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A Special Loess Hills Issue

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CONTENTS

COVER: *The Loess Hills near Preparation Canyon State Park in Monona County. Photo by Ron Johnson.*

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A World Treasure

THE LOESS HILLS OF IOWA

Along the eastern edge of the Missouri River, from where it turns south near Sioux City to where it again flows east near Kansas City, is a row of steep hills. These hills reach their zenith in Iowa, forming a narrow band from north of Sioux City to the border near Hamburg.

These are special hills. Retreating glaciers deposited finely ground silt on the existing landscape. This material, termed "loess," is of German derivation and of the same root as "los," which may be translated as "loose or crumbly."

Loess is a very extensive deposit in the world, but it reaches its maximum depth in western Iowa and northern China, with deposits nearly 200 feet thick. Its mode of deposition has been argued since scientific beginnings, with some scientists believing it was of aqueous (water-borne) origin - others thought it to be aeolian (wind-blown) origin. This argument concerned loess in general and in Iowa, Bohumil Shimek, early Iowa naturalist and geologist, supported the aeolian theory. Scientists today agree the loess of western Iowa was deposited by winds picking up material from the broad Missouri River floodplain and carrying it across the state, dropping the larger particles near the river. The only part of Iowa devoid of loess is the tongue-shaped Wisconsin-age lobe in central and northern Iowa.

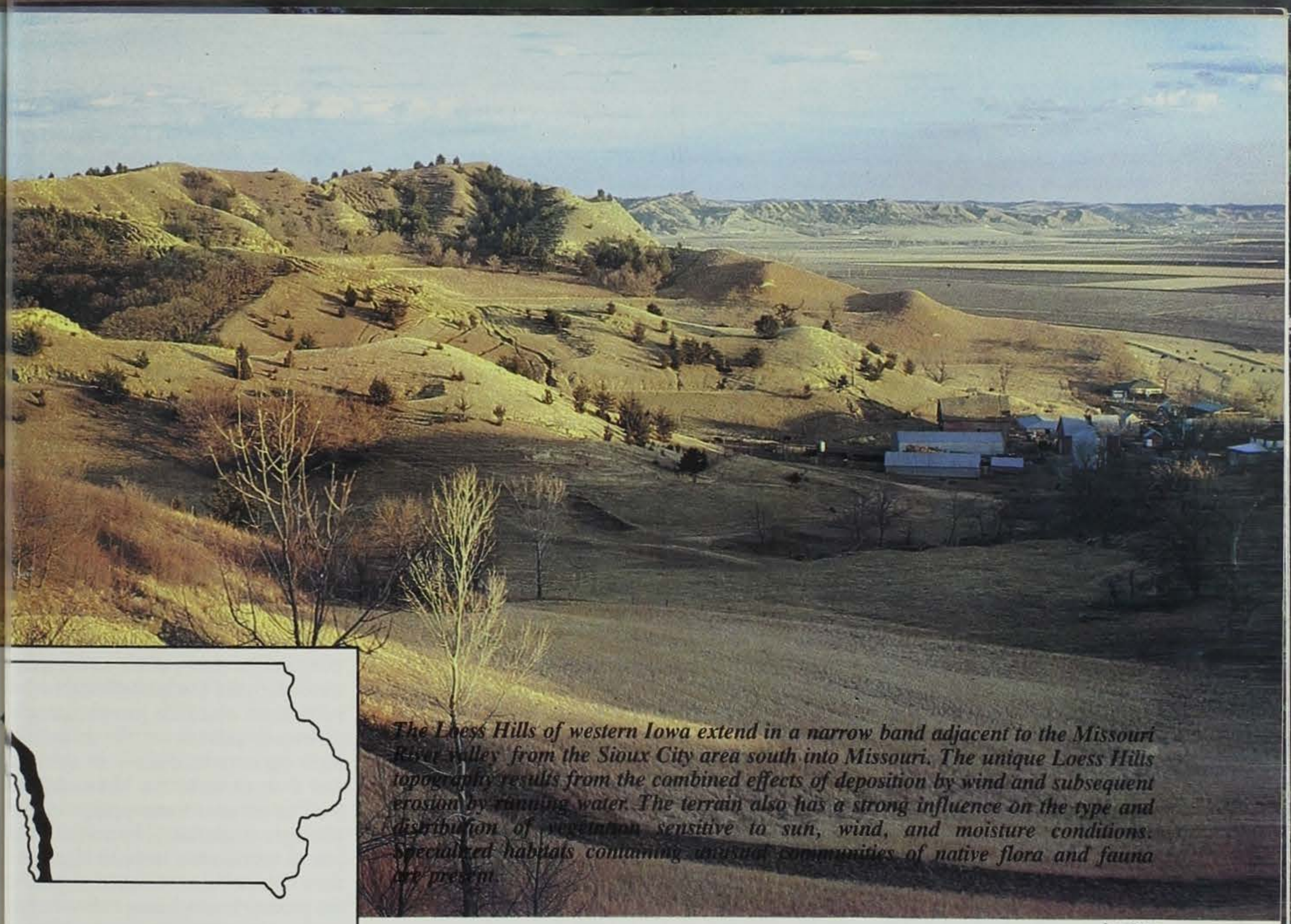
When brought indoors and dumped in a pile on a table, loess does not look at all exciting; straw yellow and of a loose loamy constitution, it exists in form between sand and clay — more compact than sand, more loose and much less plastic than clay. In nature, these loess deposits take on an excitement and importance for they are biological and geological treasures, at once scenic and rugged, tough yet fragile, somber yet full of scientific surprises.

In these Iowa hills, we find the state's rarest mammals, some of the rarest amphibians and reptiles, and some of our most unusual plants. Here is most of Iowa's remaining prairie legacy, with all of the history absorbed in the thousands of years of their existence. Here are the early American's sacred hilltops: here is where our forefathers paused before they tackled the broad river before them.

Nearly unique in the world, rivaled perhaps only by the loess of northern China, these hills have been an object of research attention by the State Preserves Advisory Board for several years, sponsoring studies on the mammals, butterflies, snails, plant communities, reptiles and amphibians, and history. The Iowa Natural Areas Inventory has located important remnant prairies. Hopefully now we can translate this knowledge into adequate protection measures for this outstanding feature.

This special issue on Iowa's Loess Hills is an attempt to help Iowans more fully understand the significance of this landform, to present some of the exciting discoveries that continue to occur, and to offer a colorful reminder that within our state lies a landscape of interest far beyond the borders of our state or our nation. *Dean M. Roosa*

Ken Formanek



The Loess Hills of western Iowa extend in a narrow band adjacent to the Missouri River valley from the Sioux City area south into Missouri. The unique Loess Hills topography results from the combined effects of deposition by wind and subsequent erosion by running water. The terrain also has a strong influence on the type and distribution of vegetation sensitive to sun, wind, and moisture conditions. Specialized habitats containing unusual communities of native flora and fauna are present.

Jean Prior

"During the day these bluffs may rn in the heat of the midday sun, they ay be swept by the hot blasts of mmer winds, or hidden in the whirl- g clouds of yellow dust which are rried up from the bars of the great er; but in the stillness of early morn- g, and again when the peace and iet which portend the close of day ve settled upon them, they are both stful and inspiring when looked upon m the valley; and there is no grander w in the great Mississippi-Missouri lley than that which is presented der such circumstances from their mmits — on the one hand over the oad valley and on the other across the llowy expanse of the inland loess lges which appear like the giant swell a stormy sea which has been sudden- fixed."

Bohumil Shimek
Geology of Harrison and Monona Counties (Iowa) *1910*

Loess Hills Geology

By Jean C. Prior, George R. Hallberg, and E. Arthur Bettis, III
Iowa Geological Survey

Bordering the full length of the Missouri River valley in western Iowa is a narrow band of bluffs, peaks, and ridges known as the Loess Hills. The western boundary of this picturesque region is sharp, with sheer precipitous bluffs rising abruptly from the lower, flat-lying Missouri River floodplain. The eastern boundary is not nearly as well defined, and the hills merge gradually into the rolling landscapes more characteristic of western Iowa. In the heart of these hills, usually within three to ten miles of the Missouri Valley, the terrain has an angular, jumbled appearance of alternating ridges and troughs. The hills are sharp-featured, with irregular peaks and saddles along the narrow ridge crests, numerous steep side-spurs, and intricate patterns of dissection. The distinct topographic identity of the region is also reflected in the strong contrasts in landuse patterns. Surrounded by geometric cultivated fields, the rough-textured hills retain their natural vegetative cover of short-grass prairie on the high exposed ridges and wooded tracts lying in the lower, protected hollows. This mosaic of topographic diversity coincides closely with the wide, north-south segment of the Missouri River valley, roughly from Sioux City to Kansas City. The hills are composed of loess, deposits of wind-blown silt; their source was the adjacent valley, which in the past, was flooded with sediment-laden meltwater from receding glacial ice to the north.

The unique topographic expression of the Loess Hills has prompted comment and study by geologists and naturalists for many years. David Dale Owen writing in the mid-1800's referred to the deposits as "silicious

Geology Continued

marl," the leftovers of sediment accumulated in an ancient lake. By 1870, state geologist Charles A. White still agreed with Owen on the origins, but referred to the hills as the "Bluff Deposit" and noted its similarity to " . . . that deposit in the valley of the Rhine (Germany), known there by the provincial name of 'loess'." White correctly looked to northwestern Iowa, the Dakotas and Nebraska for the source of this material, and commented that fine sediment was especially abundant within the drainage basin of the Missouri " . . . because the whole region was strewn with grindings fresh from those 'mills of the gods' — the glaciers." It remained for Bohumil Shimek, writing on the *Geology of Harrison and Monona Counties*, in the Iowa Geological Survey Annual Report for 1909, to accurately describe the remaining important factors — wind and erosion.

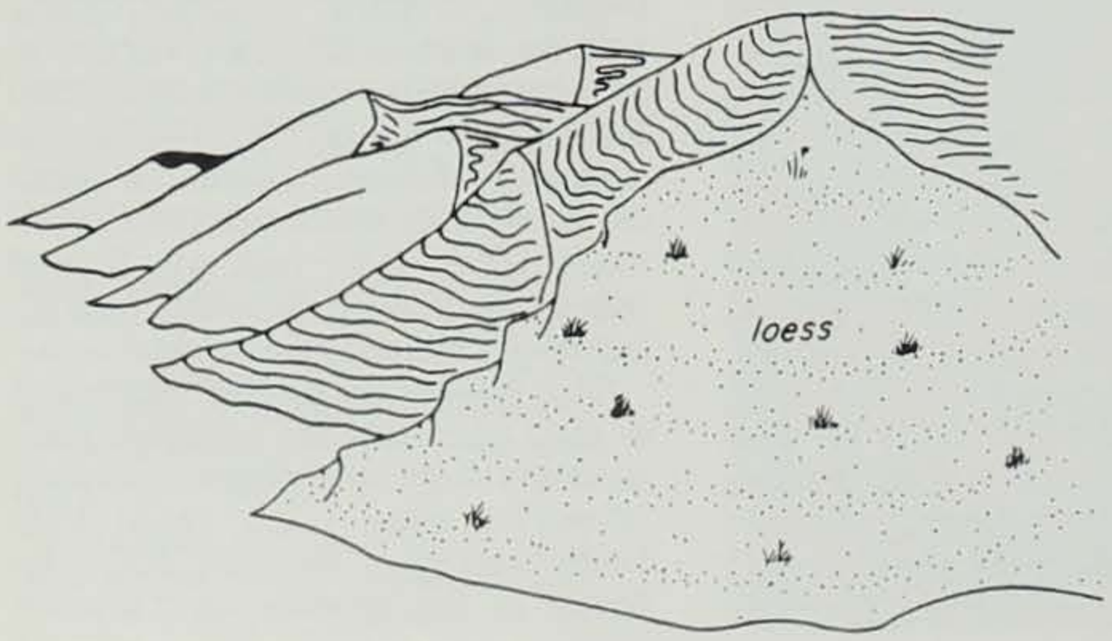
Tens of thousands of square miles of the midwestern United States are covered with loess; in itself, it is not an unusual material. Indeed, loess forms the parent material for broad areas of the nation's richest agricultural soils. In addition, notable deposits occur along the Lower Mississippi Valley and in eastern Washington, as well as in Europe and China. Many of these loess deposits are associated with major alluvial-valley sources, as in western Iowa. Here, there existed just the right combination of climate, abundant material, and valley width for unusually thick deposits to accumulate. Loess is a tan, gritty, quartz silt, and its uniform grain-size, permeable character, easy erodability, and propensity to stand in near-vertical faces will explain much about this striking topography and the fascination it holds for geologists, ecologists, engineers, and past as well as present inhabitants.

Origin and Properties of the Loess

The Missouri River valley plays an important role in the geologic history of the Loess Hills. The thick, uniformly fine-textured deposits of silt which constitute the hills originated as outwash material released by melting glacial ice to the north. The Missouri Valley served as a major channelway for these great volumes of meltwater and sediment. During thousands of Pleistocene winters, the melting slowed and water volumes were reduced. Wind winnowed and sorted the exposed sediment and swept the finer material off the floodplain into long columns and clouds of dust. These silt-laden winds dropped their loads quickly once out of the broad valley and the turbulent air along the valley margins. The greatest and coarsest accumulations occurred nearest the source, the Missouri Valley, with finer-size particles being carried downwind as far as 100 miles. Loess accumulations generally range from over 60 feet in the bluffs area to less than 8 feet in south-central Iowa. Locally in the Loess Hills region, thicknesses over 150 feet are reported. These extraordinary depths generally occur in areas where the loess filled in and buried minor, pre-existing stream valleys. Subsequent erosion into this unusually thick and easily dissected material carved the classical elements of the Loess Hills topography we observe today. The bulk of this loess deposition was of Late-Wisconsinan age — dating between 24,000 and 14,000 years ago. Older Wisconsin loess and still older Illinoian-age, or Loveland loess also occur here in western Iowa. The abrupt western boundary of the bluffs with the Missouri River floodplain has resulted from meandering of the Missouri and its tributaries into the eastern valley wall. Almost the entire bluffline has been sculpted by this lateral erosion during the last 10,000 years.

The appearance of the Loess Hills landscape at the close of loess deposition, and the nature of the topography of the underlying glacial drift and bedrock surfaces on which the loess was deposited are not well known. We do know the loess varies considerably in thickness, and even close to the Missouri Valley we can observe outcroppings of other geologic materials. Extensive post-glacial erosion has stripped large quantities of loess from the upper slopes, and the process is continuing today. Beneath the loess are older deposits consisting of Pre-Illinoian glacial tills and fluvial sands and gravels. The gravel pit at the base of the bluffs behind Turin, in

The Loess Hills contain some of Iowa's most unusual topography (below). ***The terrain has an angular appearance of abrupt bluffs, alternating peaks and saddles along narrow, prairie-covered ridge crests, steeply sloping sidespurs, and deep, wooded troughs. Loess is a wind-deposited, uniform-textured silt*** (right). ***Its physical properties account for unusual contrasts in appearance and stability. When dry it appears quite cohesive, and stands in near-vertical bluffs and cuts. Infiltration of water, however, from either natural or man-made causes along inherent vertical planes of weakness in the loess, can result in slope failure and collapse.***



Carolyn Milligan

rthwest Monona County, has yielded nificant fossil vertebrates and ar- aeological remains.

In the southern two-thirds of the bess Hills region, these uncon- lidated Quaternary deposits are derlain by Pennsylvanian bedrock, d a few limestone quarries are present ong the bluffs near Thurman, Council luffs, and Crescent. The northern third the region is underlain by Cretaceous posits, and fossiliferous limestones n be seen in Stone State Park and ong Broken Kettle Road in Plymouth unty. Another notable geologic de- sit within the region is a layer of lcanic ash, well exposed in the bluff ar the Harrison-Monona County line. his ash deposit, dated at about 0,000 years before present, origi- ted from eruptions of now-extinct lcanoes in Yellowstone National rk, Wyoming. Such ash deposits are aying an important role in the current evaluation of the early Quaternary acial deposits in the Midwest. Thus, hile the Loess Hills are foremost a pographic form developed within ess deposits, older diverse geologic aterials occur beneath them and here d there are exposed to view. It is ely that the scalloped character of the issouri Valley bluff-line results in part om the presence or absence of these der materials near the land surface and eir differential resistance to lateral osion of the valley sides. Similarly, rupt changes in hillslope form likely e coincident with changes in mate- ls. The steep, upper slopes, often arked by "catsteps," are formed in ess; these may abruptly change to ore gentle slopes below, developed on acial till with a mantle of colluvial posits.

anduse Hazards in the oess Hills

The steep, ridged topography com- ned with the special physical prop- ties of loess also impart some culiarities and problems to this re- on. The loess has sometimes been ferred to as the "clay" which stands ajestically in vertical cliffs, for no ason at all. The loess is not a clay; the ffs are seldom vertical; and obviously ere is a reason. Here, the loess is mposed dominately of coarse silt rticles. The steep slopes often range om 50 to 75 degrees in angle. The ason the slopes are so steep is related geotechnical or engineering prop- ties of the loess. The loess has a very w shear-strength when water-saturated, so low, in fact, that it could not bear its own weight in such high, steep cliffs. However, when relatively dry, the loess develops a greater apparent cohesion. This allows the loess to maintain the spectacularly bold bluffs and ridge-forms along the Missouri Valley, albeit in a rather tenuous fashion.

The relatively dry condition is maintained naturally by the steep slopes which do not allow much infiltration, as well as by the relatively low precipitation and enhanced exposure to sun and wind. With man's construction and development in the area, these conditions can be altered, sometimes dramatically. For example, if the loess becomes saturated, either from heavy rainfall or from sewer or water-line leakage or lawn watering, the loess may collapse from its own weight, or from the load of a building foundation. The Loess Hills area is replete with examples of slope failure, both from natural and man-induced causes.

Loess is also quite "loose" or friable, and therefore is easily eroded by running water. This factor, combined with its collapsibility, contributes to another major natural problem — soil erosion and gullying. Some of the highest soil erosion rates in the nation, averaging about 40 tons per acre, have been documented from this region. These excessive levels of erosion result from the combined effects of modern agriculture, easily eroded loessial parent material, and the steep slopes. High sediment loads in local streams necessitate continual maintenance of drainage ditches and stream channels and result in detrimental conditions for many aquatic species.

High sediment loads in streams are not solely a product of upland and slope erosion. An extensive gully network occupies most valleys in the Loess Hills. Gully erosion removes thousands of acres of potential cropland from production each year and threatens bridges, pipelines and roads. Gullying also releases enormous volumes of sediment into streams. Though modern agriculture, urbanization, and industrialization exacerbate the gully, soil-erosion, and slope-stability problems of the loess bluffs, the landscape history preserved in valley-fill deposits indicates that these occurences are not unique to the historic period.

The steep slopes, deep V-shaped valleys, and resulting microclimates of the Loess Hills are a product of episodes of gully cutting and filling contemporaneous with and following loess deposition. A record of the gully activity is preserved in deposits found in western Iowa valleys today. These deposits reveal a history of at least six region-wide periods of major gully growth and filling during the last 25,000 years. Five of these episodes have taken place in the last 8,000 years. Shells and bones of animals living during these periods as well as occupation debris left behind by Native Americans were buried in the gully fills. These fossils and artifacts provide us with insights about the climatic, biotic, and social conditions prevailing in western Iowa during the distant past.

Iowa's Loess Hills are one of the state's scenic natural wonders. In addition, they are an outstanding example of two basic geological processes — the strong influence of past eolian or wind deposition as well as erosional sculpture of the land. These origins also contribute to potential environmental hazards of slope failure and collapse. In addition, the association of the loess, the topography, and the vegetation combine for a classic display of the interdependence between geology and ecology. In this high-relief area, the terrain supports a mosaic of unique ecological niches of special interest to botanists and zoologists. The precipitous bluffs nearest the Missouri Valley particularly are exposed to the enhanced effects of wind and weathering, and sustain distinctive, desert-like habitats which harbor important undisturbed footholds for unusual native-plant communities. Much attention is currently focused on research and interpretation, as well as on inventory and preservation of these special natural areas within the Loess Hills.

