLAs), as well as of the Loess Hills Landform Region as a whole, are included below. Statistics on plant community coverage and land ownership status for the entire landform region as well as each SLA, resulting from the GIS analysis, are listed in Table D-1 of this Appendix.

The boundary of the landscape area depicted on maps utilized in this report are generalized boundaries, intended for interpretive use. The landform region boundaries and the boundaries of the 12 SLA's do not have legal standing.

Natural Resources of the Loess Hills Landform Region:

Remaining prairies are nearly ubiquitous, threading through the Loess Hills from north to south and east to west. These mapped prairies cover a minimum of 22,249 acres (3% of the Loess Hills). Additional prairies would likely be found among the 327,339 acres of all grasslands that cover 50% of the landform region. These figures demonstrate that prairies remain significant ecosystems throughout this special region. Their extent and interconnectedness magnifies their value as migration corridors.

The prairies change in shape and extent from north to south. They are broadest, most abundant, extensive, and flow over entire hillsides in the drier north (in Plymouth County occupying nearly 10% of the local landform region), while they narrow to cover only thin ridgetops and uppermost slopes in the moister south (where their cover is only 2-3%). Their characteristics, quality, and use also vary with location. The smaller ridgeline prairies of the southern hills, which are protected from grazing and other disturbances by their remoteness and the rugged terrain, may be in good to excellent condition. The more easterly prairies and others on less rugged terrain, in contrast, often are heavily grazed. The long, thin shape of many remaining prairies makes them especially susceptible to invasion of surrounding woody species and emphasizes their need for intensive management.

Twelve special landscapes, defined on the basis of biological, geological, and topographic considerations, encompass a total of 99,997 acres and are distributed from the northern to the southern tips of Iowa's Loess Hills. These landscapes string along the western margins of the Loess Hills, along the Missouri River Valley, where the loess is deepest, the topographic relief is greatest, and the exposure to sun and wind create very dry environments that favor mid-grass prairie communities. Within this string of blufflands, the Special Landscapes highlight those areas where the Loess Hills are the highest and most articulated; here rugged topography has served to create the greatest scenic diversity and to protect inaccessible prairies from intensive livestock grazing and other human-induced disturbance. In many other places, both along the bluffline and toward the east, the Loess Hills topography is less extreme and thus prairies have been more impacted by grazing cattle or lost altogether to rowcrop agriculture.

Detailed GIS mapping revealed that 19 percent of the Special Landscapes' total acreage (18,745 acres) is native prairie. Coarser mapping indicated that 58 percent (58,008 acres) of the Special Landscapes is "grassland" of any type, including pastures of brome, alfalfa, orchard grass or other species, hayfields, and prairies and other areas with and without shrubs or scattered trees. Some of these grasslands likely are additional overgrazed or degraded prairies that were not identified as such in the detailed, conservative prairie map. A third of the total acreage (29 percent) is covered by forests, woodlands, and dense shrublands. Most of the rest (12 percent) is planted to row crops. The distribution of state-listed species throughout the Special Landscapes displays the value of Special Landscapes as a composite in representing the region's flora, as well as the natural variation of species composition from north to south.

As of September, 2000, 17 percent of the total acreage of these Special Landscapes (17,059 acres) was in some sort of protected status, being owned either by state or county government units or by The Nature Conservancy. The same percentage of prairies located within the Special Landscapes is under some form of protected status. 82,938 acres are privately owned.

Descriptions of the Twelve Special Landscapes:

1. Plymouth North

Plymouth North Special Landscape, nearly 10,000 acres in size, lies at the far northern terminus of the Loess Hills landscape region. Here, in Plymouth County, long unbroken ridge crests and a rolling, billowy topography reflect the shallower loess depth and the presence of underlying Cretaceous bedrock in the far-northern Hills. Sweeping vistas are afforded by the large, undeveloped grasslands that cover 80 percent of the land's surface; woody vegetation covers a meager 13 percent of the site. Broad, expansive, and interconnected prairies dominate a full quarter of the land. These large northern prairies host a large number of state-listed species and western species near their eastern distributional limits. The site is the nation's most easterly location of the prairie rattlesnake and the species' only known location in Iowa.