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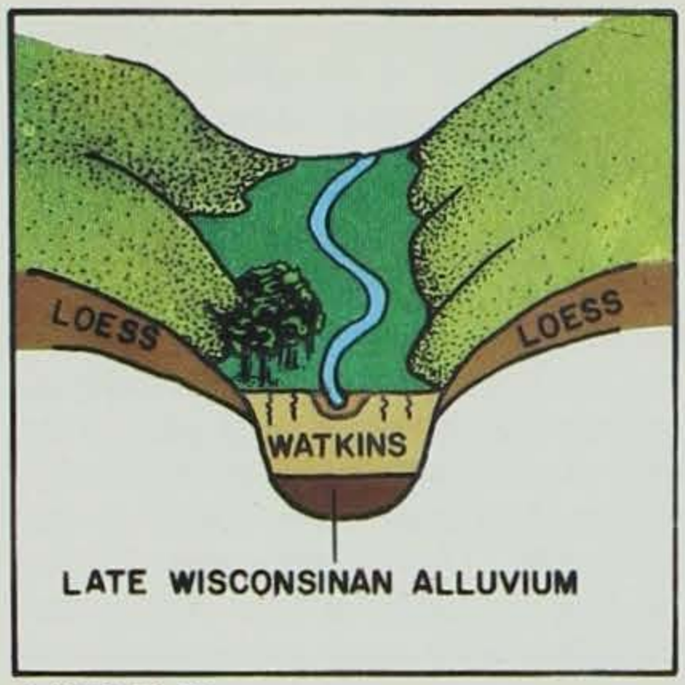
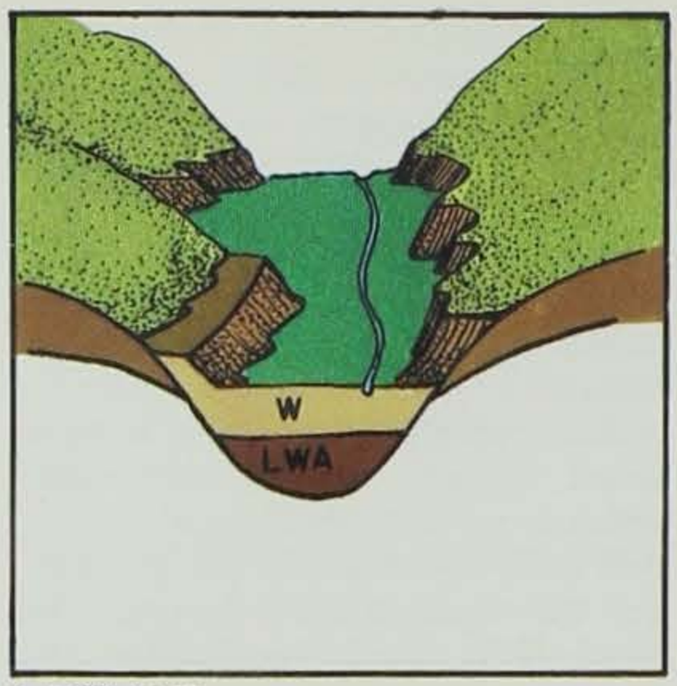
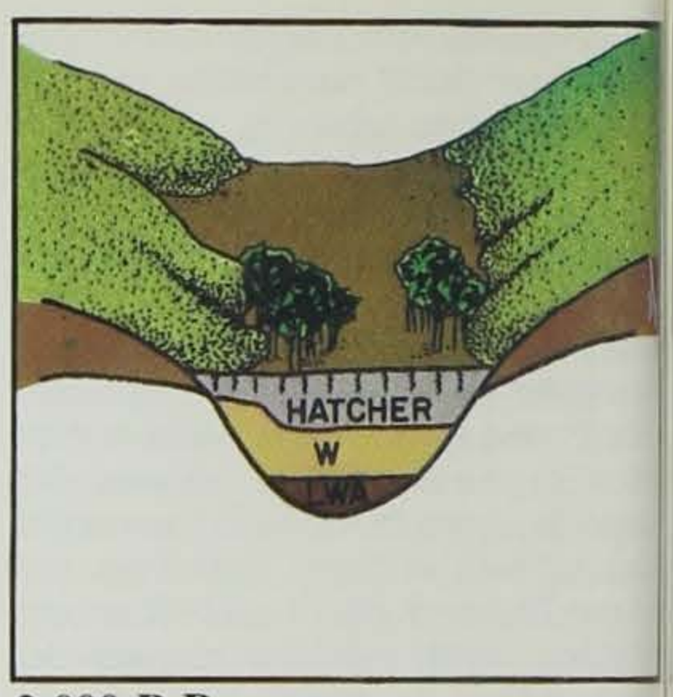


8,000 B.P.



3,500 B.P.



2,000 B.P.

The small valleys throughout the Loess Hills underwent gully erosion and sedimentation at approximately the same time. The alluvial fills which accumulated during various episodes of valley sedimentation are similar from one valley to the next and can be "correlated." Correlated fills are assigned specific names according to strict geologic procedures. The names "Watkins, Hatcher, and Mullenix" in the above diagrams refer to specific alluvial fills of comparable age throughout the Loess Hills of western Iowa.

Archaeology of the Loess Hills

By Dean M. Thompson, E. Arthur Bettis III, and David W. Benn

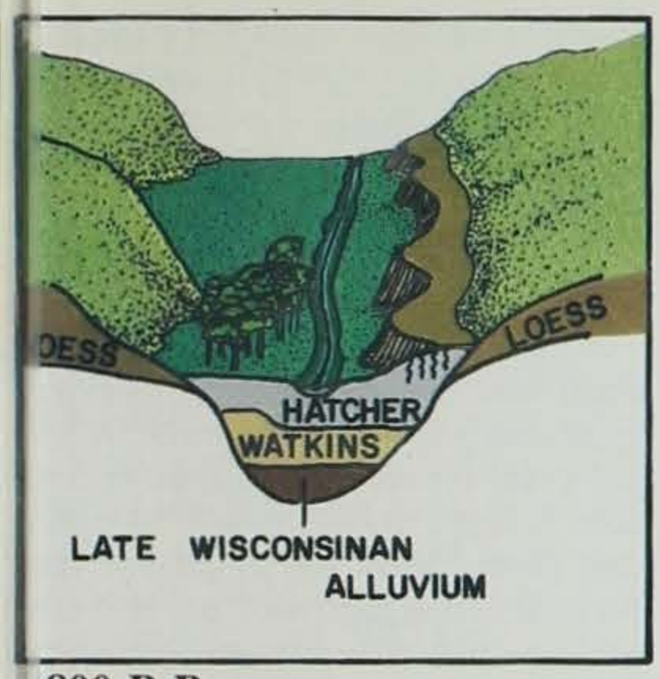
The term "fragile" is often used to describe the ecology of the Loess Hills landscape of western Iowa. Perhaps the term "dynamic" is more appropriate to describe the history of this landscape over the last 10-12,000 years. During this time the Loess Hills were modified by the forces of wind and water. Narrow broken ridge crests, flanked by steep sideslopes descending to narrow, V-shaped valleys are the products of erosion which followed the cessation of loess deposition approximately 12,000 years ago. Deep gullies throughout the region cut through not only thick deposits of loess, but also deposits of alluvium which accumulated in valleys as a result of the erosional carving of surrounding loess uplands. Ranging up to 100 feet in depth, modern gully systems expose alluvial deposits of the remote past as well as those deposits which accumulated during quite recent times. More important, alluvial deposits in valleys can be used to reconstruct the nature of landscape evolution, the timing and magnitude of erosion and deposition during the millenia prior to settlement by Europeans.

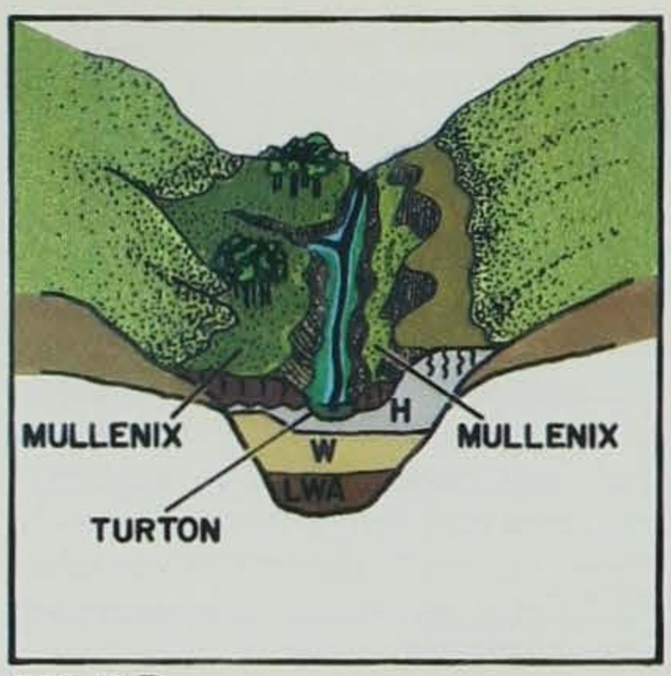
The term "dynamic" is equally suited to describe western Iowa's archaeological record, the accumulation of cultural objects and debris left by Native Americans living in the shadows of the sharply contoured hills. This record of "culture's clutter," to borrow a phrase, was shaped and molded by the same forces of erosion and deposition. What remains today is both a physical record of culture history and a record of dominant geologic processes. The archaeological record is literally wrapped-up in western Iowa landscapes. The geologic contexts of the archaeological record are unique owing to the special geomorphic history of the hills. This geomorphic, or landscape context of the archaeological record in western Iowa is the subject of this article.

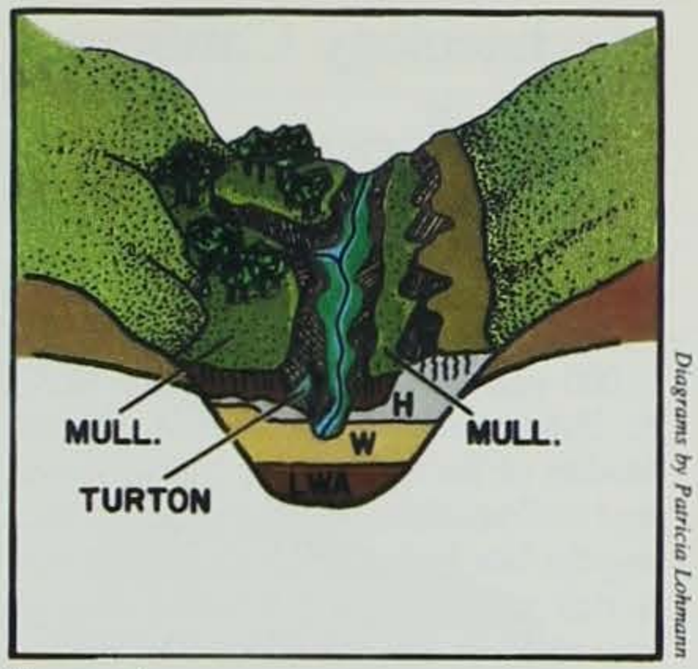
The culture history of western Iowa is seen as a sequence of technological changes in economic systems. Natural resources used to sustain populations, as well as the tools and methods of human organization required to utilize selected resources are the basis for differentiating economic systems throughout the Holocene, 10,500 B.P. to present (B.P.-years before present). The chronology of these economic systems usually is expressed by broad categories, namely Paleo-Indian (+12,000 to 8,000 B.P.), Archaic (8,000 to 2,500 B.P.), Woodland (2,500 to 1,200 B.P.) and the Late Prehistoric (1,200 B.P. to the time of European settlement around A.D. 1850). These prehistoric culture periods are discussed in "Western Iowa Prehistory" by Duane Anderson, an excellent source of archaeological background on this area.

This chronology of economic systems is a means of organizing and categorizing bits and pieces of archaeological information into a chronology of cultural evolution. The chronology is based on the assumption that technological changes, in the form of tools such as spear points or arrowheads made from stone, are indexes of culture change. For this reason archaeological studies have been object oriented. However, to really make sense of the artifacts and archaeological sites, it is necessary to develop an understanding of local environmental and social contexts.

In western Iowa the culture chronology has more organizational structure than informational substance. Much more is known of the last 1,000 years than of the previous 12,000 or more years that western Iowa was occupied by Native Americans. This poor balance of archaeological information is a problem throughout the Missouri River basin. The older the period of research







Diagrams by Patricia Lohmann

,800 B.P. **750 B.P.** **Present**

terest, the harder it is to find evidence wing to the longer periods for natural rocesses to destroy or bury archaeolog- al evidence.

Conspicuous gaps in the archaeolog- al record — empty rooms in the hronological structure — are results of ajor changes in the Loess Hills land- cape. These changes are not mysteri- us, with unaccountable effects on the rchaeological record. To the contrary, elatively new information about the istory of western Iowa landscape de- elopment from the field of geology elps archaeologists to define when, here and how a physical record of rehistoric cultures was preserved. eology helps to explain the imbalance f archaeological evidence, while point- g the way toward profitable research pportunities.

Between 12,000 and 8,000 B.P. the nvironment of western Iowa changed ramatically from the conditions preva- nt during the late-glacial period. By 1,000 B.P. the last continental ice heet retreated into Minnesota from orth-central Iowa, about the same time at loess deposition terminated in west- rn Iowa. Between 10,000 and 9,000 .P. coniferous forests sustained by the te-Wisconsinan climate gave way to ardwood forests and praires. Many rge Pleistocene mammals disap- eared. Rivers draining glaciated areas the north and east experienced great eductions of flow and sediment load.

It is a certainty that the Loess Hills ndscape was inhabited by Native mericans as early as 12,000 years go. There is irrefutable evidence of ontemporaneous occupation in states oth west and east of Iowa. The only ard evidence of this Paleo-Indian pres- nce in western Iowa is comprised of ighly-stylized spear points such as lovis and Folsom types. Finds of these rojectiles are isolated from other kinds of information with which to evaluate the nature of human occupation during this period of fundamental change in the physical environment. Thus, the local history of Paleo-Indian is inferred from information gathered elsewhere in the United States. This period is tradition- ally thought to have been a time of big- game hunting. However, we now know that the animal and plant resources exploited during the Paleo-Indian peri- od were more varied than depicted in general accounts. The relatively small number of known archaeological de- posits dating from this period has nar- rowed our view of human adaptions to late-glacial and post-glacial environments.

Considering the magnitude of land- scape changes during the Paleo-Indian period it is no wonder that so little information has been discovered in western Iowa. Only small remnants of "Paleo-Indian landscapes" remain after millenia of erosion and sedimentation. Valley landscapes were eroded away or buried by younger deposits. Since the uplands were the source of enormous volumes of sediment deposited in val- leys, it is unlikely that any significant portion of the Loess Hills landscape has been stable enough to retain undisturbed Paleo-Indian sites. A few of these sites undoubtedly will be found, but only by chance, or after the geologic settings have been defined in advance.

After about 10,500 B.P. the Loess Hills landscape underwent successive episodes of erosion and sedimentation. Episodes were of relatively short dura- tion but brought about large changes. These changes can be reconstructed from investigations in small valleys where thick alluvial deposits reveal the extent and magnitude of landscape modifications. The geomorphic history documented in these valleys suggests that today's Loess Hills landscape is almost wholly a product of gully cutting and filling during the last 3,500 years.

Relationships between the ar- chaeological record and the geomorphic history of western Iowa are more clear during the mid-Holocene. As small valleys were repeatedly eroded by gully growth, alluvial fans were constructed at their junction with larger valleys. Alluvial fans are sloping, cone-shaped landforms constructed by deposition of sediment moved by gravity and water. They usually form where there is a radical change in the gradient of a stream which causes material held in suspension to be deposited. Studies in the Little Sioux River valley indicate regional development of large alluvial fans during the extended period of small-valley erosion between 8,000 and 3,500 B.P. More important, these fans are known to be the contexts of buried archaeological remains from terminal Paleo-Indian and Early to Middle Ar- chaic culture periods. The Cherokee Sewer Site is the best known example.

By contrast, small valleys throughout western Iowa do not contain significant alluvial deposits pre-dating about 3,500 B.P. Numerous episodes of gully growth between about 8,000 and 3,500 B.P. removed older alluvial fills. Con- sequently, most evidence of early to mid-Holocene Native Americans was not preserved in small drainages, with the exception of the uppermost part of the drainages where mid-Holocene ero- sion was not as extensive. This scenario of landscape evolution during the mid- Holocene aptly illustrates an important principle of western Iowa archaeology: contemporaneous episodes of erosion and sedimentation throughout all of western Iowa either removed most evi- dence of human occupation for certain periods of time or else preserved the information beneath thick increments of loess-derived alluvium.

Archaeology Continued

The tributaries of major streams and rivers have never been a consistent focus for archaeological research into the time period between 3,500 and 1,000 years ago. This situation is likely to change in the next decade. Recent studies of the episodes of gully erosion and sedimentation in small valleys during the late Holocene demonstrates that a rich archaeological record has been preserved in the enfolding alluvial deposits in small valleys.

This particular period of time encompasses a major transition in long-dominant cultural adaptations to local environments. In an overview of archaeology in the "Driftless Area" of northeast Iowa (April/May 1983 issue of the *Iowa Conservationist*) Clark Mallam suggested that the sweep of culture history might best be understood by reducing the economic chronology to two modes of production, literally modes of life. The initial mode is one of hunting and gathering; the second mode, hunting and gathering combined with horticulture. This simplified organization of culture history applies to western Iowa as well.

The initial hunting and gathering mode spans at least 11,000 years. During this time period Native Americans lived within the capacity of the local environment to sustain life, the environment's carrying capacity. In a hunting and gathering mode of production the only real threats to the economic security of bands of humans who gather natural resources are growing population and competition with "strangers" from other bands. Competition with other bands is alleviated when bands remain within their own territories and intermarry with members of surrounding bands to maintain friendly equal relations. In such an organized peaceful social context there can be gradual growth in populations without straining social and economic relations. As bands become more densely packed, they decrease their range of seasonal movements by concentrating on the collection of the most reliable resources, such as deer, nuts, fish, and weed seeds. Inevitable conflicts between autonomous bands are resolved at regular social gatherings for feasts and ceremonies.

Despite cultural mechanisms for resolution of conflicts, a series of "cultural-ecological" crises ensued. By 1,000 years ago there began a comparatively rapid shift from hunting and gathering, the extraction of natural resources, to horticulture, the direct production of resources. This shift to a way of life based on the production of food was not just an opportunity. Escalating conflicts for increasingly scarce resources by growing populations left no alternative. It was a necessity. And the shift did not free local populations from exploiting resources provided by the local environment. The production of food resources made local populations more dependent upon a smaller number of resources susceptible to inclement weather, pests, and disease. More important, horticulture changed local populations from egalitarian networks of small bands to structured corporations with unequal statuses and privileges, and the need to protect a territory and the base of subsistence — horticultural plots. Significantly, bastions and other fortifications around some horticulture-based villages indicate a strong need to defend resources and territories.

Permanent settlements in well-defined locales along major valleys appear in western Iowa after 1,000 B.P. Large surface depressions of earth lodges, individually and in village enclaves, identify the places where populations were clustered during late prehistoric time. The sites are conspicuous; artifacts of stone, bone and pottery abound. Examples of trade goods and ceremonial paraphernalia show connections with groups hundreds and thousands of miles distant. The impressions are of permanence, abundance, complexity and social integration.

Such permanent settlements are well known along the Missouri River valley near Glenwood and along the Big and Little Sioux Rivers in northwest Iowa. They are local manifestations of a far broader trend known as the Plains Village tradition. Its origins are complex. In Iowa the sites are numerous whereas sites of antecedent culture periods are not, suggesting to some researchers that origins are not local but transplanted.

If, on the other hand, we follow a line of reasoning that argues for local development of village horticulture, there should be widespread evidence throughout the Loess Hills hinterlands of increasing populations of hunters and gatherers prior to a shift to horticulture. There should be a large number of sites with evidence of adaptations to diffuse resources available seasonally in small areas. That evidence exists. However, the evidence is inconspicuous. It is buried in the thick deposits of alluvium which accumulated in small valleys during the episodes of valley erosion and sedimentation between 3,500 and 1,000 B.P. This evidence has come to light as a result of recent archaeological and geological investigations.

Modern gullies developed in the small valleys of the Loess Hills expose more than just alluvial deposits. A long and extensive record of human occupations is also exposed, usually at significant depths below the modern surface. As joint investigations of late Holocene geology and archaeology continue, a little understood chapter of western Iowa prehistory unfolds. Far from a dearth of information about late Holocene cultures prior to 1,000 B.P., the Loess Hills contain information about a hunting and gathering tradition of broad continuity throughout the region.

At the Rainbow site in Plymouth County, excavations in 1978 revealed a history of seasonal encampments between about 1,800 and 1,200 B.P. Woodland hunters and gatherers moved into a small valley for brief periods of time. Visits were not just random occurrences. Similarities among styles of pottery, types of house structures, and the kinds of resources exploited all indicate a pattern of seasonal movement of family-sized bands in and out of small drainages. The pattern of occupations at the Rainbow site correlate with sites of the same age in other western Iowa valleys. The regional proportions of this evidence were previously unknown.

More recent studies at other sites suggest that evidence of an even longer sequence of small valley adaptations has been preserved. This evidence extends back to at least 3,500 B.P., the period known as the Late Archaic. The preserved record of brief encampments indicates occupation of gullies, the lowest and most protected landscape position. Between 3,500 and 2,000 B.P. these gullies were rapidly filled with sediment. Like the later Woodland period, represented by seasonal occupations at the Rainbow site, the Late Archaic period consisted of repetitious, short-term occupations in small drainages, evidence of which was buried on a rapidly aggrading late Holocene landscape.

The magnitude of landscape change in western Iowa between 3,500 and 1,000 B.P. obscured archaeological evidence of human adaptations. The local origin and development of village-based

orticulture have therefore eluded investigators. However, the new understanding of landscape evolution during his critical time period may change the tuation. With a model of landscape hange, it is possible to determine how, hen, and where important archaeolog-al evidence was, or was not preserv-d. The known geologic contexts of the rchaeological record will assist efforts understand the culmination of the unting and gathering mode of produc-on and the emergence of a mode of roduction based on horticulture. Both ate Archaic and Woodland occupa-ons show progressively greater locali-ation of populations, greater reliance n more diverse natural resources, and ends of population increase. In other ords, the social and environmental ontexts for development of horticulture re present.