This remarkably open and undeveloped site, with its large roadless tracts, is today a major focus of Nature Conservancy (TNC) preservation and research activities. Altogether 39 percent of the Special Landscape is protected in conservation ownership, with the majority of that held in TNC's 3047-acre Broken Kettle Grasslands. The Woodbury County Conservation Board owns another 806-acre preserve, Five Ridge Prairie, which is also one of four Loess Hills sites to be designated an Iowa State Preserve and receive the strong legal protection afforded by that status. These preserves protect nearly 60 percent of the site's prairies.

2. Plymouth South

The 13,549-acre Plymouth South site, straddling the Plymouth-Woodbury County line and extending from the Plymouth North Special Landscape down to the northwestern edge of Sioux City, resembles Plymouth North in many ways. Plymouth South was selected for its similar biological traits (expanses of open grasslands, large numbers of rare species) and geological qualities (impressive vistas of classic loess topography and the broad plains of the Big Sioux and Missouri rivers beyond). Prairies cover a third of the land's surface. In addition, seeps and moist valleys in the site's southern portion have produced interesting woodland communities, some of which are mature, high-quality, diverse forests.

A total of nine percent of this parcel is publicly owned, the remaining 12,369 acres are privately owned. Nearly all of the public ownership is within woodland-dominated Stone State Park, which protects only four percent of the site's prairies. Mt. Talbot State Preserve, recognized for its geological and biological qualities, occupies the northern portion of the park and contains high-quality, diverse prairies. The Woodbury County Conservation Board owns a small acreage around the Dorothy Pecaut Nature Center, as well as the Riverside Bluffs site. Most of the prairies and woodlands to the north, in Plymouth County, remain on undeveloped land in pastoral agricultural use. The prairies are threatened by suburban homes that are fingering their way through the natural areas. The site's combination of high natural resource value, vulnerability to urban expansion, and strong management needs make this a prime area for increased protection efforts.

3. Luton

This small 1,941-acre open, grassy, bluff-edge site in central Woodbury County contains broad, continuous prairies unbroken by farm fields. Such sites are rare in Woodbury County, where intensive agricultural use has altered most of the native vegetation. Prairies cover about a third of the site. All are heavily grazed; the site lacks the undisturbed prairie remnants found in other Special Landscapes. Woody vegetation covers about a fifth of the site. All land in this parcel is in private ownership and used for agricultural purposes.

4. Grant Center

This 5,364-acre rugged triangular segment of the Loess Hills straddles the Woodbury-Monona County line. Here in the north-central Loess Hills, the loess is deep, landform characteristics are well developed, and the topography spectacular. Expansive, interconnected, undeveloped ridgetop and sideslope prairie areas cover nearly a quarter of the site. Prairies are fair to high quality. Woody vegetation covers a mere 14 percent of the Special Landscape. Topographically, long, high, narrow summits, open and often horizontally notched by catsteps, feed into branching spurs and steep-sloped deep ravines.

None of the area is in protected status. All of the land is used for agriculture, with few roads or structures penetrating the site. However the site was one of three areas that Ruhe et al (1983) recommended for National Natural Landmark (NNL) status. Although this site's qualities were described as similar to those of the other two proposed NNL sites, Grant Center was not selected because of its smaller size.

5. Turin

The 15,049-acre Turin area is located in the heart of the Loess Hills in central Monona County, where loess deposits are deepest and the classic Loess Hills terrain is best developed. Extensive concentrations of broad, large, interconnected prairies roll over the crests of sharp summits and high, miles-long, broad ridges as well as down dramatic westerly bluff faces. In all, 2,776 acres (18 percent) of the site is prairie-covered, with some prairies being quite diverse and high in quality. Woody growth covers nearly a quarter of the site. This site was cited in all geological surveys for its exemplary topographic and typical deep loess features, including its 200-foot bluffs with some summits towering 350 feet above the Missouri's floodplain, a high density of incised drainageways, narrow divergent ridges and steep slopes, and steep catstepped slopes.

Nearly a fifth of the site and nearly a fifth of its prairies are publicly owned. Protected landfalls within the Loess Hills Wildlife Area, where prairies have been managed by burning since the mid-1970s. The annual Loess Hills Prairie Seminar, a major natural history educational event, is held here, and two State Preserves (Sylvan Runkel and Turin Loess Hills) fall within the boundaries of the Wildlife Area. Much of the remainder of the site constitutes the Turin Site of the Loess Hills National Natural Landmark; no special management practices accompany that designation.

6. Little Sioux

This very large 23,736-acre Special Landscape in Monona and Harrison Counties has been acclaimed for several geological and biological values. Portions of the nearly 4,000 acres of prairie remain high quality and diverse. Topography is very rugged, with steep western blufflines and 400 feet of local relief in places affording scenic vistas across the Missouri's valley and up and down the Loess Hills. Volcanic ash deposits and other Pleistocene stratigraphic features have inspired scientific investigations in this region since the mid- to late-1800s. Ruhe et al (1983) selected portions of the Special Landscape as his first choice for a Loess Hills National Natural Landmark and recommended that the site also be considered for National Monument status.

About a quarter of the site is in public ownership, with sections of land falling within the Loess Hills State Forest, Gleason-Hubel Wildlife Area, and Murray Hill Scenic Overlook. All told, these public lands protect 18 percent of the prairies. Portions of the Loess Hills National Natural Landmark also fall within this Special Landscape.

7. Mondamin

The 5,394-acre Mondamin site in central Harrison County constitutes a long narrow band of rugged hills along the western edge of the landform region. A third of the land is heavily forested, but good quality prairies cover 13% of the protected high ridgelines.

A fifth of this landscape falls under public ownership (which protects nearly a fifth of the landscape's prairies). Public lands include the Mondamin unit of the Loess Hills State Forest (owned by the Iowa Department of Natural Resources) and Sawmill Hollow Wildlife Area (owned by the Harrison County Conservation Board).

8. Loveland

The long, thin, 3,828-acre Loveland site, stretching from southern Harrison County down into Pottawattamie County, skims the western border of the landform region. The site claims highly visible, high quality prairies (covering around 500 acres) on ridgetops and steep sideslopes and bluffs. However its precipitous slopes with narrow, deep valleys are largely covered with bur oak and other woodlands; woody vegetation claims over half the Special Landscape. The site includes the Loveland Loess geologic type-section, which lies nearby the DOT Scenic Overlook (just north of I-680). The high terraced exposure reveals the internal composition of the Loveland (Illinoian) and Peoria (Wisconsinan) loess deposits (major stratigraphic units) and is often visited by researchers of midcontinental loess deposits.

About a quarter of this area falls within the Hitchcock Nature Area, owned by the Pottawattamie County Conservation Board. The Nature Area preserves about a quarter of the site's prairies. Urban sprawl from nearby Council Bluffs potentially poses a major threat to the region.

9. Council Bluffs North

This 5,021-acre Special Landscape in central Pottawattamie County just north of Council Bluffs boasts large concentrations of prairies capping the topographically prominent narrow, winding, branching ridges. While prairies cover 15 percent of the high, rugged promontory, woodlands (which coat about half of the landscape) cloak the hillsides and form the dominant vegetation.

None of this landscape is in public ownership. Urban sprawl poses a major threat to remaining natural areas, as does the excavation of loess for fill dirt. A large limestone quarry also lies along the northeastern edge of the site.

10. Folsom Point

This 5,936 Special Landscape in Pottawattamie and Mills Counties spans most of the bluffline between Council Bluffs and Glenwood. With portions of the landscape forming a high, rugged range of grassland-capped ridges, the site was selected for its isolated, good-quality prairies and for its distinctive topography. However the site as a whole is heavily forested (woodlands cover about 40 percent of the land). Prairies, covering only 10 percent of the land, are restricted primarily to the ridgetops and highest driest slopes.