The archaeological record of Native mericans in the Loess Hills is some-ing of a benchmark of change: change mong prehistoric ways of life and hange in the landscape system. It is ifficult to categorize the human adapta-ons as strictly cultural or landscape elated, and it is impossible to separate he two in any thorough study of the oess Hills environment. Here, the isciplines of geology and archaeology/ nthropology come together to deal ith a larger, common problem. Prehis-oric peoples once occupied the small alleys of the Loess Hills because the nvironment was conducive to their ispersed pattern of existence. The ar-haeological record of those peoples has een shaped and molded by geologic orces. This relationship is no different oday. The modern episode of gully rosion destroys the "old" archaeologi-al record as it buries a "new" record or future generations to expose. In this anner geological and cultural process-s are repeated in a seamless succession f historical development that is part of he human experience for all of us.

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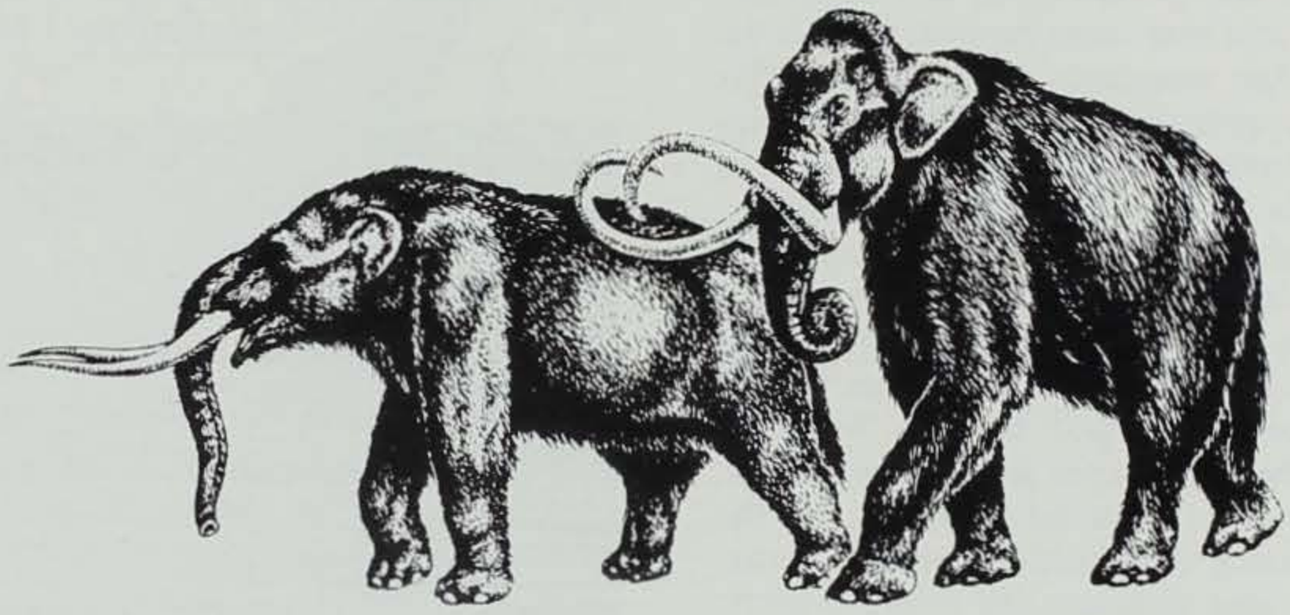
Fossil Mammals
of the Loess Hills

By R. Sanders Rhodes II and Holmes A. Semken, Jr.



Artist's reconstruction of a mammoth (right) ***and mastodon*** (left). ***From Kurten and Anderson.*** **Pleistocene Mammals of North America** ***© 1980, Columbia University Press. Reprinted by permission.***

Bones and teeth of fossil vertebrates are commonly found in the Loess Hills region of western Iowa. These remains include mammals that are now extinct (e.g. mammoths), survive only in Arctic regions (reindeer), or lived in Iowa until the last century (bison). Many specimens were collected in the late 1800's by teamsters excavating sand from pits with horse-drawn equipment. These fossils were described by the pioneering Iowa naturalists Samuel Calvin and Bohumil Shimek. This cooperation between amateur and professional paleontologists significantly expanded our knowledge of Iowa's prehistory. Other specimens, including the collections of Fred Delavan of Glenwood, were picked up from gravel bars in streams or were found on spoil piles in sandpits. Their exact geologic age is not certain, but the abundance of extinct species indicates that many lived here during the Pleistocene Ice Ages.

Very few fossil vertebrates have been collected directly from the loess because conditions generally are unfavorable for their preservation in upland areas. However, specimens recovered from associated stream deposits show that a diverse Ice-Age fauna definitely was present in Iowa at the time of loess deposition. Each of the species mentioned here have at least one representative from the loess proper.

Probably the most fascinating and familiar fossil vertebrates from the loess and associated deposits are the large extinct mammals. These include Jefferson's ground sloth, a giant armadillo, flat-headed peccary, stag-moose, a stilt-legged deer, woodland muskox, giant beaver, at least one kind of camel, American mastodon, and both Jefferson's and Columbian mammoths. Also included in this remarkable fauna are

Modern range of barren-ground muskox

the remains of displaced large mammals which now survive either far to the north (barren-ground muskox and caribou) or in Eurasia (wild horse). The large mammals living in Iowa at the time of European settlement (wapiti or American "elk," deer, bison, beaver,

Fossils Continued

black bear, and red fox) also are known from fossils in the state's Ice-Age deposits.

Thus, the late glacial environment actually supported a more diverse community of mammals than that known from historic time. While browsers (deer and ground sloth) and carnivores (fox and bear) were present, most of the Ice-Age mammals were grazers. This high species diversity suggests that significantly better-quality forage than that of the modern prairie was provided by the grasslands of the last (Wisconsinan) glacial episode. The giant beaver, on the other hand, required wetlands to support its soft, aquatic-plant diet. Forest groves, developed both on favorable southern exposures and in river valleys, provided sheltered habitats for the browsing mammals during this period of colder summers and cooler winters. The large number of species present suggests that this climate was not as harsh as that of the modern tundra.

Small mammal remains, recovered from the base of the loess in Mills County, have been the subject of recent intensive study. These rodents and shrews, because of their small home ranges and specific ecological requirements, are excellent indicators of past environments. Unlike the large mammals, none became extinct. They can, like the large mammals, be separated into displaced and extant types. Now-displaced varieties present in the Loess Hills region 23,000 years ago included the western pocket gopher, Arctic shrew, heather vole, and northern bog lemming. These all presently range to the north or west of Iowa. Extant species included masked shrew, Franklin's and thirteen-lined ground squirrels, plains pocket gopher, and both the meadow and prairie voles ("short-tailed mice"). The most common small mammal in western Iowa during this time was the meadow vole. Its abundance, along with that of other open-ground species (ground squirrels, gophers, and other voles), required the presence of extensive grassland. Tree-dependent small mammals were scarce in this deposit.

By 14,500 years ago, near the close of the Wisconsinan glacial interval, tree density had increased to forest proportions. This forest development allowed the establishment of both the chickaree (the noisy red squirrel of the northern conifer forest) and the yellow-cheeked vole (a tundra/forest border species) in the Loess Hills region. Grasslands were still an important constituent of the vegetation because grazing rodents, although present in reduced numbers, were still common.

Modern range of yellow-cheeked vole

At the end of the Wisconsinan, the environment changed radically. Around 12,000 years ago dense conifer forest covered most of the state. By 10,000 years ago, however, the conifer forest was replaced by either deciduous forest or modern prairie. The cold-adapted species (muskox and heather vole) failed to reproduce in Iowa and now are found only in the tundra and northern conifer forest. The extinct large mammals also disappeared at this time. The possibility that man, as a hunter, exterminated remnants of the declining populations of large mammals is the subject of vigorous debate.

Mammals representative of modern environments have been recovered from both geological and archaeological sites younger than 10,000 years. The recovery of small mammals, at aboriginal habitation sites, aids the archaeologist in reconstruction of the natural environment exploited by native American peoples. Bison, one of the few Ice-Age grazers to escape extinction, is the most frequently encountered fossil in deposits of this "recent" geologic age. Most of the mammals from this period are still native to Iowa, but it is clear that the ranges of these species have responded to changes in "modern" climatic regimes.

The study of plant fossils and pollen grains indicates that there was a period of significant aridity between 5,000 and 8,000 years ago. Rodent fossils collected from the Cherokee Sewer Site (an archaeological excavation just east of the Loess Hills) show that there was an increased number of prairie small-mammal species during this period. One species, a pocket mouse now found only west of the Missouri River, appeared in the site only during this unusually dry interval and overall spe-

Life-sized model of Jefferson's ground sloth being prepared for the Iowa Hall gallery, Museum of Natural History, on the University of Iowa campus (below). ***The gallery is scheduled to open in the summer of 1985.***

P.R. Gulley Studio

ies diversity was reduced by more than one-third. This drought was longer and of greater intensity than any in the last 00 years, and a recurrence would have severe economic impact on Iowa's agricultural industry.

The study of fossil mammals from he Loess Hills demonstrates that Iowa has had a history of changing climate and that these changes were of greater magnitude than any experienced in owa's recorded history.

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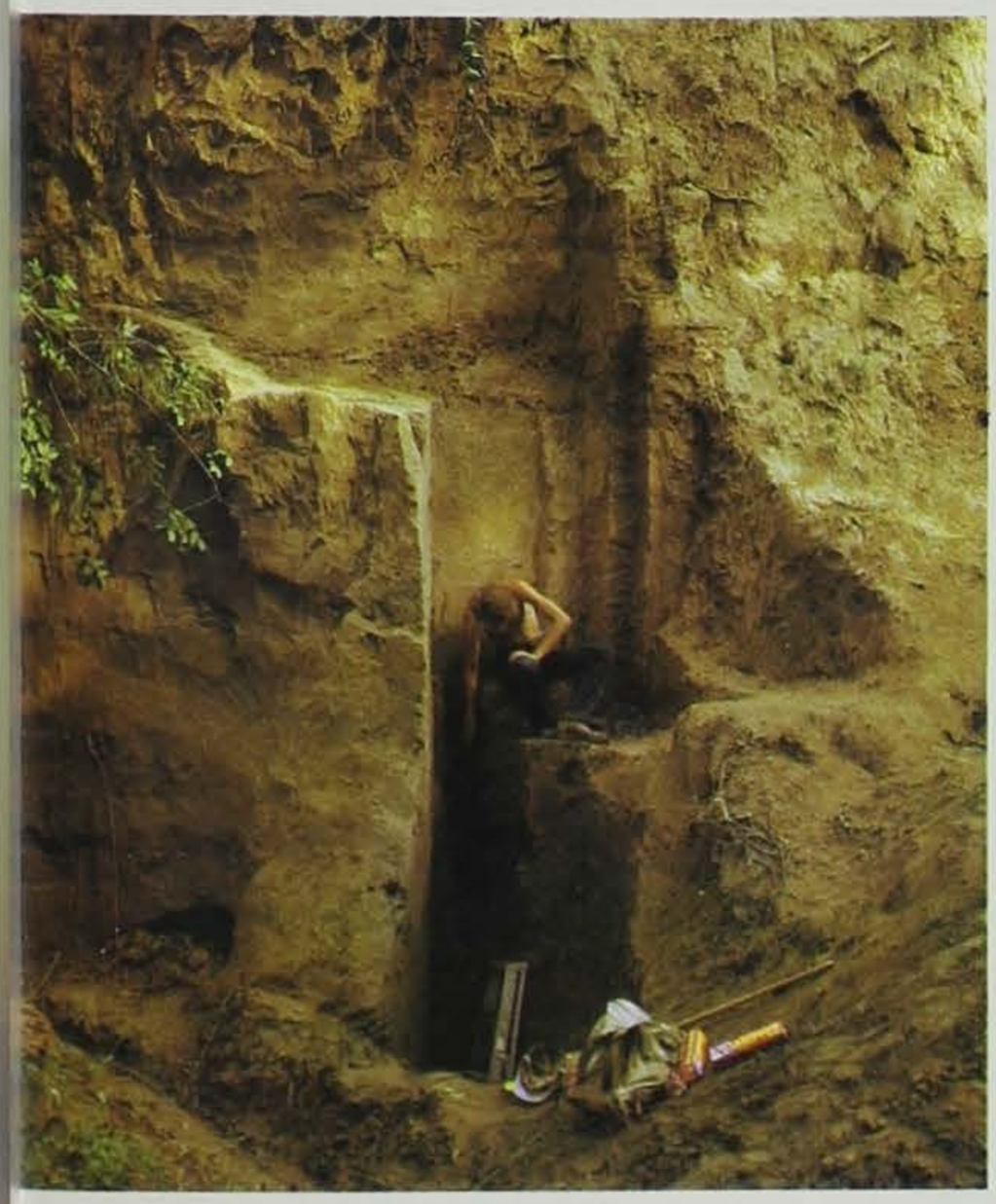
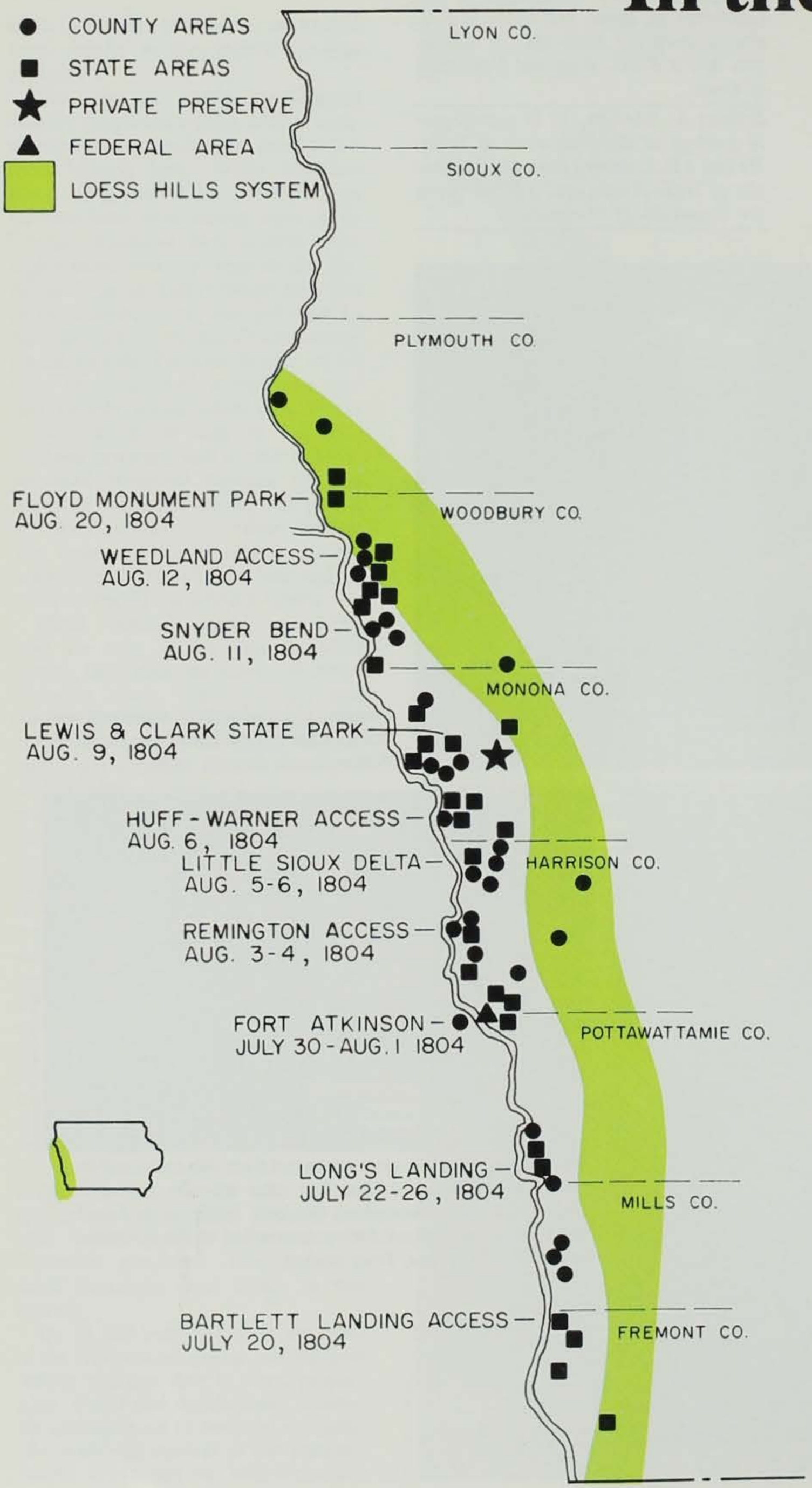
Remains of a Columbian mammoth tusk (left), ***in the upland loess near Oakland, Pottawattamie County, Iowa.***



Office Iowa State Archaeologist

Small mammal fossils were recovered from this gully wall in Mills County, Iowa. Archaeology sites are also found in similar exposures throughout the loess bluffs (left). ***Fossil bison vertebrae exposed during excavation of the Cherokee Sewer Site, Cherokee, Iowa*** (above).

In the Footsteps



A Trek Along the Loess Hills

By Wendy Van Gundy and James J. Zohrer

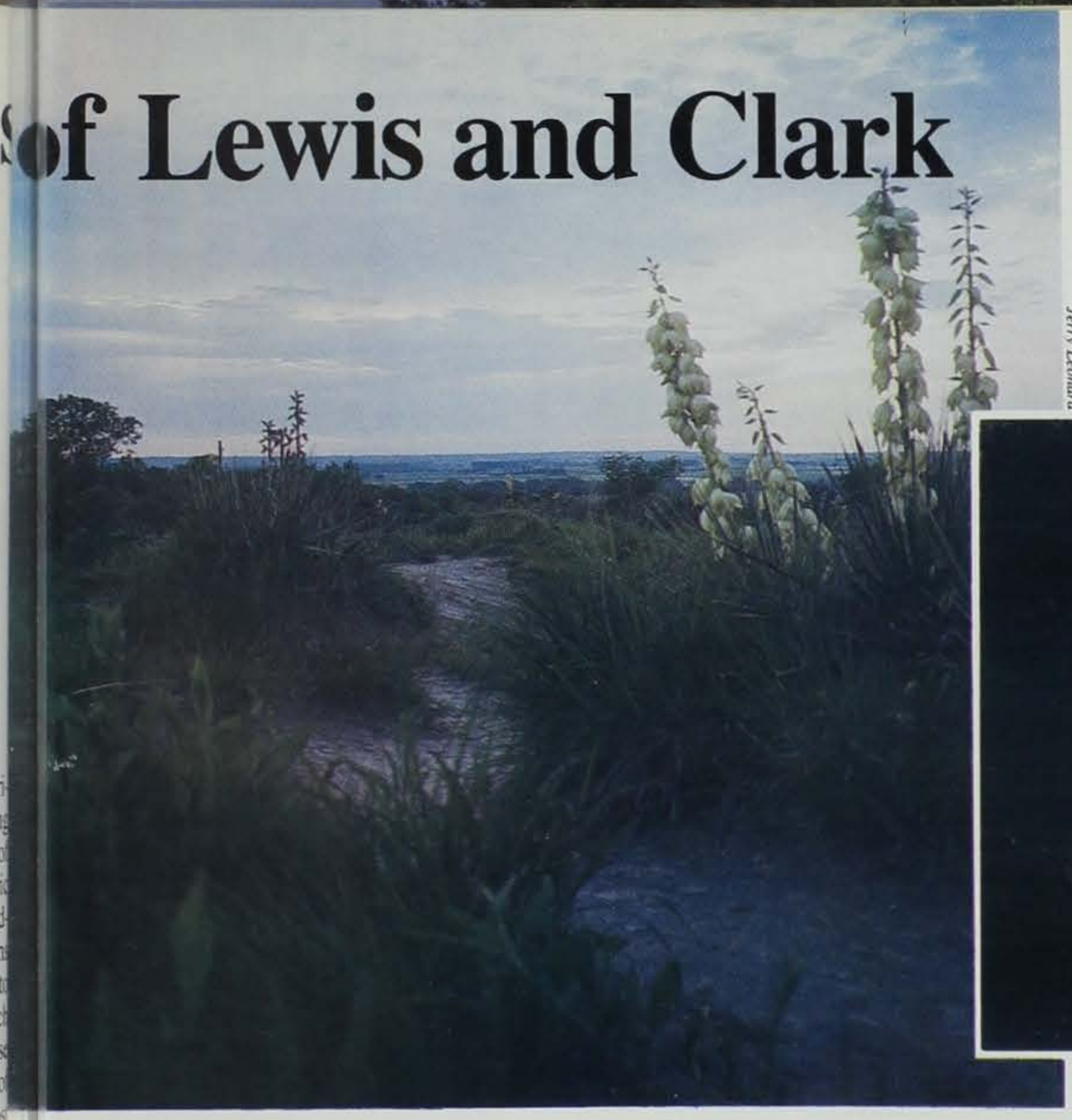
On May 14, 1804, Captains Meriwether Lewis and William Clark along with 43 men set out from the mouth of the Missouri River on their historic march to the Pacific Ocean. This expedition was acting on specific instructions from President Thomas Jefferson to "...explore the Missouri River and such principal streams of it, as by its course and communication with the waters of the Pacific Ocean, may offer the most direct and practical water communication across this continent for the purpose of commerce..." During the next two years, these men crossed lands that now lie in ten states and viewed and documented plants, animals, geologic features and peoples that had never been seen by white men before.

We are going to join this expedition and explore Iowa's western border as it was in 1804. Along the way, we will examine many of today's special places now managed by county conservation boards or the Iowa Conservation Commission.