This site contains by far the largest number of recorded archeological sites of any Special Landscape because it overlaps a portion of the Glenwood archaeological area, with its concentration of Nebraska Phase (or Glenwood Culture) sites. As many as 1,000 Nebraska Phase earthlodges may have existed in the Glenwood locality, representing perhaps 300 years of prehistoric human occupation (ca. 1000 A.D. - 1300 A.D.) by farming people who were culturally similar to nearby groups in today's Nebraska, Missouri, and Kansas.

Two protected parcels are found within this site: The Nature Conservancy's 261-acre Folsom Point Prairies and the Mills County Conservation Board's 273-acre West Oak Forest. Together, these protect about 10 percent of the site and 10 percent of the site's prairies. Over 90 percent of the area is in private landownership. With the landscape's close proximity to Council Bluffs, urban sprawl poses a major threat to the landscape. This area is also experiencing severe pressure from the excavation of loess for fill-dirt.

11. Bur Oak Ridge

This 6,000-acre high, steep, rugged, westerly bluffline and upland in Mills and Fremont Counties represents the dissected, heavily wooded terrain that typifies the southern Loess Hills, but it also contains a greater concentration of very small, prairie-capped ridges than most other southern sites. Prairies cover a mere 10 percent of the land, with forests dominating nearly half of the landscape. Mature, diverse, high-quality forest remnants may exist in the site's short, high-gradient ravines. Prairie-topped ridgelines, with their fringes of bur oak savanna, afford some beautiful vistas.

This landscape includes the southern tip of the Glenwood Archaeological Area. Public lands in this landscape are limited to a single small (53 acre) site, a hillside portion of the Iowa Department of Natural Resources' Forney Lake Wildlife Area.

12. Waubonsie

The 4,249-acre Waubonsie Special Landscape stretches along the westernmost bluffs in southern Fremont County, near the southern terminus of Iowa's Loess Hills. The site is characterized by rugged highly dissected uplands with pencil-thin ridgecrests, very large, steep, western bluffs facing the Missouri River valley, and mature, undisturbed oak forests. Long thin prairies (covering in all eight percent of the landscape) string along the ridgetops, spill over onto dry south- and west-facing slopes, and span some of the massive western bluff faces. Former bur oak savanna areas on upper hillsides, still recognizable by their large open-grown trees, are now largely overgrown. Certain deep valleys are known to contain mature forest communities dominated by very large bur and white oaks with individuals exceeding 200 years of age. All woodlands combined cover 56 percent of the site, more than any other Special Landscape. This area boasts bobcats, paw paw trees, zebra swallowtail butterflies, and other rare Iowa species that reflect the woodland dominance of the southern Loess Hills.

About a fifth of the Special Landscape Area falls within the boundaries of its sole publicly owned portion, Waubonsie State Park. This park safeguards 22 percent of the landscape's prairies. Although state park status has protected prairies for decades, management through burning and cutting brush has begun only in the last few years.

Table D-1: Land Cover and Protection in the Loess Hills Special Landscape Areas

	Total Acres	Prairie[1]		Amount of Prairie Protected[2]		Other Land Cover[3]						Land in Non-Private Ownership[2]	
						Grasslands		Woody		Row Crops			
		acres	%	acres	%	acres	%	acres	%	acres	%	acres	%
***1.* Plymouth North**	***9,929***	***2,458***	***25***	***1,455***	***59***	***7,984***	***80***	***1,270***	***13***	***640***	***6***	4,200	39
2. Plymouth South	***13,549***	***4,481***	***33***	***195***	***4***	***10,062***	***74***	***2,676***	***20***	***767***	***6***	1,180	9
3. Luton	***1,941***	***599***	***31***	***0***	***0***	***1,458***	***75***	***372***	***19***	***68***	***4***	0	0
4. Grant Center	***5,364***	***1,164***	***22***	***0***	***0***	***3,861***	***72***	***761***	***14***	***703***	***13***	0	0
5. Turin	***15,049***	***2,776***	***18***	***496***	***18***	***9,353***	***62***	***3,446***	***23***	***1,958***	***13***	2,839	19
6. Little Sioux	***23,736***	***3,774***	***13***	***697***	***18***	***12,236***	***52***	***6,941***	***29***	***4,413***	***19***	5,814	24
7. Mondamin	***5,394***	***681***	***13***	***126***	***18***	***2,755***	***51***	***1,634***	***30***	***956***	***18***	1,086	20
8. Loveland	***3,828***	***521***	***13***	***119***	***23***	***1,542***	***40***	***1,983***	***52***	***279***	***7***	910	24
9. Council Bluffs North	***5,021***	***756***	***15***	***0***	***0***	***2,087***	***42***	***2,440***	***49***	***393***	***8***	0	0
10. Folsom Point	***5,936***	***597***	***10***	***58***	***10***	***2,730***	***46***	***2,303***	***39***	***616***	***10***	534	9
11. Bur Oak Ridge	***6,000***	***600***	***10***	***3***	***1***	***2,534***	***42***	***2,770***	***46***	***510***	***9***	53	1
12. Waubonsie	***4,249***	***338***	***8***	***73***	***22***	***1,485***	***35***	***2,369***	***56***	***302***	***7***	795	19
Total: All Special Landscape Areas	***99,997***	***18,745***	***19***	***3,221***	***17***	***58,088***	***58***	***28,966***	***29***	***11,605***	***12***	17,059	17
Entire Landform Region	***649,906***	***22,249***	***3***	***3,400***	***15***	***327,339***	***50***	***73.432***	***11***	***231,223***	***36***	26,600	4

[1] data from Selby (2000), using 1980 infrared photos. [2] data calculated by digitizing maps collected from all public and non-profit agencies, September 2000, Iowa Dept. of Natural Resources, Geological Survey Bureau. [3] data from Iowa Department of Natural Resources (1992). "Grasslands" include pastures of brome, alfalfa, orchard grass or other species, hayfields, and prairies and other areas with and without shrubs or scattered trees. "Woody" areas include forests, woodlands, and shrublands of all types and ages. Note that additional minute percentages categorized as barren, artificial, or water have been ignored.

Appendix E: Public Involvement

Through newsletters, public service announcements, and public workshops, the public was invited to participate in the study process. Seven informational open houses were held in the seven Loess Hills counties during the week of February 28, 2000. The purpose of these meetings was to inform citizens about the Special Resources Study and to respond to questions and concerns. A newsletter was distributed following these meetings. A second newsletter was issued in the fall which summarized various management strategies for preserving the Loess Hills, announced public workshop dates for refining these management options, and included a comment card for those unable to participate in the workshops. Finally, five workshops were held in local communities, and in Des Moines, Iowa, to capture input from residents living within and outside of the Loess Hills. Over four hundred individuals attended these last workshops, which were held between November 13-16, 2000.

Approximately 800 written comments were received. Of those, about seven hundred letters reflected the official position of National Parks Conservation Association, a private, non-profit organization dedicated to protecting and enhancing America's National Park System. Additionally, the study team received letters from the Iowa Chapter of The Nature Conservancy, the Iowa Department of Natural Resources, the Golden Hills Rural Conservation District, and the Loess Hills Landowners and Operators Association. These letters are included in this appendix.

Summary of Written and Verbal Comments

There is general consensus that "something should be done" in the Loess Hills to protect the natural, scenic, and cultural heritage of the area. Residential developments, quarrying operations, and erosion were the most often cited threats to the resource. However, opinions on how future protection should be accomplished varied.

Many individuals did not want the federal government involved, resented outsiders telling them what to do with their land, and asked the National Park Service to "go home." Many of these individuals expressed the fear that they would relinquish their private property rights, and noted that they were already good stewards of the land. Conversely, many others felt that options #1 and #2, which left management at a local or regional level, were too weak (lacked regulatory control), did not have enough federal involvement, and were not viable because the local government units could not be trusted to implement conservation programs. These individuals supported federal designation and felt that the designation would lead to additional funding for protection.