It wasn't until the second month of their journey that these men passed through land now known as Iowa. What most impressed them in this area was the narrow band of hills to the east which was deeply eroded, very rugged, and which supported an array of unique plants and animals. The view from the top of these hills to the east was one of unending grasslands broken by narrow wooded streams and scattered isolated trees. Below the hills to the west was the broad, rich Missouri River floodplain containing the meandering river, their highway to the west.

Captain William Clark noted in his journal as he entered Iowa that "the soil of these prairies appears rich, but much

# of Lewis and Clark



Jerry Leonard

Some 180 years ago Lewis and Clark no doubt enjoyed similar sunrises (left) ***such as this one at Stone State Park. The huge cottonwood tree*** (below) ***at Lewis and Clark State Park was present when the explorers camped there in 1904.***

Jerry Leonard

parched with frequent fires. Deer bea-ver, elk, and turkey are quite common." In the weeks which followed, these animals became an important food source for the expedition. Much time was spent hunting and exploring this new and unique landform now known as the Loess Hills.

Today, over 60 state- or county-owned parks and wildlife areas are located along the Missouri River or in the hills to the east. Waubonsie State Park in Fremont County sets aside over 1,200 acres of public land for your enjoyment. This park provides excellent picnicking and camping facilities. While hiking Sunset Ridge Interpretive Trail during twilight, one can easily imagine ghostly images of Lewis and Clark's expedition navigating up the river some 300 feet below.

On July 20, 1804, the first official campsite was set up at Bartlett Landing Access north of Waubonsie. Clark stated that a large yellow wolf was killed by one of his men, and it was later identified as a coyote.

The next five days were spent at White Catfish Camp (Long's Landing County Park). The weather was fair, but time had to be spent in repairing oars and hunting. Hunting was poor, but deer, turkey, and several "grous" were added to their game bag.

Long's Landing Park, a 24-acre county park, lies on a sweeping bend of the Missouri River near Council Bluffs. This park provides camping, picnicking, and boat ramp access to the river. Just north of this county park lies Lake Manawa State Park. This is probably the most heavily visited park in the Omaha-Council Bluffs metropolitan area.

During the journey, many new species of animals were documented along the Iowa/Nebraska portion of the Missouri River. One of the first was the "barking squirrels" or prairie dogs. Lewis and Clark's journal of July 30 described this animal as they camped at Fort Atkinson Historical Park in Nebraska. "They burrow and bark and except for their short tails, they look like squirrels." Joseph Fields also killed a "brarow" or badger. The following relates their observations of this animal. "This anamale burrows in the ground and feeds on flesh (prairie dogs), bugs, and vigatables. His shape and size is like that of a beaver, his head and mouth is like a dog's with short ears, his tail and hair like that of a groundhog . . . he is of the bear species."

After documentation of these two species, the expedition floated by the present sites of Wilson Island State Recreation Area and DeSoto National Wildlife Refuge. They then landed at the present site of Remmington Access in Harrison County. For the next two days, they explored this new region. Remmington Access is timbered today, but travel to the east and the delicate beauty of the hills will burst forth and tickle the senses as one approaches this loess formation. The hills lose their desolate appearance as splashes of gold and purple greet the eye. The yellow flax, pale purple coneflower, and skeleton plant sparkle like jewels across the landscape in late July. These jewels are interspersed among stands of little bluestem, blue and sideoats gramma, and buffalo grass. The bluegrass in your backyard will lose its color as August approaches, but the prairie grasses will change to a subtle russet glow and provide a beauty all their own.

As the expedition continued up the river, the men faced many physical obstacles as well as foul weather and pesky insects. Storms plagued them for two days while staying at Little Sioux Delta, and no progress was made up the river. This did not prevent the discovery

Footsteps Continued

of two new animal species. The bullsnake and the least tern were described in their journal and added to their collection.

The voyagers continued on course after the storms subsided, and they spent August 9 at the campsite which is now named after their expedition. Lewis and Clark State Park is nestled around Blue Lake, an oxbow of the main river channel in Monona County. This oxbow was formed when the river changed its course and isolated this sharp bend of the river. Today Blue Lake offers walleye, northern pike, catfish, crappie, and bluegill fishing opportunity.

The adjacent state park offers extensive recreational activities including camping, picnicking, a self-guided nature trail, and campground programs throughout the summer. One majestic old cottonwood still provides shade on a hot summer's afternoon, just as it did in 1804 when the expedition paddled by on the river. Today, it looms above the area, with its twisted, divided trunk, still seeking stability in the porous sand.

After leaving Blue Lake, the trip upriver was relatively uneventful for the explorers until August 20. Death hit the expedition without warning. Sergeant Charles Floyd had been ill three weeks, and the symptoms suddenly reoccurred on August 19. Nothing could be done, and Sergeant Floyd died of a burst appendix the following day. He was the first soldier to die west of the Mississippi River, and the only man to die during their 28 months in the wilderness. A 100-foot monument now marks Floyd's burial site in the Loess Hills. It can be seen above Interstate 29 in Sioux City.

The Lewis and Clark Expedition left Iowa on their trip to the west near the present location of Stone State Park. Here bear, bobcat, and bison once roamed. Old worn trails still weave through dense undergrowth and are believed to have been originally formed by herds of bison as they searched for new grazing areas. Stone Park offers over 1,000 acres of dramatic Loess Hills topography, extensive hiking and equestrian trails, and a self-guided nature trail, as well as picnicking and camping.

These hills that so impressed the members of the Lewis and Clark expedition in 1804 are still there for us to see. Though man has since altered much of their surface through cropping, grazing, and fire control, their beauty and uniqueness remains to be found by the interested observer. Many relict plant and animal species are preserved in the numerous state and county parks and wildlife areas located in the Loess Hills/ Missouri River system. Why not take advantage of your parks in this area? They not only expose us to a unique part of our natural world, but they can take us back into time to experience the sights, sounds, and smells that once greeted our early explorers.

Jerry Leonard

From Loess ridgetops, views of the vast Missouri River bottoms can be enjoyed. Although the river and its floodplain have changed dramatically, parts of the hills differ little from Lewis and Clark days.

Wendy Van Gundy is an information specialist for the conservation commission. She holds a BS in fisheries and wildlife biology from Iowa State University and has been employed in the conservation field for nine years.

James Zohrer is an assistant administrator for county conservation activities. He holds a B.S. from the University of Illinois and an M.S. in wildlife ecology from the University of Wisconsin. He has worked for the commission for twelve years.

Sites of Interest In The Loess Hills

County	County Conservation Board Areas	State Areas	Others
Fremont		Bartlettt Lake	
		Forney Lake	
		Percival Wildlife Area	
		Scott Wildlife Area	
		Waubonsie State Park	
Harrison	Gleason-Hubel Wildlife Area	California Bend	DeSoto Bend
	Little Sioux Delta	Deer Island	
	Missouri Dale Wildlife Area	Nobles Lake	
	Mondamin Wildlife Area	Rand Bar	
	Murray Hill Scenic Overlook	Soldier Bend	
	Remington Boat Launch	Tyson Bend	
	Sawmill Hollow Wildlife Area	Wilson Island	
	Sioux Dam Fishing Access		
Mills	Folsom Recreation Area		
	Mile High Lake		
	Pony Creek Park		
Monona	Decatur Bend Access	Badger Lake Wildlife Area	Turin Loess Hills
	Huff-Warner Access	Blencoe Lake Wildlife Area	
	Interstate 29 Wildlife Area	Lewis and Clark State Park	
	Monona Arboretum	Loess Hills Wildlife Area	
	Onawa Materials Yard	Louisville Bend Area	
		Middle Decatur Bend Area	
		Preparation Canyon Park	
		Upper Decatur Bend Area	
Plymouth	Loess Hills Nature Preserve	Stone State Park	
	Millsite Access		
Pottawattamie	Interstate 29 Marsh	Gifford Forest	
	Long's Landing	Lake Manawa	
		Wilson Island	
Woodbury	Brown's Lake	Bigelow State Park	Floyd Monument
	Lakeport Wildlife Area	Brown's Lake	
	Liberty Wildlife Area	Lake Port Area	
	Snyder Bend Park	Liberty Area	
	Southwood Area	Mile Long Area	
	Weedland Access	Snyder-Winnebago Bend	
	Wimson Park	Stone State Park	

For a more complete listing of areas and facilities, contact your State Conservation Commission for a State Parks Directory, Iowa Public Hunting Area Guide, Directory of State Preserves, or County Conservation Directory.

PRESERVING THE HILLS

By Dean Roosa

The geological importance of the Loess Hills has been realized for over a hundred years, the biological significance for nearly as long. A study conducted during the past four years, sponsored by the State Preserves Advisory Board and the Iowa Conservation Commission, has served to underscore the hills' biological significance.

In the 1,050 square miles (672,000 acres) of what is called the Loess Hills landform, over 4,000 acres are owned by the State of Iowa under jurisdiction of the Conservation Commission. Over 1,600 acres are owned by the County Conservation Boards of Plymouth, Woodbury, Monona, Harrison, Pottawattamie, Mills, and Fremont Counties, and over 1,000 acres are owned by the Iowa Chapter of the Nature Conservancy. Over 400 acres of natural parkland is owned by the municipalities of Sioux City and Council Bluffs. The Turin Loess Hills Preserve, has been formally designated as a state preserve.

There is a need for a multi-faceted approach to protection of the Loess Hills.

Certain species require large, unbroken tracts. Through efforts of the State Conservation Commission and the Iowa Chapter of the Nature Conservancy, this approach has been partially realized. The State of Iowa owns an approximate 2,500-acre tract in Monona County, a tract of over 1,200 acres (Waubonsie State Park) in the southern part of the loess, and over 800 acres (Stone State Park) in the northern portion. Recently the Nature Conservancy has purchased a 900-acre tract in the extreme north part.

One advantage of large-tract ownership is the relative ease for land managers to properly manage for community integrity; for example, by using fire in prairie management. Other reasons are better control if a species is ever to be reintroduced into our state, ease in law enforcement, and monitoring of populations. We should be critically examining our large holdings to see if they are sufficient to protect communities and populations.

While there is not a wide diversity of community-types in the Loess Hills, there have been identified the following: loess hills forest, loess hills prairie, and loess hill savanna. The outstanding examples are being located.

There is an equally strong argument for protection of small areas which may protect a single species. In fact, one approach should not exist without the other. In the Loess Hills the existence of numerous rare or unusual species has been documented. It is probably more feasible and certainly more cost-effective to protect a species (especially of microtines and plants) by protection of a small area.

While large tracts will provide a safe stopover place for migrating species, it is the smaller tracts that provide a "corridor" for the species' movements. Again, we have taken steps to meet this end. The cities of Sioux City and Council Bluffs both contain significant tracts of protected land, and the various county conservation boards have acquired tracts in portions of the Loess Hills.

Protection of species:

The following rare or unusual species have been documented as occurring in the Loess Hills:

Grasshopper mouse	Ornate box turtle
Plains pocket mouse	Ottoe skipper
Southern bog lemming	Tumble grass
Great Plains skink	Scarlet globe mallow
Western spadefoot	Schrankia
Great Plains toad	Mentzelia
Prairie rattlesnake	Lomatium (2 species)
Chuck-will's-widow	Penstemon

There is a need to locate and protect the best populations of these species. Such protection could come from a variety of strategies including registry, preservation dedication, acquisition and easements. Location of these sites is now occurring through the process of natural history surveys, activities of the Iowa Natural Areas Inventory and efforts of the various county conservation boards.

Management considerations:

Probably as important as acquiring or protecting new tracts is the process of managing currently-owned lands. The Loess Hills landform was historically nearly treeless, due to prairie fires. Trees have encroached, allowing shrubs to grow in their shade and thus creep up the slopes. If more aggressive use of fire as a management tool is not soon implemented, the remnant prairies and savannas will be lost.

National Natural Landmark Status:

Periodically the National Park Service shows interest in the Loess Hills as a national natural landmark or national monument. Such designation would provide only limited additional protection, but would acknowledge national significance.

State preserve designation:

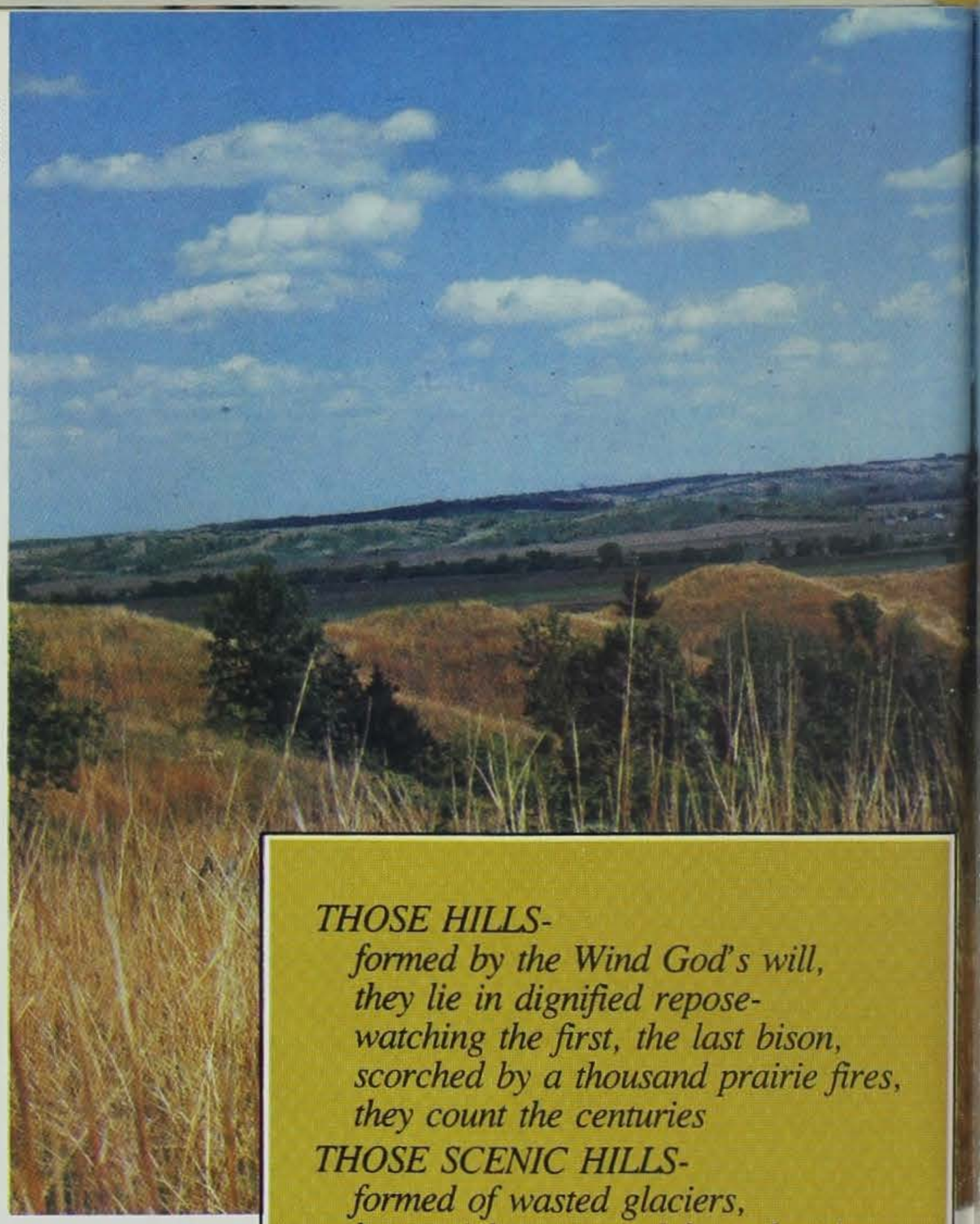
Only one tract currently has been afforded the special status of a "state preserve." This status, conferred by the Governor in cooperation with the landowner, provides the highest form of protection available under state law. Agencies, organizations, municipalities, and private landowners should be encouraged to apply for this special protection.

Private landowner options:

Private landowners are the most important key to perpetual and adequate protection for the Loess Hills. There are several programs which may be of interest to those owners who desire perpetual protection. The Iowa Natural Heritage Foundation has begun to work with landowners to help them understand their options and to offer assistance in protecting land. The Nature Conservancy has a program to assist landowners by "registering" their property and helping in the proper management. The Iowa Conservation Commission has an easement program and provides assistance to those who may qualify for the "slough bill." County Conservation Boards assist with persons who wish to apply for benefits under the slough bill, in proper management of land, and are a source of information for protection programs. The State Preserves Advisory Board cooperates with private landowners who wish to give a significant tract the best form of protection.

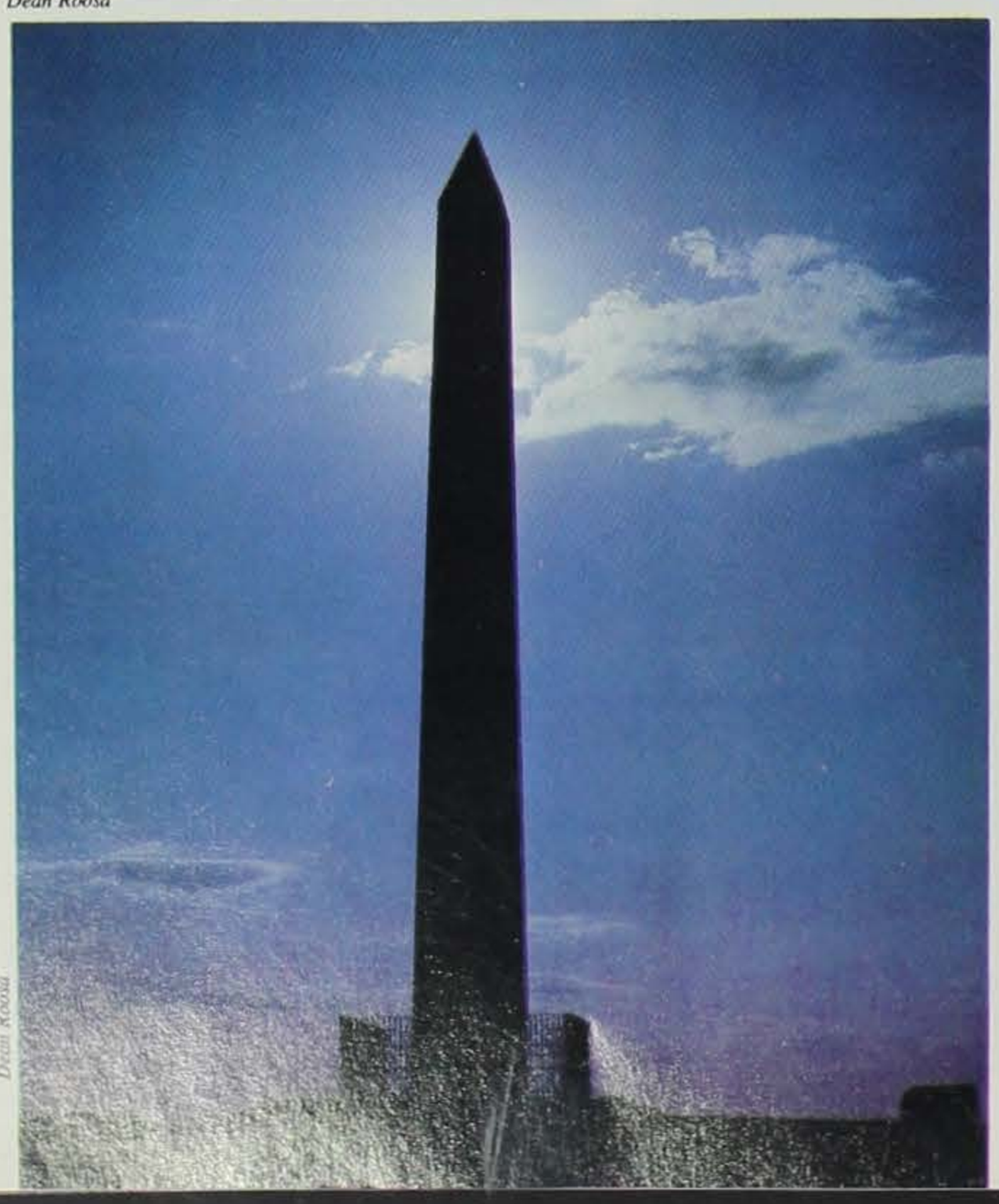
Ours is a large responsibility; the programs initiated will have an influence on all present and future Iowans.