There was a common concern that the local government units would not be able to, as one individual phrased it, "handle zoning and planning," citing lack of staff, technical expertise, and funding as stumbling blocks. Most of the residents supported an alternative that would help willing private property owners implement preservation options through technical assistance and educational forums, creation of conservation easements, or targeted Loess Hills-friendly tax incentives. It was often suggested that partnership opportunities with the U.S. Department of Agriculture, Loess Hills Alliance, and other state, local and federal agencies should be enhanced.

Summary of Central Survey's Opinion Survey (2000)

During November and December, 2000, a telephone opinion survey of the general public, landowners, and Loess Hills Board Members was conducted (Central Surveys, Inc. 2000). The purpose of the survey was to explore land management issues within the Loess Hills Region. The

report is based on a total of 700 cross section interviews and 578 interviews with landowners (owning one acre or more) in the Loess Hills.

Results of the telephone survey are summarized below.

This survey found strong consensus among both landowners and the general public on a number of questions or issues addressed in the survey. The majority felt that "not enough, rather than too much, is being done to protect/preserve the Loess Hills," and that "not enough, rather than too much is being done to protect the rights of private landowners." There was strong opposition to increased residential development in the region, and strong agreement that local zoning laws are needed. There was also strong agreement that state and regional coordination is needed to ensure consistency of laws and regulations affecting the Loess Hills and that increased incentives are needed to encourage conservation practices.

The majority of respondents felt that acquisition of land from willing sellers by the state, or by the Loess Hills Alliance in partnership with private conservation groups, for the purpose of preserving the landform, was an acceptable approach. Likewise, over 50 percent of those interviewed did not agree that federal acquisition of land from willing sellers in the Loess Hills is the best way to protect the Loess Hills. However, a similar question, inquiring about the federal acquisition of land for the purpose of establishing a National Park, yielded some interesting contradictory results: while in four of the seven counties over 50 percent of Loess Hills landowners disagreed with this proposal, a cross section of interviewees agreed with federal land purchase for a National Park in all seven counties (with over 50 percent agreement in five of the seven counties). Likewise, there were strong differences within the landform, with Mills, Pottawattamie, and Woodbury Counties showing the strongest support for NPS land acquisition, and Monona County opposing such purchase most strongly (based on the cross section sample). Considering only the landowners, majorities in four of the seven counties disagreed with the statement "…the National Park Service should acquire land in the Loess Hills to be designated as a National Park and managed by the federal government". Landowners in the four northern counties were strongly opposed to the idea of a National Park in the Loess Hills region.

There was general agreement that zoning laws are needed to regulate mining and other land use activities, that state and regional coordination of zoning and conservation efforts is needed to ensure consistency, and that increased incentives to landowners should be encouraged.

Interestingly, while over 50 percent of those interviewed in the cross section felt that governmental involvement is needed to protect and preserve the Loess Hills, 50 percent also felt that protection of the landform can best be achieved through partnerships of private landowners and private conservation groups. There was strong agreement that the National Park Service should work with local and regional planners on tourism and economic development, and should provide technical and educational assistance on conservation.

Appendix F: Definitions

Catsteps: Bench-like features that are characteristic of the steep, loess slopes. They are the result of natural slippage of loess slopes.

Comprehensive Planning: The comprehensive planning process takes into account environmental problems such as population growth, erosion, resource depletion, urban sprawl, and landscape degradation. A Comprehensive Plan (CP) provides goals, policies, and guidance for future land use to direct the physical development of a site for long-term resource protection and sustainable growth. It is a written document that specifies the actions, controls, and strategies to maintain an area's important qualities.

Cumulative Impacts: The results of actions that, viewed with other actions, have an additive impact on the resource that is affected by those actions.

Cultural Resources: Aspects of a cultural system that are valued by or are significantly representative of a culture or that contain significant information about a culture. Cultural resources may be tangible entities (such as sites, buildings, and objects) or cultural practices.

Environmental Assessment (EA): A brief document prepared in response to requirements of the National Environmental Policy Act (NEPA). An EA helps determine whether a proposed action or alternative actions could have significant adverse impacts on the environment.