Dean Roosa



Lonely, solitary burr oaks (below), ***survivors of prairie fires, stand on the bluff ridges. They are called 'oak grubs' or 'wolf trees' and may be much older than their size would indicate. A monument commemorating the service and travels of Sergeant Charles Floyd*** (bottom), ***overlooks the Missouri River and the town of Sergeant Bluff.***

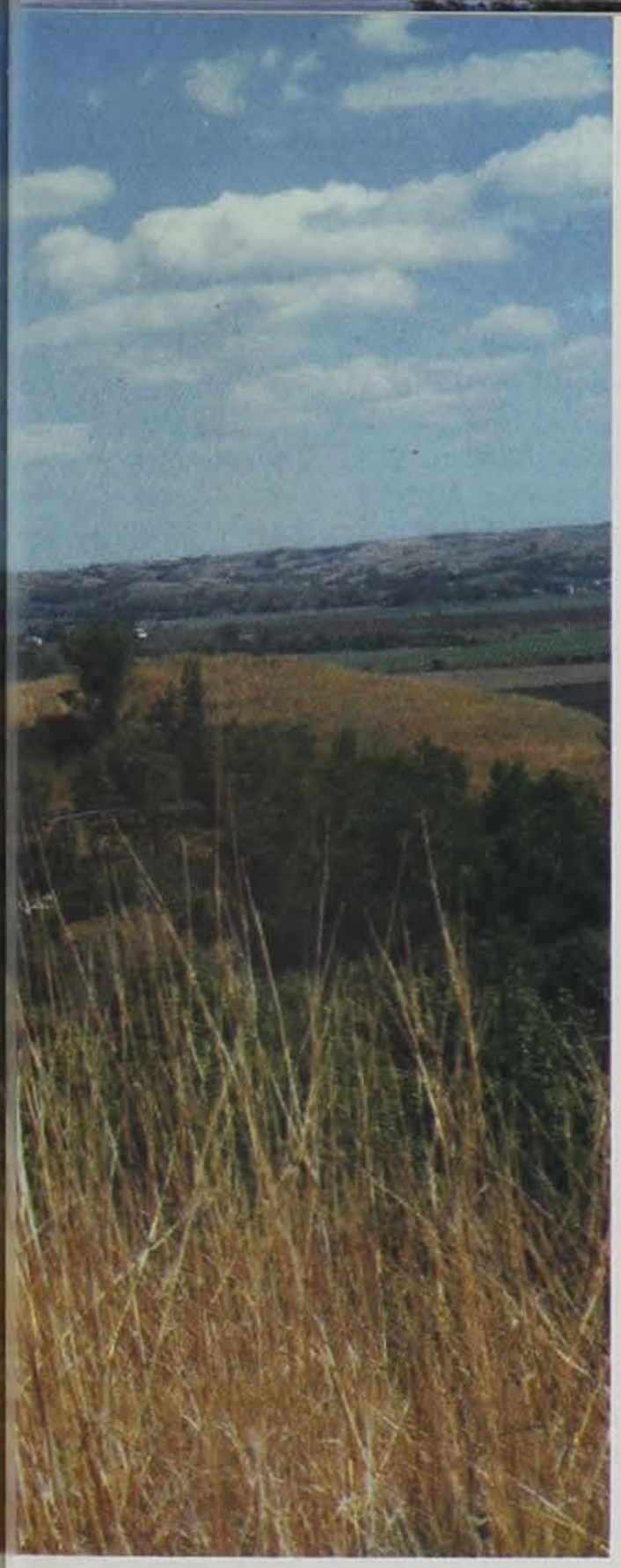
Dean Roosa

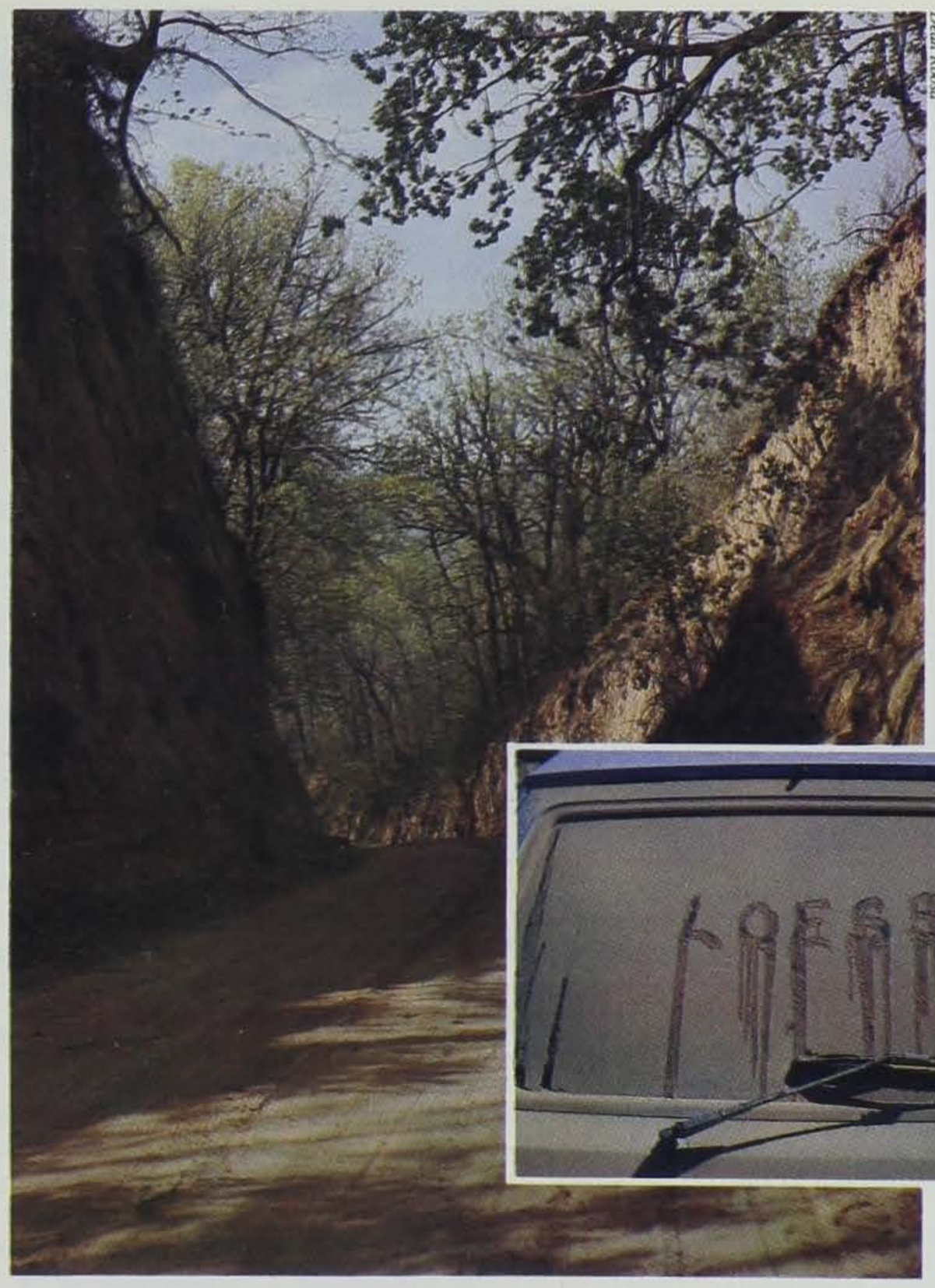


Dean Roosa

THOSE HILLS-
formed by the Wind God's will,
they lie in dignified repose-
watching the first, the last bison,
scorched by a thousand prairie fires,
they count the centuries
THOSE SCENIC HILLS-
formed of wasted glaciers,
by particles captured from the air-
straw brown dust of the millenia,
they lie at rest, in peace
THOSE SACRED HILLS-
the earliest man trod here,
worshipped here
and thought the bluff-tops sacred
here are his roots; his being was in harmony;
here his Spirit walks today
THOSE SCIENTIFIC HILLS-
yield their secrets slowly,
for they have much to tell;
they provide safe harbor for the skipper,
safe passage for the eagle-
they are gentle, they are fragile, they are the Loess Hills

Dean Roosa

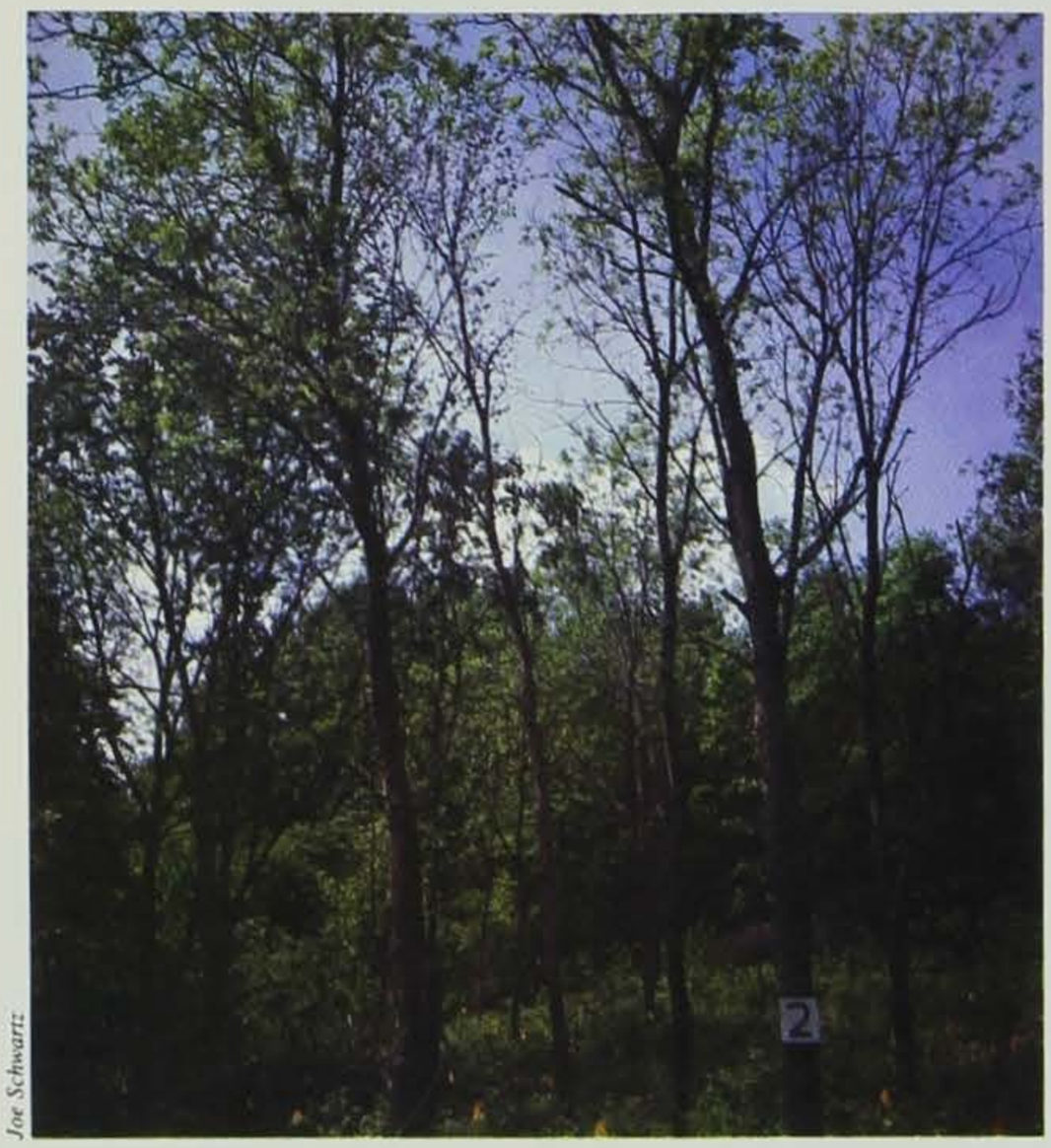




Dean Roosa

Dean Roosa

'Catsteps' are characteristic of the steep loess (left). ***They are a result of natural slippage of the loess and may be enhanced by cattle or bison.***



Joe Schwartz

LOESS HILLS FOREST DEMONSTRATION

Joe Schwartz, District Forester for the Iowa Conservation Commission, has developed a demonstration woodlot stressing the principles of forestry and wildlife browse production. This demonstration area is located in the northwest corner of Loess Hills Wildlife Area in Monona County. Schwartz, woodlot manager, says, "This demonstration area shows what forest landowners should be doing to make their woodlots as productive, or more so, than their crop fields. With time, it will prove that forest management *works* in Iowa and should be profitable for those who pursue it."

A proposed interpretive trail through the area will explain three areas which show the disastrous effects of lack of management, as compared to an early mature forest and recommended methods for improving these wooded areas. Data will be collected from this site and should help promote the idea that forestry can work in northwest Iowa.

Interested groups, teachers, private landowners and other professionals are encouraged to visit this area. Schwartz is available for short guided tours but must be contacted at least one month in advance. He also plans to hold additional informational meetings on forestry in northwest Iowa. Contact him at 712-546-5161 or write him at Box 65, LeMars, Iowa, 51031.

THE LOESS HILLS OF IOWA — FRAGILE GIANTS IN NEED OF FRIENDS

By Dean M. Roosa

Natives of western Iowa call them simply "the hills;" early eastern geologists and many old-timers call them the "Lerss Hills;" geologists speak of the technical aspects of their formation and physical properties; archaeologists envision them as home for a major native culture; Iowa scientists revere them as the state's most significant landform for unusual plants and rare animals and most of the remaining prairie.

These hills act as stop-over places for migrating birds, as safe refuge for wintering hawks, for retreats for our rarest mammals, and as extensions of the ranges of plants from the Great Plains. They offer a glimpse into the Iowa that Lewis and Clark saw, the America that Chief War Eagle saw, the robust Iowa that confronted the pioneers. Unlike anything in the world, they can tell us much about past climates, past geological events, and allow inferences to be made about the ecological conditions that existed in the region during formation.

It may well be that the current generation will be the last to have the opportunity to protect portions of these treasures. The start made by the Conservation Commission, the Iowa Chapter of the Nature Conservancy, County Conservation Boards, and the Iowa Natural Heritage Foundation, is an important and impressive first step. Now comes the difficult part - the thoughtful and coordinated elaboration of a protection strategy including land use, good land management, working with private landowners who wish to protect forever the portion he owns, the continued studies, prioritization of sites, funding of acquisition programs, and the proper management of those lands now in public ownership.

We have learned much about the Loess Hills in the past half-decade; we must now translate that knowledge into a comprehensive and intelligent plan. Shall we begin?

LOESS HILLS SEMINAR, SYMPOSIUM PLANNED

The eighth annual Loess Hills seminar, organized by the Western Hills Area Education Agency 12, will be held on the first weekend of June at the Loess Hills Wildlife Area northeast of Onawa.

This seminar, designed to acquaint people with Iowa's unusual loess hills, will begin on Friday evening, June 1st, at the Onawa High School, and continue with field trips on Saturday and Sunday morning. A banquet will be held on Saturday evening. Specialists in botany, ornithology, photography, mammalogy, prairie ecology, herpetology, geology, and other natural history subjects will lead field trips.

Continuing education credit is available. For information, contact Larry Benne, Western Hills A.E.A. 1520 Morningside Ave., Sioux City, Iowa 51106. (712) 274-6080.

Symposium

A special symposium on Iowa's loess hills is planned for April 27 at Iowa City in conjunction with the annual meeting of the Iowa Academy of Science.

Speakers will present overviews on the status of the animals, special plants, archaeology, palentology, geology and conservation strategies. The symposium will be held on the campus of the State University of Iowa from 2:00 p.m. to 5:30 p.m. on Friday, April 27th, and is sponsored by the Iowa Natural History Association, in cooperation with the Iowa Academy of Science.

Additionally, numerous papers will be presented on Saturday, April 28th.

WARDEN'S DIARY

By Jerry Hoilien

Remember hearing the ol' timers say, "Way back when?" That's what your first look at the Loess Hills near Onawa, will say to you, "way back when." You can't look at this area without your mind moving back in time, making you wonder about all the things that happened here eons ago. Back when the river first cut through the valley, back and forth, eating and cutting its way, first one side and then the other, cutting away a bank only to replace it a short time later, moving the sands and silt with careless ease. With those soft Loess Hills patiently watching the river run wild each spring from the melting snows from the Dakotas, hearing the sounds of millions of Snow and Blue geese noisily honking their way north to the tundra, resting on the safe, wide sand bars in and along the river. It was a rich-flowing river in the summer, carrying tons of top soil, layering it gently on the valley floor to feed the abundant wildlife that thrived along its cottonwood banks. Let your mind wander over the years. Think of the changes that took place along the river, the valley and its surrounding Loess Hills.

I got my first look at this area in '49, (oops — telling my age again) coming over those hills from the east and looking down on that broad, flat valley floor that stretched out in front of me almost as far as I could see. It's a sight that still takes my breath away.

I first walked those hills with men like Basil Downing, a tough gamewarden who came to a rough territory. They had a spring duck season, back in those days. It wasn't legal, but you couldn't tell out there on the bottoms in the spring, for all the shooting going on. With the "gumbo-mud" roads that rolled up on tires 'til the wheels couldn't turn anymore, the warden could get to 'em. I remember Basil taking off afoot across a mile square field after three men shooting geese one spring morning. They were way out in the middle and the further out he got, the bigger his feet became with the mud building up on them. If you've never been in "gumbo-mud," you won't know what I'm talking about. The mud builds up with every step until you have to stop and try to kick it off, go a ways and try it all over again. At any rate, there went Basil. Of course the shooters were in the same mess, but they had a half-mile advantage. They would run and Basil would run, he would stop and puff, and they would stop. That's the way they went all across that field. Basil looked back to his car on the road and realized he had made a big mistake; in his haste, he had left his keys in his car. As he watched from the center of that big section, a pickup pulled up to his car, opened the door and threw away his keys. The pickup continued on around the mile and picked up the three he was chasing and drove off. Basil wasn't so mad at their outsmarting him, as having to replace all the locks in his car. He only had one set of keys.

Basil wasn't fooled very often. I remember one spring sitting on the Blue Lake grade, watching geese flying out across the bottoms. All of a sudden, without hearing a shot, one of those big Canadas folded up and came tumbling down. Basil was off like a rocket, leaving me standing behind. (I wasn't a warden then.) About a half-hour later, he came back with a grin on his face. In his back seat I could see the big Canada goose and a 22 rifle. Basil had gotten his man.

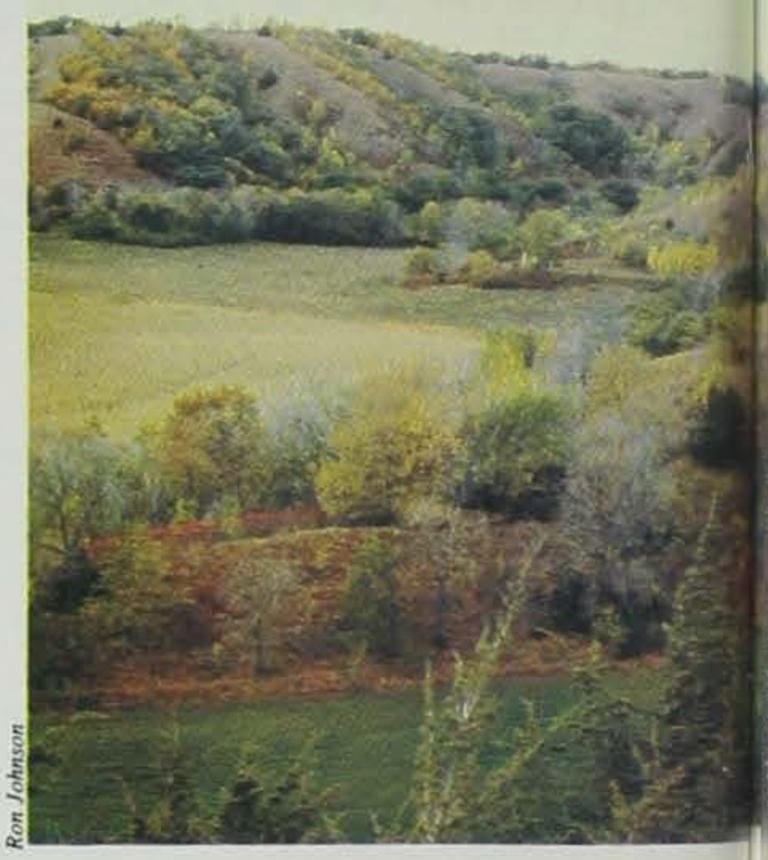
Basil Downing was the man who got me interested in becoming a gamewarden. We used to talk about his work by the hour, and one day I said to him, I'd like to be a warden. An hour later he handed me an application blank, said, "Fill it out, I'm going to Des Moines in the morning. I'll take it with me." Things broke just right and some time later, I was sworn in. Lots of water has flown down that ol' Missouri River since then. But the river's changed, no, I take that back, they've changed the river. It's not like it used to be, wide and wild. It's now more like a drainage ditch, tightly corsetted between two sets of pilings, straightened to a gutter pipe, with no flowing banks or wandering sloughs, devoid of the once thriving wildlife. We've lost one of the wonders of our world. The Loess Hills must shed a tear or two looking down on what once was a proud son, now shackled and broken. Lewis and Clark would be shocked if they could see the river now. Sargeant Floyd, buried on its banks near Sioux City must turn restlessly in his grave. Audubon, who wrote about the river and its magnificence years ago, couldn't help but be sickened by what's happened. But the Loess Hills stand silent and patient, waiting for another day. Their wind-blown, knarled tops, rare in this world, still remind us of..."way back when."

Jerry Hoilien is presently the conservation officer for Allamakee County. He has served as a conservation officer since 1960.

Snow geese make annual stops to feed in the Missouri River bottoms.

Ken Formanek

Roger Laushman



Ron Johnson

Stunted bur oak trees (right) ***scatter the prairie slopes of the Loess Hills creating a savanna — just one example of the complex communities of this region.***

Natural Communities
of the Loess Hills

By Wayne Schennum

Rugged landscapes with scenic vistas are seldom mentioned in a traveller's conversations about Iowa. Fields of corn are usually thought to have replaced the original prairie in all but a few odd unplowed corners. Iowa's Western Loess Hills Region, however, provides a remarkable exception to both of these time-worn impressions. Here, wind-blown silt, called loess, has been piled to depths of 200 feet, forming a narrow band of hills that stand in sharp contrast to the level plain of the Missouri River Valley below. Thousands of years of erosion by wind and water have further carved these hills to provide a mosaic of steep slopes and rolling, winding hogback ridges, adding to the area's variety both aesthetically and ecologically. But the real treat is the carpet of verdant native prairie vegetation across much of this rolling terrain. The contrast between this and the checkerboard of plowed fields in the river valley below is a stark reminder of how much we have changed the original landscape.

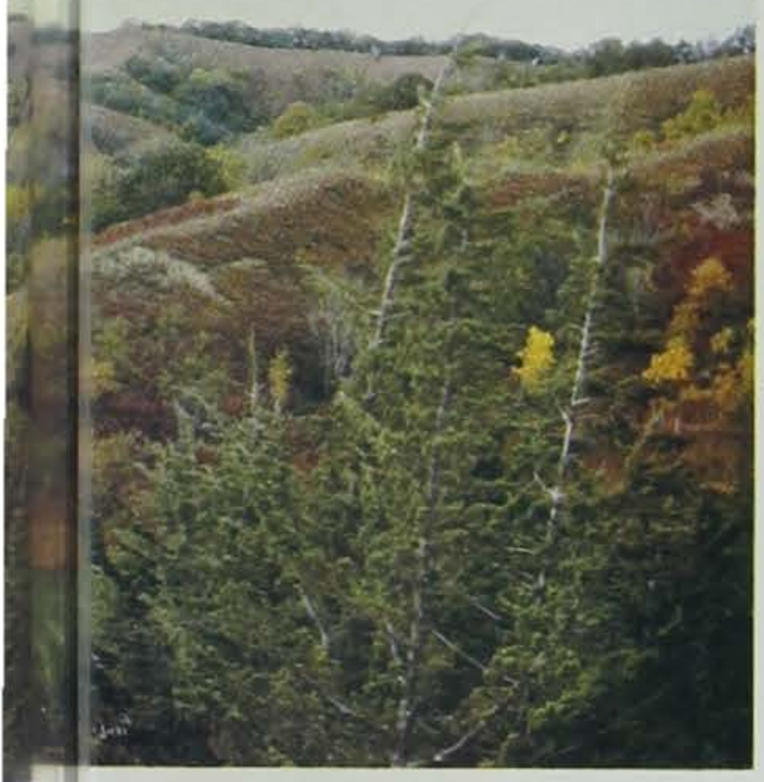
The prairie has survived in the Loess Hills for a variety of reasons. Nearly all of the land here is too steep to plow. Across much of the area, the combination of very well-drained soils, steep slopes and exposure to searing summer heat and drying winds has created a very droughty environment. The prairie that developed here is well-adapted to very harsh conditions and has been able to survive grazing by domestic livestock, a form of land use that has prevailed in this region for over 100 years.

The prairie vegetation that carpets all but the most protected slopes and ravines in the Loess Hills is quite unlike that found over most of Iowa. Because the environment created by the soil and exposures is drier than that of the fertile black soil regions of the state, the typical Iowa tall grass prairie is replaced by a midgrass prairie more typical of the central Great Plains. In fact, many plant species typical of the Plains reach the eastern edge of their range on the steep bluffs of the Loess Hills. They are found nowhere else in Iowa. Examples are the cactus-like yucca, locoweed, and the nearly leafless and appropriately named skeleton weed.

The dominant grasses of this midgrass prairie are only 2 to 3 feet high, but their extensive, deep root systems and dense cover help hold the highly erodable loess in place. Little bluestem, a bunch grass, is the most abundant. Its leaves and stems color the Hills with a deep shade of wine-red in fall. Muhley grass and side oats gramma also contribute much of the ground cover. Though less common, the short grasses of the western Plains that thrived beneath the hooves of vast bison herds are also present. Hairy and blue gramma are examples of these. Porcupine grass, a midgrass named for the nearly foot-long needle at the tip of its seed, is common on some slopes and ridgetops less exposed to the full brunt of summer heat and wind. This long seed appendage, or awn, twists into a corkscrew spiral as the seed ages, literally planting the seed by screwing it into the ground.

The midgrass prairie of the Loess Hills becomes mixed with the typical tall grass plants on exposures that allow the soil to retain more moisture. North- and east-facing slopes and the bases of some slopes provide such protection, and it is here that big blue stem and Indian grass, the tall prairie grasses most Iowans are familiar with, occur. Short, gnarled bur oak trees, some so old that they pre-date the settlement of Iowa, occur as scattered trees on these protected slopes, forming a savanna.

The Loess Hills prairies are far more than "seas of grass" with rare Great Plains plants. Several typical Iowa prairie wildflowers add brilliant color to the landscape. Myriad animal species find suitable food plants or cover here where the native grassland has not been replaced by row crops. Their relationships with one another illustrate the ecological complexity of this prairie community and the dependence of each species on an environment still carpeted with native grassland. The butterflies common in the Loess Hills show this very well. The regal fritillary, a butterfly totally restricted to virgin prairie, can be seen easily by a casual observer traversing the ridgetops of the Loess Hills in midsummer. Here the males can be seen "hill-topping", that is, establishing territories actively defended against other males of their kind. But their abundance here, and complete absence on tilled ground east of the Loess Hills, is due to



William Pusateri

Dean Roosa

Lewis and Clark were introduced to ground plums (left) ***by Indians in the area. The large green fruits of this plant can be eaten cooked or raw. The Ottoe skipper*** (below) ***as well as several other butterflies need native prairie grasses to lay their eggs and feed the caterpillars.***

ıe dependence of their caterpillars on ıt a few species of prairie violets, iolets that cannot survive on ground ıat is plowed or overgrazed. Similarly, ıe Ottoe skipper and several other ıipper butterflies found in Loess Hills rairies lay their eggs only on prairie rasses, their caterpillars' primary food lants. A meadow of timothy hay simly won't do for them.

Larger, more familiar prairie animals re far less dependent on specific food lants than many insects, but still they o best where native grasses are dense, specially when in large tracts of land. he six-lined racerunner lizard and lains spadefoot toad are common burowers in Loess Hills prairie. The accuulation of grass litter may make them fficult for a visitor to spot, but that is st the point — even a keen-eyed redator such as a hawk will have fficulty spotting these animals before ey disappear down a hole near a ump of little blue stem. This same over provides nesting materials for the estern meadowlark, a bird typical of y prairies and noted for its melodius arbling song, clearer and sharper than at of its near relative, the eastern eadowlark, which prefers low, moist rairies for nesting.

The same grass cover that protects e lizards and rodents of the Loess ills prairie is also beneficial as a reen to stalking predators like the adger. Badgers are quite common here ecause they prefer loose, dry subrates for burrowing.

Many of the typical Iowa prairie ildflowers, especially those which are ost tolerant of drought, are common in the Loess Hills and bloom in a seasonal sequence that is related to their stature and timed to the appearance of certain pollinating bees and flies. Pasque flowers adorn the Hills in April, the first sign of spring on the prairie. Prairie violets and puccoons follow in May, all less than a foot in height. Later, the familiar purple coneflower and lead plant appear, followed by the prairie clovers and many others in late July, and then the prairie sunflower and silky and aromatic asters in late summer. All of these plants are well-adapted to the dry, wind-swept slopes of the Loess Hills. Silky aster, for example, protects its leaves from excessive evaporation loss with a coating of long white hairs that do, indeed, resemble silken threads.

Many familiar Iowa prairie plants are absent here, though. Rattlesnake master and golden alexanders, common on low or level prairies elsewhere in the state, simply cannot make it on these arid hills. Other moisture-loving species are replaced by their better-adapted near relatives from the Great Plains. Examples are the showy red-purple dotted blazing star, which replaces the prairie blazing star, and the downy yellow painted cup, which replaces the red Indian paint brush, a plant which is actually parasitic on the roots of prairie grasses.

Two other interesting western species, which reach their peak in the Loess Hills, help give these prairies their distinctive character. Both are legumes, building valuable nitrogen compounds into the soil of the otherwise sterile loess. Both show how man too depended on the plants of the region. The first is ground plum, a red purple-flowered, foot-high plant which looks like a miniature sweet pea. Its unusually large green fruits, or "plums", were cooked or eaten raw by the Indians who passed their knowledge of this plant on to Lewis and Clark and the settlers who followed them. The second is the prairie turnip or Indian breadroot. This blue-purple-flowered plant was a prize food of the Indians, especially the Sioux, who peeled and ate the enlarged tuberous starchy roots, or, more often, roasted them like potatoes. If cultivated, this plant could provide a nutritious addition to the modern diet, as the Indians often sold this plant to settlers.

A traveller driving Route 29 from Council Bluffs to Sioux City today sees very little of the Loess Hills as Lewis and Clark experienced them in their journey up the Missouri River in 1804. Notes on the vegetation of the area, as recorded by government land surveyors in 1851, found very few trees save for scattered bur oaks on protected slopes.

Communities Continued

These trees were part of the savanna mentioned earlier, a community in which the Loess Hills prairie grassland was still the prevailing ground cover. Toward the south, savanna increased until, in Fremont County in the very southeast corner of the state, a greater variety of oaks could be found, along with linden and ash, on interior slopes. Here, where precipitation levels are slightly higher, narrow bands of forest did occur naturally. Yet, today, forest seems to dominate the Hills for much of their length. Except in a few Plymouth County locations, prairie is restricted to the steepest west- and south-facing slopes and ridgetops. Upon close examination, it is obvious that nearly all of the forest is made up of very young trees, few dating even to the time of settlement. Something has happened with the coming of modern civilization.

Prior to 1850, frequent fires, set intentionally by Indians or accidentally by lightning, swept across the prairies and wetlands of the Missouri River Valley and up through the Loess Hills, driven by prevailing westerly winds. These fires burned off young tree saplings but left the prairie unscathed. The growing points of prairie plants, unlike those of trees, are below ground in spring and fall when the dried remains of the prairie grasses provided the fuel for fires. The fires assured that few if any trees would ever reach maturity to shade out the prairie.

After 1850, as settlement of the Loess Hills increased rapidly, these natural fires were suppressed. Trees, especially bur oaks, increased, spreading up the steep loess slopes from the few original protected areas of savanna and forest. Only on the steepiest, driest slopes and ridges has this advance been checked, or at least slowed, by excessive evaporation. The bur oaks now form dense stands, and the distribution of shrub seeds by berry-eating birds has led to the establishment of even denser stands of sumac and dogwood under the oaks so that even the savanna aspect is lost.

Lack of fire is not the only factor that has led to the loss of the extensive Loess Hills prairies. The original native grazers, the bison, kept trees in check not only through occasional trampling and grazing but by using them as rubbing posts to remove ticks and other parasites. Because bison were unconfined, highly mobile, and non-selective grazers, they seldom overgrazed or severely trampled a prairie except in small patches such as those used as dusting wallows. Their occasional light grazing actually increased the diversity of prairie vegetation by preventing the dense build-up of grass litter where fire was insufficient to remove it. With the coming of civilized men came also the demise of the bison. Their replacement, domestic cattle, in some ways duplicated the bison's ecological role. But cattle are confined to fenced pastures by their owners and they are lazier animals than bison preferring to graze on the lower slopes of the Hills, only moving upslope when the forage is depleted elsewhere. They are also more selective feeders, thus removing especially nutritious or palatable plants to the advantage of those less "tasty". The result of all this has been further loss of virgin Loess Hills prairie to overgrazing. Weeds, plants from Europe and northern Asia that can tolerate the constant chewing and plodding of cattle and plants that are toxic, spiny, or otherwise unpalatable, have replaced much of the Loess Hills' native prairie grasses and flowers, just as the cattle replaced the bison.

Another, more recent threat to the area has been urban development and terracing for agriculture. In the Kansu province of China, the only other place in the world with deep loess formations like those in Iowa, nearly all of the native vegetation has been lost to terrace-farming.

Margaret Oard

Tallgrass species, typical of most native Iowa prairies, are replaced by midgrass species in most of the Loess Hills. Several prairie wildflowers add color to the landscape.

As a result of the "taming" of the Loess Hills, only 3-5% of the original prairie remains, mostly as scattered tracts confined to those arid, windswept, and hard-to-reach ridgetops and steep slopes. Many grassland birds and other animals have suffered great declines here as a result. Some may have been lost like the bison. But by contrast to the remainder of Iowa, the 3-5% remaining seems like a lot. Other Iowa prairie types have been reduced to less than .02% of their original extent, and most remnants of these are far smaller, on the average, than are the Loess Hills prairie remnants. Iowans can be proud that some Loess Hills prairie remnants have been recognized for their uniqueness and natural values and are preserved in state and county parks and wildlife management areas. These are being managed with controlled burning to ensure that they are not inadvertently converted to forest. However, several other large, high quality tracts remain unprotected and unmanaged in private ownership; their future is uncertain. It is up to us to assure that as much as possible of this unique land is preserved and managed for future generations to enjoy.

Wayne E. Schennum serves as ecologist for the commission's Iowa Natural Areas Inventory. He received a Ph.D. in biology from the University of Illinois in 1975.

Special Plants
of the Loess Hills

By William P. Pusateri

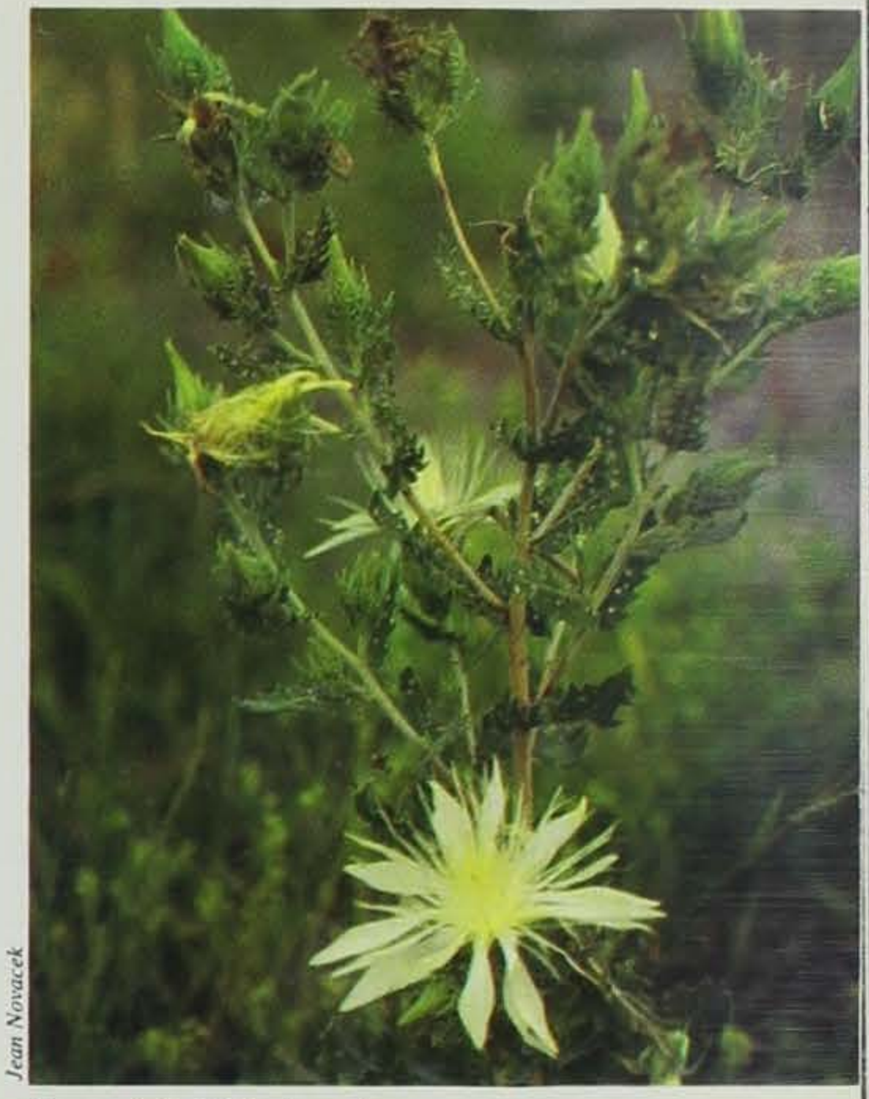
The Loess Hills of western Iowa have ong been recognized for their unique loristic components. Bradbury, in 811, was probably the first naturalist o collect plants from the bluffs over- ooking the Missouri River. Much later, n 1953, Morrill published a thesis on he prairie flora of this area. More ecently, efforts have commenced to verify and document rare plant species, natural prairie and savanna com- munities in order to establish priorities for preservation and future needs for scientific investigation. Many of the special plants of Iowa's Loess Hills demonstrate an affinity with the flora of the Great Plains. Some of the special plant species of concern will be dis- cussed in this article.

Ten-petaled blazingstar *(Mentzelia decapetala)* is a member of the Losasa family and is known by many common names such as stickleaf, eveningstar, sandlily and moonflower. The genus *Mentzelia* is noted for its rough thistle- like leaves. In fact, the leaf surface has a sandpaper texture created by one of the most bizarre types of plant hairs known. These hairs are multicellular and are shaped like small pagodas. Unlike the corners of a real pagoda roof which curves upward, each cellular hair is capped by a ring of stiffly curved hooks which curve downward. The mature fruits are also covered by these hairs which undoubtedly serve as a major means of seed dispersal. The hooked hairs grip tenaciously to both fur and clothing. Therefore, fruit and seed can be carried great distances by furbearing mammals and wool-clad hik- ers before the seeds find a final resting place for eventual germination.

Mentzelia is a tall plant reaching heights of three to five feet. Here in Iowa, it is found growing on the steeply eroded west-facing bluffs as a pioneer species, much like yucca. It usually displays a biennial or weak perennial habit. The flowers are very beautiful and are displayed as ten white or whitish-yellow petals (as the scientific name *M. decapetala* implies). The cen- ter of the flower is a mass of yellow- colored stamens. There may be more than 200 stamens per flower. These flowers may reach over four inches in diameter. *Mentzelia* portrays a fascinat- ing flowering syndrome. The flower usually opens at night and the petals are folded up during the daylight hours. This alternating opening and closing is the result of an elaborate growth pattern of these flowers. Apparently cool air and a decrease in light intensity pro- duces a rapid growth of the cells lining the inside of the petals. This rapid growth is the result of these environ- mental factors stimulating the release of a plant growth regulator or hormone. The chemical regulator travels down- ward along the inner portion of the petal, stimulating faster growth on the inside of the petal than on the outside. Hence the petals bend outwardly and the flower opens. Conversely, light and warmth stimulate faster growth regula- tion of the exterior of the petal and the petals bend inward closing up the flow- ers. Now if you spot flowers which are open during the day, don't be surprised, for after they have reached maturity and are fully grown, the alternating opening and closing ceases.

In Iowa *Mentzelia* is known from about five different sites in the Loess Hills. It is one of those peripheral species displaying a more western affinity.

Dog fennel *(Lomatium foeniculaceum)* was one of the very first plants to be collected and described during the exploration of the Upper Missouri River in the early 1800's. There was little if any mention of it in the Loess Hill's literature until Morrill's thesis was pub- lished in 1953. Then 30 years later, what may have been the original popu- lation was rediscovered (along with a few additional populations) during the 1983 Natural History Foray, which was sponsored by the State Preserves Advi- sory Board. This event allowed us to



Jean Novacek

Ten-petaled blazing star

update its present distributional status and allowed us to remove it from the undetermined category which was based entirely on old historic records. Like many species of special plants which grow in the Loess Hills of Iowa, *Lomatium* has a more western distribu- tional pattern and is a peripheral species on the eastern terminus of its range in Iowa.

Other common names include, whiskbroom parsley, hairy parsley, car- rot leaf parsley, or celery. As a member of the Carrot family *(Apiaceae)*, it has the characteristic basal leaves which are deeply divided into three divisions, and the leaf stalk or petiole has a conspicu- ous sheath as in carrots and parsley. Growing from a perennial rootstock, it may grow to ten inches in height. The compound flowering arrangement (in- florescence) is very similar to wild carrot or Queen Anne's lace, except the five-petaled flowers are yellow instead of being white. The fruit is oval-shaped and bears a winged rib or appendage that runs laterally down the edges of the fruit.

If the leaves or stem is bruised, the aroma of celery can be detected. The aroma is very strong indeed — a little too strong for some sensitive noses. The seeds, roots and stems have been known to be edible even in the raw condition. Another name for this plant is biscuitroot, for the root has been ground up into a flour to make biscuits. However, some members of the Carrot

Plants Continued

family which resemble *Lomatium* are poisonous. So edibility is strongly discouraged (especially of protected Iowa species such as *Lomatium).*

Our Iowa species of *Lomatium* displays a hairless condition of the outer surface of the immature fruit. Some plant taxonomists would ascribe these to the species *Lomatium foeniculaceum* var. *daucifolium*. But that would be as picky as "splitting hairs!"

Cowboys delight *(Sphaeralcea coccinea)* or scarlet globemallow is a member of the Mallow family *(Malvaceae).* It has such well known relatives as okra, cotton, marshmallows and native and cultivated species of hollyhocks. The distinctive feature of the Mallow family is its flower morphology. The flower has evolved in such a way that there is a cohesion of the filaments of the stamens to form a tube which surrounds the pistil. This tube is fused to the basal portion of the five petals. The petals are a brick red color, or what some call either a dark red tomato color, or sometimes salmon colored. A very beautiful flower indeed, with the bright yellow antlers flaring out from the central column which is surrounded by the red-colored petals.