Environmentally Preferred Alternative: Of the action alternatives analyzed in either an Environmental Assessment or Environmental Impact Statement, it is the alternative that would best promote the policies as stated in NEPA section 101 (Congressional declaration of national environmental policy).

Geographical Information System (GIS): A GIS consists of computer hardware, software and georeferenced data. Georeferenced data corresponds to a place on the surface of the earth. A GIS is capable of storing, analyzing, and producing georeferenced data, such as maps.

Issues: For the purposes of National Environmental Policy Act documents, issues are environmental, social, and economic problems or effects that may occur if the proposed action or alternatives (including the no-action alternative) are implemented or continue to be implemented.

Joint Powers Board: An entity composed of state and/or local governments that makes efficient use of their powers by providing joint services and facilities with other agencies, and who cooperate in other ways to their mutual advantage. Any public agency may enter into an agreement with one or more public or private agencies for joint or cooperative action, including the creation of a separate entity to carry out the purpose of the agreement.

Local Government Units (LGU): As described in the Special Resource Study for the Loess Hills, LGUs are the first order of government that responds to local community needs, and makes policy decisions. Examples are town, city, and county governments.

Loess: A fine-grained silt composed dominantly of quartz and deposited by the wind during the Pleistocene Age. In Iowa, it originates primarily from glacial outwash. It is normally yellowish-brown and has a widely varied calcium-carbonate content.

National Historic Landmark: National Historic Landmarks (NHLs) are designated by the Secretary of Interior under the authority of the Historic Sites Act of 1935, which authorizes the Secretary to identify historic and archaeological sites, buildings, and objects which "possess exceptional value as commemorating or illustrating the history of the United States." Section 110(f) of the National Historic Preservation Act requires that federal agencies exercise a higher standard of care when considering activities that may directly and adversely affect NHLs.

National Preserve: Usually a large natural place similar to a national park, but where Congress has permitted one or more of the following activities: public hunting, grazing, mineral exploration, and extraction.

National Reserve: An area of nationally significant resources that are protected through a program of local land use management supported by federal financial and technical assistance.

National Natural Landmark: The National Natural Landmarks program was established by the Secretary of Interior in 1962, under authority of the Historic Sites Act of 1935 (16 U.S.C. 461-467), and administered by the National Park Service. A National Natural Landmark (NNL) is a nationally significant natural area that has been designated by the Secretary of Interior. To qualify as nationally significant, a site must be one of the best examples of a type of biotic community or geologic feature in it physiographic province. Landmarks are designated on both public and private land, with the program designed to have concurrence of the owner or administrator.

National Register of Historic Places: The Nation's official list of cultural resources that are deemed worthy of preservation. Authorized under the National Historic Preservation Act of 1966, the National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect our historic and archeological resources. These resources can be significant at the local, state, and/or national level.

Natural Resource: Any material that exists in nature independently of human industry and that is somehow utilized by humans, such as water, air, soils, forests, fish and wildlife. Scenic landscapes are included in this definition.

National Scenic Byway: The National Scenic Byways (NSB) Program was established to recognize certain roads as National Scenic Byways or All-American Roads based on their archaeological, cultural, historic, natural, recreational, and scenic qualities. The program is administered by the Federal Highway Administration.

Preferred Alternative: The alternative that has been identified as preferred at the draft EA/EIS stage. It is identified to indicate which alternative is likely to be selected, thereby helping the public focus its comments.

Resources: In this document resources are regarded as either/or the natural (flora, fauna, soil, water, air, scenic views, etc.) and cultural (historic structures, archeological sites, historic landscapes, etc.) components of the landscape.

Special Resource Study: A study authorized by Congress to determine if an area/site meets established criteria for inclusion into the National Park System. The National Park Service (NPS) is responsible for carefully screening proposals for new park units to assure that only the most outstanding natural or cultural sites or resources are considered for addition to the System. To be eligible for favorable consideration as a unit of the National Park System, an area must possess nationally significant natural or cultural resources, be a suitable and feasible addition to the system, and requires direct NPS involvement.

Topography: The physical relief features or surface configuration of the landscape.

Viewshed: A broad landscape or panorama that is within sight.

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