Being only six to twenty inches tall, cowboys delight is a deep-rooted perennial, growing in similar habitats to *Yucca* and *Mentzelia,* on the steep, open, eroded, west-facing bluffs overlooking the Missouri River. The leaves are also of interest for they are alternately arranged and are deeply divided into narrow segments. These dark green leaves have a mealy appearance and texture. If one looks closely at the leaf surface with a hand lens, they might see the characteristic star-shaped or stellate multicellular hairs. Like *Mentzelia* these grappling rook-like hairs also occur on the outer surface of the fruit and seeds, thereby aiding in the dispersal of the species. These hairs also serve as windbreaks sheltering the leaf surface from the harsh, dry winds; therefore, serving as an evolutionary modification for growing in a dry or xerophytic environment. In Iowa, Cowboys delight is known from only about five historical localities and demonstrates its close western affinity by occurring in Iowa only on the western front range of our loess hills.

The Snapdragon family *(Scrophulariaceae)* is one of the most predominant plant families found in the Loess Hills. Many of these species have western affinities but are also found widely distributed in western Iowa. They seem to be well adapted to the disturbance of the natural prairie community. Disturbance created by heavy grazing pressure and in some selected situations, extensive soil erosion, these species which increase in numbers under these artificial-disturbance conditions are termed increasers, for they are opportunists taking advantage of a newly opened habitat where less adapted prairie species are no longer able to grow. The latter of these are called decreasers, for their numbers decline with an increase in disturbance.

One of the most spectacular of the increasers is the great flowered beardstongue or shell-leaf *(Penstemon grandiflorus).* There is just no way you can miss seeing this species for it grows to a height of four feet and bears a multitude of flowers which are about two inches in length. The entire plant is smooth, lacking hairs and is covered by a waxy, whitish coating to protect the leaves and stems against the hot, dry winds. Botanists call this smooth condition glaberous, and the waxy coating a glaucous condition.

The thick, bluish-green leaves are somewhat round and clasp the stem in a manner so that they lack a leaf stalk or petiole. The leaves are entirely lacking teeth. Usually the tubular flowers range in color from a light pink to pale violet

Bill Pusateri

Bill Pusateri

Left to right, ***cowboy's delight, great flowered penstamon, penstamon lobaea and downy paint brush.***

or pale purple color. If one searches extensively, an albino or white-flowered specimen can be occasionally found. The name beards-tongue comes from the family characteristic of usually producing a modified sterile stamen which has a profusion of hairs. This staminode appears as a "hairy tongue" protruding from the mouth of the flower.

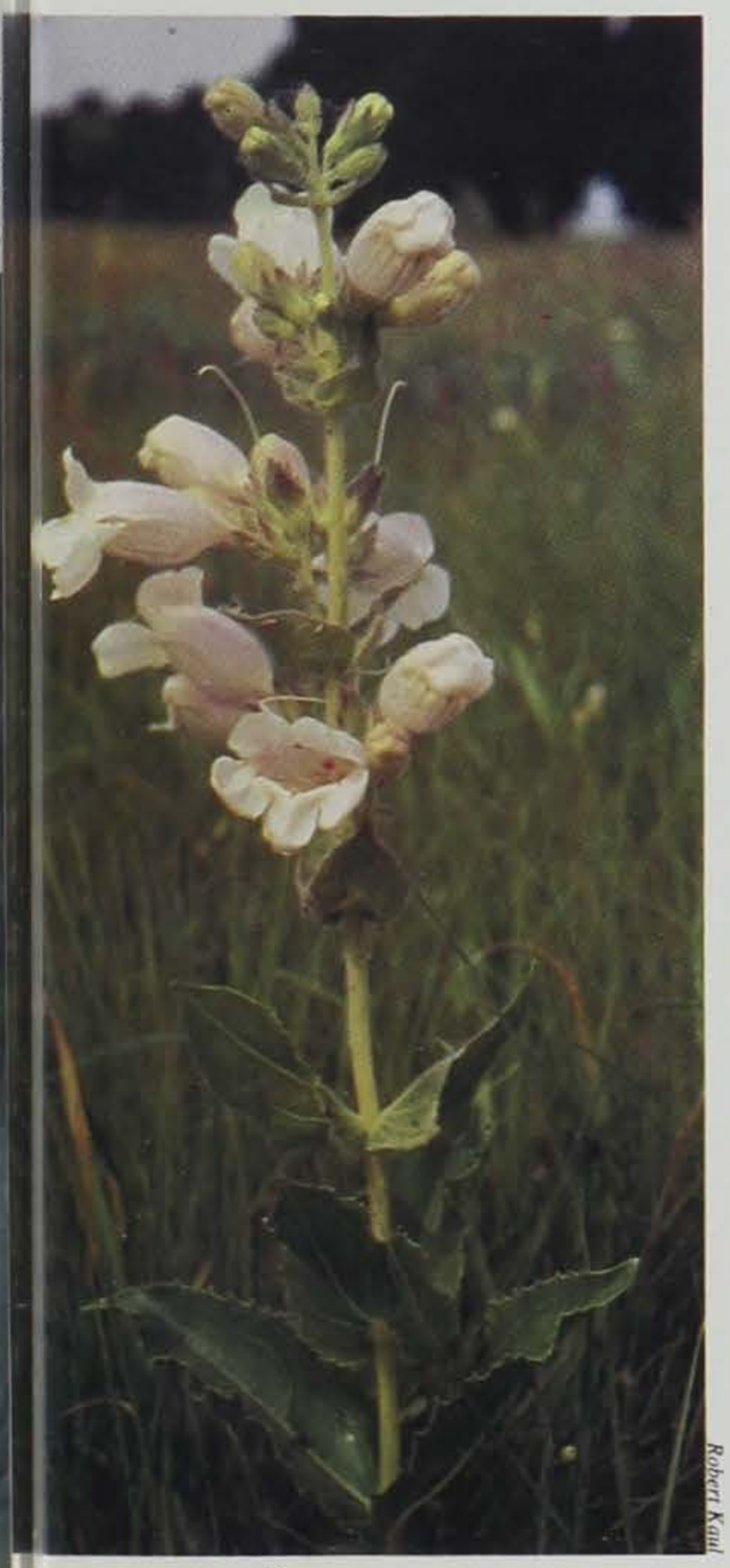
The great flowered penstemon has an interesting hop-skip-and-jump distribution in Iowa. It may be found growing very rarely in sandy prairies and along abandoned railroad prairie in central Iowa, then shows up again in far eastern sand prairies along the Mississippi River in Muscatine County.

Another intriguing penstemon species is the cobaea penstemon *(Penstemon cobea)*. It grows to about half the size of the proceeding species but is every bit as beautiful. The flowers are just as large, but the shiny, waxy, green leaves have conspicuous teeth on the margins. They also are rather thick and leathery and clasp the stem. Unlike the great flowered penstemon, this species is minutely hairy and the flower color is a light purple; however, white forms are known. The inner throat of the flower exhibits dark purple stripes. During the 1983 Natural History Foray, one population of the cobaea penstemon was found in the loess hills of southern Iowa. This was recorded as a new state record, for no one had ever documented its presence in Iowa before this time.

An additional member of the snapdragon family which is rather common in the loess hills is the downy paintbrush or plain's indian paintbrush *(Castilleja sessiliflora)*. It is called downy, for the soft, hairy pubescences which it displays. It grows to about 18 inches tall and has several stems eminating from a single base. The flowers are tubular and creamy yellow in color. The upper lobe of the flower has an olive green coloration while the lower lobe has a rose tint. Usually the flowers are tinged pink while still folded in the bud.

The downy paintbrush is known to be parasitic on the roots of prairie asters. As a root parasite, it may have a poorly developed root system for accumulating water and soil nutrients. Therefore, it establishes a close interrelationship with a host species. When the roots of the paintbrush grows in close proximity of the aster, it will "fuse" with the aster root at the point of contact. It does so by producing an organ known as a haustorium. This organ penetrates the root of the aster by digesting away the cellular components of the host root. The haustorial organ seeks out the conductive tissue of the host root which is known as phloem. Phloem cells conduct the nutrient sap throughout the plant body of the host plant. The downy paintbrush thus taps into this conductive phloem tissue and pirates the nutrient sap from the prairie aster. This evolutionary mechanism which is expressed by the paintbrush is also found in many other members of the snapdragon family. This mechanism ensures survival of the parasite when it is growing under harsh environmental conditions. Usually the host species is not greatly harmed, for if it is, it may also mean the death of the parasite as well. This type of symbiosis is known as commensulism, where one species benefits from another, but the host species does not retain any particular benefit or harm from the relationship.

Pasqueflower *(Anemone patens)* epitomizes the distributional phenomenon of plants occurring in the Loess Hills. Spreading up from central Texas to South Dakota (where it has been declared the official state flower), it reaches its peak occurrence in Iowa along the Missouri River bluffs. Through north-central Iowa, it is found occasionally in shallow loess-capped hill prairies then reaches a second distributional peak on the loess-capped goat prairies of Iowa's northeastern paleozoic plateau. One reason why our Iowa pasqueflowers may be so relatively plentiful is simply due to their having a very early blooming and fruiting



Robert Kaul

Bill Pusateri

Plants Continued

sequence; usually blooming before the rest of the prairie vegetation begins to green up, and before grazing animals are usually released on the landscape. Seeds have a chance to be distributed before production has a chance to be halted.

As a member of the Buttercup family *(Ranunculaceae),* the flower holds some cryptic suprises. What really appears to be large white or deep lavender petals are in actuality not flower petals at all, but instead modified sepals which are petaloid in nature. Flower color is changeable from flower to flower and plant to plant, a partial result of genetic variability and soil acidity or alkalinity. When in fruit, the plant is sometimes called prairie smoke for the wispy feather-tipped fruits. If one looks closely in mid-summer, they may still identify the plant by the remaining weathered leaves which bear a similarity to the basal leaves of *Delphinium*.

One of the most important botanical discoveries in Iowa recently took place in the Iowa Loess Hills. Iowa botanists have discovered and documented a species of grape fern quite unlike any species before seen in the midwest. Later searching by professional plant taxonomists (sponsored by the State Preserves Advisory Board) revealed four major populations ranging from extreme southern Iowa to the northern terminus of the deep loess deposits in the northern part of the state.

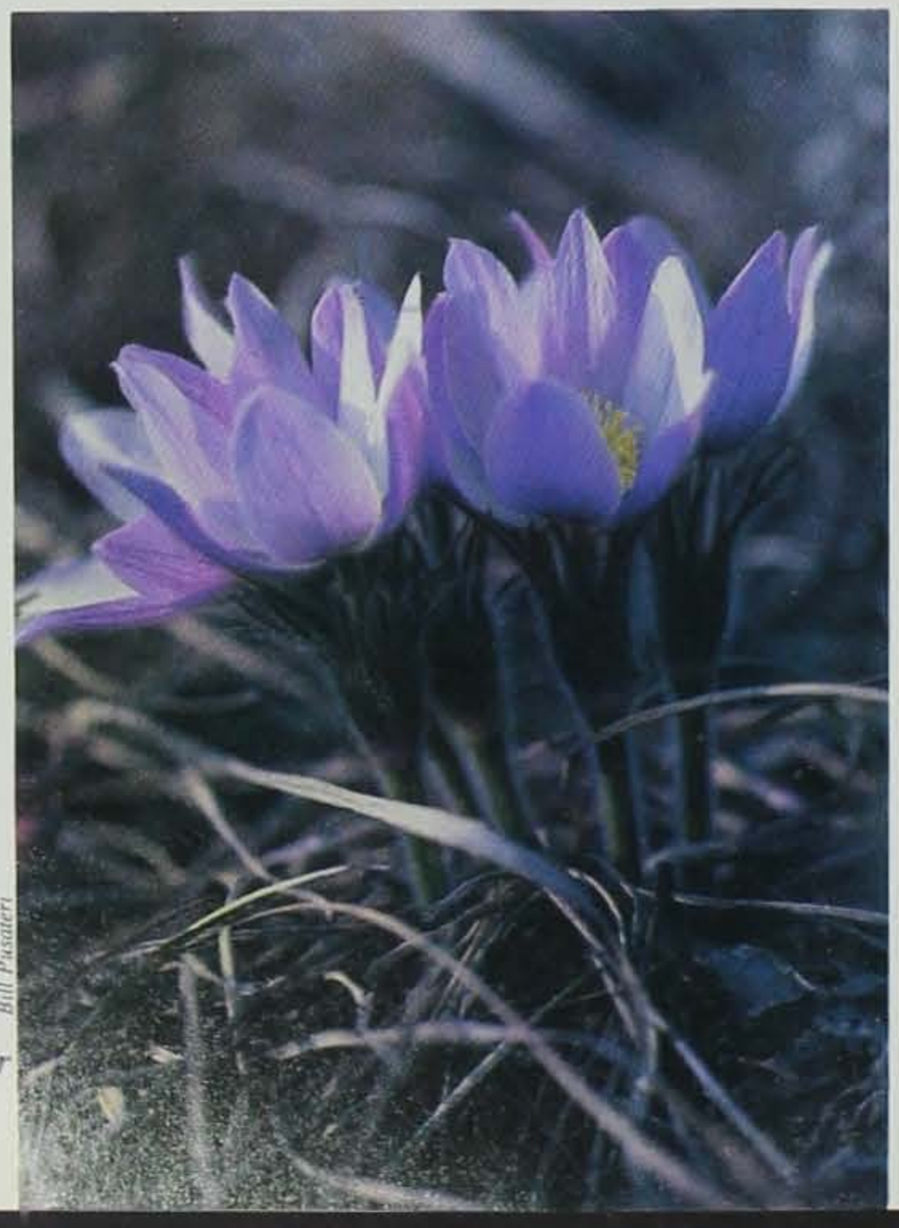
Presently, the species is being researched by professional fern experts called pteridologists. It is plausible that their investigations may conclude that this is a new species of fern which has never before been described. That is, a species new to science which occurs only in the Loess Hills of Iowa — what taxonomists like to call a state endemic species. If this proves to be true, then this is just one more valuable justification for the preservation of an extremely significant landform with unique natural communities which are rapidly being destroyed before our very eyes.

This article has strived to make you aware of just a few of the very special plants found in the Loess Hill bluffs of western Iowa. We emphasize "just a few" for there are many, many more. The botanists who work for the Iowa Conservation Commission are always interested in knowing where the rare and unique plant species are found, so that we can help set priorities for preservation and management. As always, we welcome your help and deeply appreciate your efforts for seeing that these special plants are protected for future Iowans to enjoy and cherish as part of their midwestern heritage.

William P. Pusateri, a native of Cedar Rapids serves as a botanist for the commission's Natural Areas Inventory. After receiving a B.S. degree from Coe College in 1973, he earned an M.S. in botany from Southern Illinois University.

Bill Pusateri

Hills fern



Bill Pusateri

Pasque flower

The

By Jean Novacek

Jean Novacek, a native of Sioux City, earned a B.S. degree in botany from the University of South Dakota in 1983. She is presently working toward an M.S. degree at the University of Nebraska at Lincoln.

More than 100 years ago noted botanists and naturalists of Iowa began recognizing that the vegetation of the Loess Hills was unique, quite unlike any other plant community elsewhere in the state. As Louis H. Pammel, Iowa State professor of botany, at the turn of the century pointed out: "The region is of great interest from the botanical standpoint because the flora has many plants which are common to the western flora…The intermingling of western and eastern prairie types is most marked on the loess bluffs." And, indeed, there are many members of the Great Plains flora inhabiting the loess bluff prairies.

The geology of the Loess Hills and the plants growing upon them are inextricably intertwined, as the ecological conditions at the time of loess deposition were important to their formation. The greatest amount of loess was deposited after the glacial ice had retreated to the north and the climate had moderated enough to permit the development of an extensive vegetation upon the valley walls lining the Missouri River. The abundant plant-cover on higher grounds provided an anchorage for the loess after deposition so it did not wash or blow away. Plant distribution may, in part, explain the differences in loess thicknesses on the east and west sides of the Missouri River. Prevailing westerly winds produced an arid environment which supported a prairie flora on the Iowa side where loess piled up like snow in drifts. Since the Nebraska side was protected from the desiccating winds, it was mostly wooded, so when the wind direction changed occasionally, this area received a thinner blanket of loess which settled more or less uniformly in the dense vegetation. Thus, irregular and unequal loess deposits were partly a result of a drier land surface supporting a xeric, or dry, prairie vegetation.

In general, the prairie community thrives upon the south- and west-facing

Western Connection

slopes of the loess bluffs, while the woodland community maintains a foothold upon the protected east- and north-facing slopes. With the westerly summer winds constantly sweeping them, the southwestern slopes of a typical upland loess prairie are directly exposed to the hot mid-day sun. This, coupled with the loess soil's capacity to dry out quickly, creates a truly xerophytic environment, that is, almost desert-like. A true xerophyte, or a plant adapted to arid conditions, the yucca *(Yucca glauca)*, a striking member of the lily family, thrives upon the harsh southwestern slopes. Yucca is the deepest rooted member of this prairie flora with a root system reaching 40 feet downward! In fact, it has been shown that plants rooted in loess, on the whole, are normally rooted much deeper than the same species rooted on glacial till.

The upland loess prairie is dominated by two bunch-grasses, little bluestem *(Andropogon scoparius)* and side-oats grama *(Bouteloua curtipendula)*; both are warm-season mid-grasses. Little bluestem is the more common of the two, comprising about 90% of the total vegetation of the Loess Hills; however, since side-oats grama is extremely drought-resistant and increases under grazing pressure, it can be found to be the dominant grass in areas damaged by drought or overgrazing.

Oddly enough, even though grasses are the most common and numerous plants on the Great Plains, nevertheless, there are no grass species which cannot also be found outside of the region; that is, there are virtually no grasses endemic to the Great Plains. An endemic is a species or genus which is restricted to a geographical area. Thus, it is not surprising to learn that there are but six grasses in the Loess Hills of unusual interest because they are at the eastern edge of their ranges. Typically found upon the western plains, these grasses, red threeawn *(Aristida longiseta)*, needle-and-thread *(Stipa comata)*, green needlegrass *(Stipa viridula)*, tumblegrass *(Schedonnardus paniculatus)*, buffalo-grass *(Buchloe dactyloides)*, and Sandhills bluestem *(Andropogon hallii)*, are not really restricted to the loess bluffs, but also can be found in other northwestern Iowa counties.

Many other Great Plains species reach the eastern-most limit of their ranges on the upland loess prairies of western Iowa. In fact, if it were not for the xeric habitat which the Loess Hills offer, these westerly plants would not be present in Iowa at all. Although some of these plants are quite rare, such as cowboy's delight *(Sphaeralcea coccinea)* and buffalo berry *(Shepherdia argentea)*, many are quite common in spite of being restricted to the narrow band of hills immediately adjacent to the Missouri River floodplain, one of these being the scarlet gaura *(Gaura coccinea)*, an early spring flower of the evening-primrose family which can be found the entire length of the Loess Hills. There exists an unusual plant on the first flank of the hills which is indeed a long way from home, the sand lily *(Mentzelia decapetala)*, also called the ten-petal blazing-star. The mentzelias, in the loasa family occupy the same ecological niche as cacti and have their center of distribution in the American Southwest; thus, it is truly amazing to find one thriving in Iowa!

Nineanther dalea *(Dalea enneandra)*, a member of the legume family, is also common on loess prairies, but one would have to travel at least 200 miles westward in Nebraska to find it growing once more. In fact, this plant exhibits a pattern similar to the majority of these westerly species: they probably followed an easterly migration route from northern Nebraska and the Dakotas, initially entering northwest Iowa, particularly through Plymouth county, then moving southward on the loess bluffs along the Missouri River. This makes sense when considering that the highest elevations in the state are found in northwest Iowa, in addition to receiving the lowest mean annual precipitation. Iowa geologist, Jean Prior, has appropriately referred to northwest Iowa as a "jumping off place, a definite step upward to the High Plains of the Dakotas."

Why are so many wetern plains species happy to call the loess hills home? As yet this is unknown, but is currently being investigated. There are also intriguing distributional mysteries within the loess prairies themselves. Two Great Plains milkvetches are present, lotus-flowered milkvetch *(Astragalus lotiflorus)*, which is quite common the length of the loess hills, and Missouri milkvetch *(Astragalus missouriensis)*, which is a threatened species in Iowa. Both members of the legume family, these plants are similar in microhabitat preferences, but there seems to be no readily apparent reason why one would be rare and one common. The Missouri milkvetch is common in western Plymouth county, becoming less abundant southward, until its terminus is reached just north of Holly Springs in Woodbury county; thus, the total distance of distribution in the state is approximately 50 miles! Why this species has not migrated further south is not known. Possibly it is a "recent entry" into the state via the Plymouth county "gateway." If this is so, then it would appear to us, locked into time as we are, that it is not moving; when, in reality, it just moved in! Or, on the other hand, possibly the distance between its preferred habitat is too great for effective seed dispersal; in this case, there is a large floodplain between prairie bluffs which has been greatly modified by cultivation, perhaps preventing its further migration. It's a possibility that the lotus-flowered milkvetch is so commonly found on all loess prairies because it migrated long before man's disruption of migratory routes.

The Loess Hills offer a unique perspective of our Iowa prairie heritage. Their steep slopes burning in the summer sun, swept by the ever-blowing westerly winds, support a botanically fascinating plant community, which mimicks the western prairies of the Great Plains. As Bohumil Shimek, an early Iowa botanist, naturalist, and geologist, so eloquently described the Loess Hills: "In the spring when abundant rains have bathed the rugged slopes an almost uniform green suffuses them; in early summer they are brilliant with loco weed and other flowers; but when summer has advanced, when the rains have ceased and the blistering winds and scorching sun have robbed the southwesterly prairie slopes of their moisture, the sheltered groves and the exposed prairie surfaces stand out in sharp contrast, visible for many miles and setting out with striking effect and unmistakable precision the varied features of this singular topography."

Animals
of the Loess Hills

By Robert W. Howe

A summer walk through the dry, wind-swept ridges of Iowa's Loess Hills can be an exhilarating experience. The flat Missouri River floodplain spreads westward from steep, sometimes precipitous bluffs. Unusual wildflowers color vast areas of native prairie, interrupted only by bur oak woodlands and deep valleys. Houses and roads are visible but far away, usually confined to the floodplain or more gentle land to the east.

For the naturalist, however, this is a quiet place. Perhaps a field sparrow can be heard singing from a lone red cedar. An eastern yellowbelly racer might dash through the grass. Butterflies flutter among the purple coneflowers. Still, one does not casually encounter a high diversity of animal life.

Yet the solitude in these hills is the source of their uniqueness. This is a harsh environment. Animals of the Loess Hills prairies must be able to tolerate conditions that occur nowhere else in Iowa. Steep slopes and dry soils discourage a number of animals that thrive in moister grasslands to the east. Standing water is rare. The dry climate is more typical of western Nebraska's Great Plains. Indeed, the Loess Hills fauna has a decidedly western flavor.

The Loess Hills' steep topography is responsible for another important feature — lack of intensive cultivation. This, in turn, has meant that large areas of native prairie have been left intact. One vast grassland in Plymouth County, for example, covers more than 4,000 acres. Nearly all remnant Loess Hills prairies have been grazed to varying degrees, but the fundamental natural qualities of many tracts are still present.

Bison, pronghorn and other conspicuous prairie animals are gone from Iowa's prairies. So, too, is the once-abundant prairie chicken, although attempts by the Iowa Conservation Commission to reestablish populations might eventually achieve success. Today, one must look closely to find representatives of the native prairie fauna, but many important species are still with us. Perhaps nowhere else in Iowa is this better illustrated than in the Loess Hills.

Finding Water

The special character of Iowa's Loess Hills fauna is illustrated by the plains spadefoot. This open-country toad was not known from Iowa until 1967, when it was discovered in the vicinity of DeSoto National Wildlife Refuge near Missouri Valley. Dr. James Christiansen and Kathy Mabry of Drake University now have shown that the spadefoot is widespread in the Loess Hills. Warm rains during late spring or early summer bring thousands of these burrowing toads to the surface. Males congregate around small, temporary pools, where they call to attact females. Like all Iowa amphibians, their eggs and young require an aquatic environment for development. But the plains spadefoot is able to tolerate very limited and unpredictable water supplies. If breeding ponds are scarce, tadpoles of the plains spadefoot become cannibalistic. This helps insure that at least a few young will be produced each season. The plains spadefoot is an opportunistic breeder. When the spring weather is too dry, they simply wait until summer.

The plains spadefoot is joined by other western species: the Great Plains toad, Woodhouse's toad, and plains leopard frog. Even though they are at home in the dry hills, these species depend on wetlands in the surrounding valleys or floodplains. Early accounts of western Iowa described the Missouri River valley as a vast complex of moist prairies and wetlands. Today, nearly the entire floodplain has been transformed into farmland. Roadside ditches and flooded fields now replace wet swales and marshes. These less attractive substitutes probably still play an important role in the ecology of the Loess Hills.

Landscape Architects

Shelters from weather extremes and hiding places from predators are sparsely distributed in the open Loess Hills prairies. Some species, like the plains spadefoot, make their own retreats. Others, like the prairie rattlesnake, depend on the activities of an unlikely cooperator — the badger. Dr. James Christiansen of Drake University has shown that, within their limited Iowa range, prairie rattlesnakes make regular use of abandoned badger burrows as denning sites and probably as hibernacula (places for hibernating). Firm, dry, loess soils maintain badger excavations long after these wide-ranging carnivores have moved to new sites. Besides prairie rattlesnakes, other opportunistic tenants include bumblebees, wasps, spiders, rabbits, small mammals, plains spadefoot, Great Plains toad, and even tiger salamanders. Remnant badger burrows, a common sight in the Loess Hills, apparently help many animals survive in this unique environment. According to Dr. Richard Lampe of Buena Vista College, the badgers, too, may later benefit from this relationship. All of these animals, including the prairie rattlesnake, are known to be badger food items!

Relicts from a Drier Era

Another Great Plains species, the plains pocket mouse, lives in a few scattered prairies in the Loess Hills. This species is Iowa's only representative of the Heteromyidae, a family that includes kangaroo rats and other desert rodents of southwestern United States. The plains pocket mouse is most common in the Sand Hills of Nebraska. During this century, several isolated populations also have been found in sandy habitats east of the Loess Hills. One of these (Big Sand Mound in Louisa and Muscatine Counties), is known to persist today.

Ken Varland

The relationship between sandy substrates, plains pocket mice and the Loess Hills is no accident. Indeed, a comparison of Loess Hills animals with those of Big Sand Mound, Iowa's most extensive sand deposit, reveals some remarkable similarities. Besides the plains pocket mouse, these two areas share the lark sparrow, Woodhouse's toad (different subspecies), six-lined racerunner, ornate box turtle, and other species that are locally distributed or otherwise rare in Iowa. Steep Loess Hills and well-drained sandy soils both lead to xeric (very dry) conditions. The substrates are rather different, but dry-adapted animals find both areas favorable. Dr. Christiansen of Drake University suggests that low densities of forest-associated predators, as well as lack of water, might help tip the ecological balance in favor of these specialized species.

Scientists have shown that, after the most recent ice age, very dry conditions spread over much of the Midwest. During this post-glacial period (called the "Xerothermic"), ranges of many western species extended into dry grasslands of Iowa, Illinois, Indiana, and nearby states. A few leftover populations of these species still occur in locally dry habitats. Iowa's plains pocket mice and associated species are excellent examples of these "Xerothermic relicts".

Today, plains pocket mice are rare even in the Loess Hills, where they are far outnumbered by species like the western harvest mouse, white-footed mouse, prairie deer mouse and prairie vole. Dr. Richard Lampe of Buena Vista College and Dr. John Bowles of Central College have conducted intensive surveys of mammals in the Loess Hills. They have found plains pocket mice at only 5 localities, including the state-owned Loess Hills Wildlife Area and a preserve purchased recently by The Nature Conservancy and Plymouth County Conservation Board. These populations deserve to be protected.

Rare Butterflies

Butterflies are one of the most habitat-specific groups of animals. Despite their seemingly erratic flights, many species tenaciously defend small territories. Most lay their eggs on only one or a few types of host plants. Because so much of their original habitat has been destroyed, most prairie butterflies have become rare across North America. Some examples are the Dakota skipper, Poweshiek skipperling, Ottoe skipper, dusted skipper, Pawnee skipper and regal fritillary.

Paul Opler, an endangered species biologist with the U.S. Fish and Wildlife Service, suggests that prairie preserves larger than 1000 acres might be needed to maintain viable populations of these native insects. In Iowa, prairie areas of this size occur only in the Loess Hills.

In 1980, some of North America's most distinguished naturalists gathered in Iowa to survey butterflies of the Loess Hills. They discovered a number of prairie species, previously thought to be very rare. The Ottoe skipper, dusted skipper and regal fritillary, for example, are well established in the Loess Hills, but are rare elsewhere in Iowa.

Other important finds included the hickory hairstreak, spicebush swallowtail and the beautiful zebra swallowtail, all woodland species. Zebra swallowtails are closely associated with pawpaw, a small southern tree that extends into Iowa at Waubonsie State Park. Woodlands and prairie openings at Waubonsie, perhaps reminiscent of pre-

Rich Singer

The prairie rattlesnake (left), ***endangered in Iowa, uses badger burrows as denning sites. The Great Plains skink*** (top), ***like the prairie rattlesnake, is restricted in Iowa to the Loess Hills. The regal fritillary*** (above) ***is rather common in the Loess Hills, but uncommon elsewhere.***

Animals Continued

settlement savannas, provide habitat for four other rare butterflies: the hoary edge, white m hairstreak, Henry's elfin and Olympia marblewing. Prairies, woodlands and forests of Waubonsie should be treasured as some of Iowa's richest butterfly habitats.

Last Stands

Two of Iowa's rarest animals occur only in the Loess Hills. Both species are widespread in western or southwestern United States; each appears to have entered Iowa via a different route. The secretive Great Plains skink is known only from the southern Loess Hills in and near Waubonsie State Park. The prairie rattlesnake occurs only in the northernmost Loess Hills.

The Great Plains skink lives in prairies at the edges of bur oak woodlands. Only a few people have ever seen one in Iowa. Unless special steps are taken to locate surviving individuals and to protect their habitat, this interesting animal may disappear from Iowa during our lifetimes. A similar fate is probably inevitable for the prairie rattlesnake. A few individuals still are observed on privately owned land in Plymouth County, but numbers are so low that killing of rattlesnakes by humans could eliminate all hopes for survival of this species in Iowa.

Another rare prairie species, the ornate box turtle, was rediscovered in the Loess Hills during the 1983 natural history "foray", sponsored by the State Preserves Advisory Board. Individuals were found at four localities in Mills and Fremont Counties. One of these was the exact locality where box turtles had last been recorded in the Loess Hills, more than 40 years ago. Box turtle populations apparently still exist in the southern Loess Hills, but the low frequency of sightings and encroachment of woody vegetation suggest that their survival is precarious.

Hidden Surprises

Visitors to the Loess Hills are likely to see few, if any, of the rare or unusual species described above. The most conspicuous Loess Hills animals are familiar to Iowans: mourning dove, eastern kingbird, blue jay, eastern cottontail, fox squirrel and other common species. With a little effort, however, chances to glimpse interesting animals are very good in the Loess Hills. Bell's vireo, a species listed in the American Birds "Blue List" of declining species, is still fairly common in shrubby ravines of the Loess Hills. Few places in Iowa provide better opportunities to find western kingbirds, orchard orioles, blue grosbeaks, chuck-will's-widows, prairie ringneck snakes and milk snakes. Colonies of bank swallows occur frequently in vertical road cuts. Turkey vultures are common. So are coyotes, although they are more secretive. Waubonsie State Park is home for gray squirrels and an unusual population of black or "melanistic" fox squirrels. Collectively, these animals give the Loess Hills a subtle richness. Exploring this richness is challenging, yet rewarding.

The Future

Like most of Iowa's remaining natural features, the Loess Hills are losing ground to agriculture (overgrazing), housing developments, and other human influences. A less obvious change, encroachment of woodlands, may pose an even greater threat to native Loess Hills animals. Prairies and savannas in the southern Loess Hills already are restricted, for the most part, to steep slopes and narrow ridgetops. Prairie animals will not be able to maintain populations in such limited areas. Indeed, some of today's most interesting species in the southern Loess Hills are woodland animals (e.g., chuck-will's-widow, zebra swallowtail, woodland vole). Plains pocket mice, upland sandpipers, regal fritillaries and other prairie animals flourish only in the more open northern Loess Hills.

Iowans still have a chance to protect large, contiguous tracts of Loess Hills prairies, remnants that include not just native plants, but also many of the prairie's typical animals. The state-owned Loess Hills Wildlife Area and new preserves in the vicinity of Sioux City are good starts. Unfortunately, they will not, alone, be adequate. Unless large nearby prairie areas are protected, the existing preserves will gradually lose many of their original inhabitants. Like most of our other prairie preserves, they will become solitary islands, only nostalgic pieces of a viable, intact ecosystem.

Bob Howe serves as biologist and coordinator for the commission's Natural Areas Inventory. He earned his Ph.D. from the University of Wisconsin working with birds in small woodlots of southern Wisconsin and Australia.

Profile of an Endangered Species

Southern Bog Lemming

(Synaptomys cooperi)

By Dean M. Roosa

The southern bog lemming *(Synaptomys cooperi)* ranges from Kansas and Missouri throughout the northeastern United States and southeastern Canada. Its genus name is of Greek origin and means 'unite' and 'mouse,' indicating a link between two other groups of rodents — the meadow mice and the true lemmings. The species name commemorates William Cooper, collector of the first known specimen.

In Iowa, the southern bog lemming occurs statewide, but the most recent records of the animal have come from the Loess Hills. It prefers heavy stands of bluegrass in low moist areas, but also lives in moist woods, marshes or prairie swales. Bog lemmings are somewhat colonial and live in loose groups of a few to dozens of individuals. They make characteristic runways in heavy vegetation; these can be used to indicate their presence. These runways are used most frequently in the evening and at night.

Ron Johnson

Their rarity in Iowa is due to the lack of grasslands with a heavy cover of vegetation. It is now more often relegated to grassy ditches and the vegetation of the Loess Hills.

Its presence in these scenic hills is yet another reason why we should forever protect portions of these hills for future Iowans.

Nature Tale for Kids

LOTOR — FROM THE LOESS HILLS

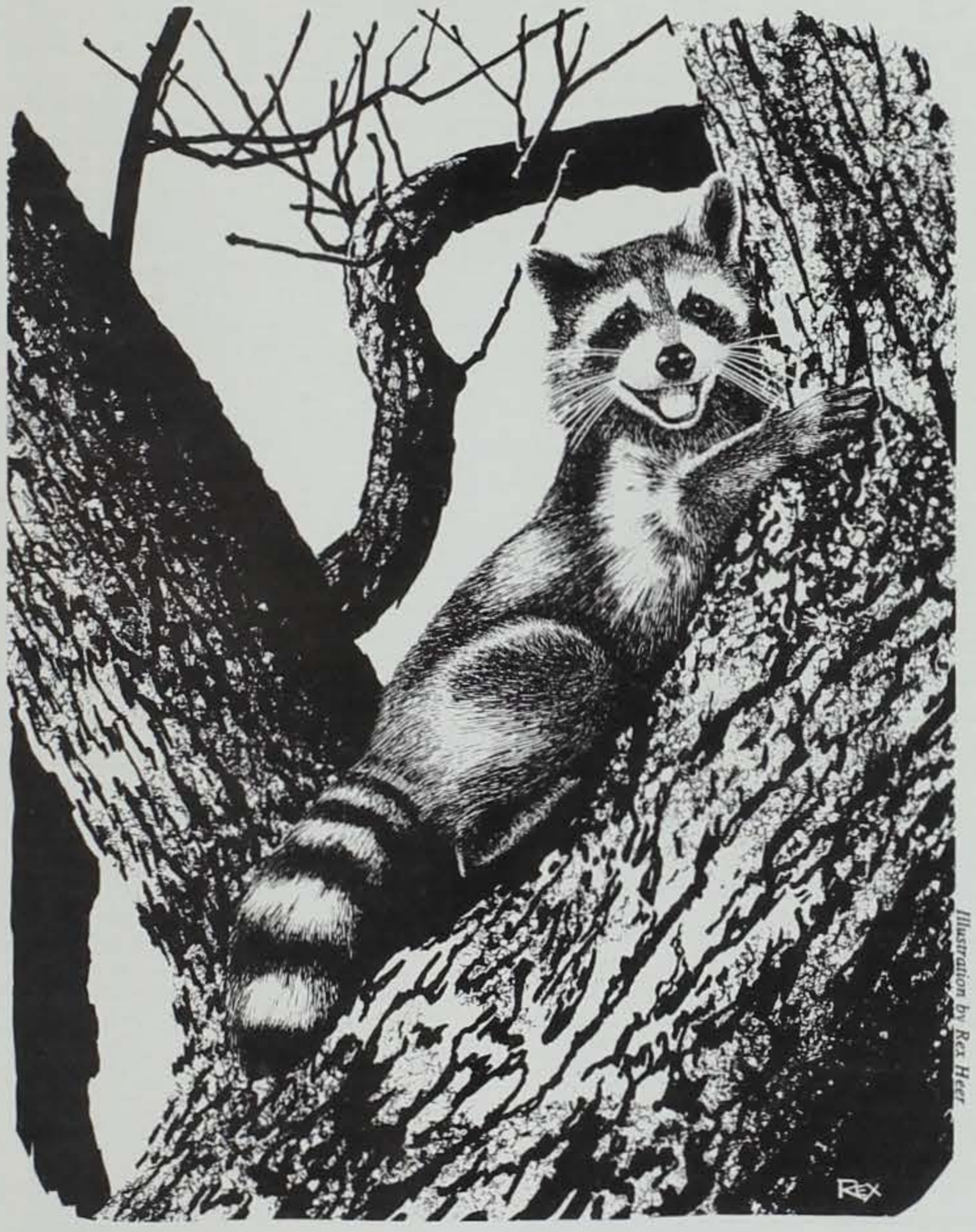


Illustration by Rex Heer

By Dean M. Roosa

It was the kind of storm that comes along only once every twenty years. The old den tree shook and swayed, worrying the mother raccoon within. She had good reason to worry; in fact, four good reasons — four tiny young less than a week old. The den tree was a monstrous old bur oak, gnarled, crooked and hollow. It had felt the last bison rub against it. It had seen the last prairie chicken dance on the flat floodplain just to the west. It had felt the heat of a thousand prairie fires and had survived a hundred such storms now causing the mother raccoon to fret. The next morning, the old tree still stood, the air was quiet and five raccoons were sleeping peacefully.

The Little Sioux River flowed close to the old den tree and was back to normal flow, weeks after the big storm. The mother loved to fish along this little river. It had delectable crayfish and occasionally small fish could be caught swimming in the backwater. She was catching crayfish early one morning, thoroughly enjoying herself in the predawn quiet. Suddenly the silence was shattered by shrieking and whimpering coming from the direction of the old den tree. Only a worried mother could cover the distance in record time as did the old raccoon. There on the ground she found Lotor, her firstborn who had tried to follow her to the river. He fell from the tree on this, his first outing. More scared than hurt, more chagrined than anything, Lotor wanted some comfort. Instead, he received a stern cuffing for leaving the den. Lotor was the biggest of the litter, more adventuresome, and destined for a life of (depending on your perspective) adventure, mischief, or crime.

A week later the mother awoke in late afternoon to find Lotor gone. She found him happily splashing in the shallow water of the river. She chastised him and spanked him back up the tree. Many other such episodes followed, and if the mother's vocabulary had been sufficient, she would have called him incorrigible.

Lotor was the first to leave in the late summer. He loved to wander on the high bluffs of the Loess Hills. He felt safe here in the prairie grasses and would drop down into the damp valleys to dig grubs, catch frogs and search for crayfish. His wanderings took him to the Missouri River, back to the hills, and to a small town where he gained a reputation as a garbage connisseur. But a narrow escape from the big town mongrel, where Lotor spent nine hours in the top of a young oak, convinced him that city life was not for him. He escaped by dark of night, returning to his beloved hills. He learned that campgrounds in state parks were fruitful places to raid. There were seldom any of the hated dogs around, often unattended food supplies and fairly tolerant park rangers.

His love of adventure kept him on the thin line between social acceptability and social ostracism. No sweet corn patch was safe, no garbage bin too well-covered, no campground too secure from Lotor's nightly prowls. One angry gardener, complete with two hounds and flashlight, convinced him to be more moderate in his visits, at least for a week.

That fall he learned more lessons about hounds. He was mauled one night, but fortunately the hound was young and inexperienced, and Lotor escaped with a ragged ear, missing fur and mangled pride. He also learned about steel traps; the loss of a toe in one gave him a healthy respect and he learned to cover them or turn them over.

The following spring, after spending a comfortable winter sleeping in a burrow in the loess soil, Lotor started wandering south until he came to the Nishnabotna river. Here he raised a family in a gnarled oak on the bluff. He was a fairly good father, but life was boring, because his adventuresome spirit was being stifled. Eventually he could stand it no longer and off he went, raiding towns, campsites, and generally creating havoc. He grew fat and sleek on sweet corn, crayfish, frogs, and clams.

Today he claims a portion of northwest Missouri as his own Loess Hills. A veritable giant among raccoons, his tracks excite trappers and delight hounds. He travels occasionally to the Missouri River for lunch but always returns to his home where several generations of descendents welcome Lotor, the raccoon of the Loess Hills.

Wildflower of the Month

Yucca

(Yucca glauca)

By Dean M. Roosa

In late May or early June in extreme western Iowa, the west-facing faces of the Loess Hills become nearly aglow with the blossoms of yucca *(Yucca glauca)*. This handsome plant, generally placed in the lily family, has a spike of white flowers which stands erect and achieves a height of three feet, although it may grow to heights of six feet in other parts of its range. The large nodding bell-shaped flowers have three petals and three similar sepals, each up to an inch and a half long.

The leaves grow from the base and are stiff, almost bayonet-like, which gives the plant another name, Spanish bayonet. Each leaf has whitish, thread-like marginal hairs, is perennially green, and may grow to three feet long.

Seed production depends on a moth that lives in the flower. The moth gathers pollen and places it on the stigma, or female part of the flower, thus insuring pollination. It also lays eggs in the developing seed capsule where the seeds provide food for larva. Enough seeds survive to insure successful reproduction. Neither moth nor plant could exist alone.

Roots of the plant produce a good lather when cut, pulverized and rubbed in water, thus giving it a third common name — soapweed.

The plant has been extensively used for food, fiber and medicine by native Americans.

When you see the yucca plant in Iowa's Loess Hills — remember it is a living lesson in biology, medicine and history.

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