



**IOWA
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IOWA GEOLOGY 2000

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COVER

Fall colors along the shore are reflected in the calm waters of Springbrook Lake at Springbrook State Park in Guthrie County (see article p.16). Fed by the upstream waters of Kings Creek, the lake drains downstream to the Middle Raccoon River and is part of that watershed. The quality of any Iowa stream or lake is a reflection of land use on the slopes that drain its watershed.

Cover photo by Roger Hill



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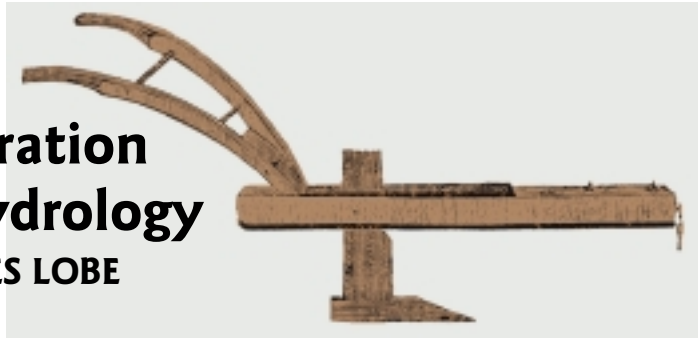
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Historic Alteration of Surface Hydrology ON THE DES MOINES LOBE



Kathy L. Andersen*

Iowa once was a vast tallgrass prairie ecosystem, interspersed with upland savanna, prairie marshes and sloughs, riparian woodlands along small streams and rivers, as well as isolated stands of trees in small park-like groves. These were components of the Iowa prairie matrix at the time of European settlement in the mid-1800s. To provide a geographic framework for land ownership, the Government Land Office was established, and first-hand accounts of its surveyors were later used in state guides and handbooks that promoted settlement and agriculture.

The surveyors recorded a general description of the terrain, vegetation, soils, and stream crossings of each township after first laying out their rectangular grid of square-mile sections. They used the term, “prairie,” and characterized it as first, second, or third rate, and “level” or “rolling” as an indication of the area’s farming potential. Surface water features were described with spe-

cial detail in an effort to label counties as “well watered throughout.” Other descriptions such as “marsh,” “slough,” or “bottom” indicated wetter areas, and “timber” or “barrens” documented areas with trees. Soils also were classified as first or second rate, which related primarily to township topography. These historic descriptions of Iowa’s pre-settlement landscape provide a valuable reference from which the extent of change in the state’s land and water features can be measured.

The landscape most drastically altered by Euro-American settlement and cultivation was the “wet prairie” of north-central Iowa, a landform region known as the Des Moines Lobe. This area is part of the much larger Prairie Pothole Region that extends north and west into Canada. Iowa’s “wet prairie” coincides with the most recent glacial activity to occur in Iowa, the advance of the Wisconsin ice sheet into the state between 15,000 and 12,000 years ago.

Left: The mole plow, pulled by horses or oxen, was an early tool used for underground drainage of land.

Engraving from *The Principles and Practice of Land Drainage*
by John H. Klippart. Robert Clarke & Co.,
Cincinnati, 1867, p. 232.

This glaciation left much of north-central Iowa's terrain flat to undulating, with few well-defined drainage networks. Small prairie streams, while gently meandering through the tall grasses, subtly linked the marshes, sloughs, and wetlands to larger streams and rivers, making it difficult to determine exact watershed boundaries.

The natural surface-water features of the pre-settlement landscape provided an infiltrative hydrology, which allowed surface water to be collected, stored, and gradually released to larger streams and underground aquifers. The *Hand-Book of Iowa*, written in 1869 by Rufus Blanchard, describes the youthful land-

scape of the Des Moines Lobe as follows: "*the country consists of broad tables with but slight depressions, drained by frequent undulating sloughs. These are found in parts most distant from large rivers, where the admirable system of drainage which nature has provided for this State has not yet had time to be developed.*"

Mr. Blanchard further notes that: "*the immediate sources of these tributaries are often found in narrow and deep sloughs, where water issues from the ground beneath the tall grasses.*"

These natural wetland conditions described on the Des Moines Lobe in 1869 are nearly beyond recognition today. Instead, a mono-crop agricultural



Photo from *Report of the Iowa State Drainage Waterways and Conservation Commission, State of Iowa, 1911, Plate 5.*

Excavations of large ditches were intended to prevent stream overflow by widening and deepening existing channels, cutting off stream bends, and constructing auxiliary channels and levees.

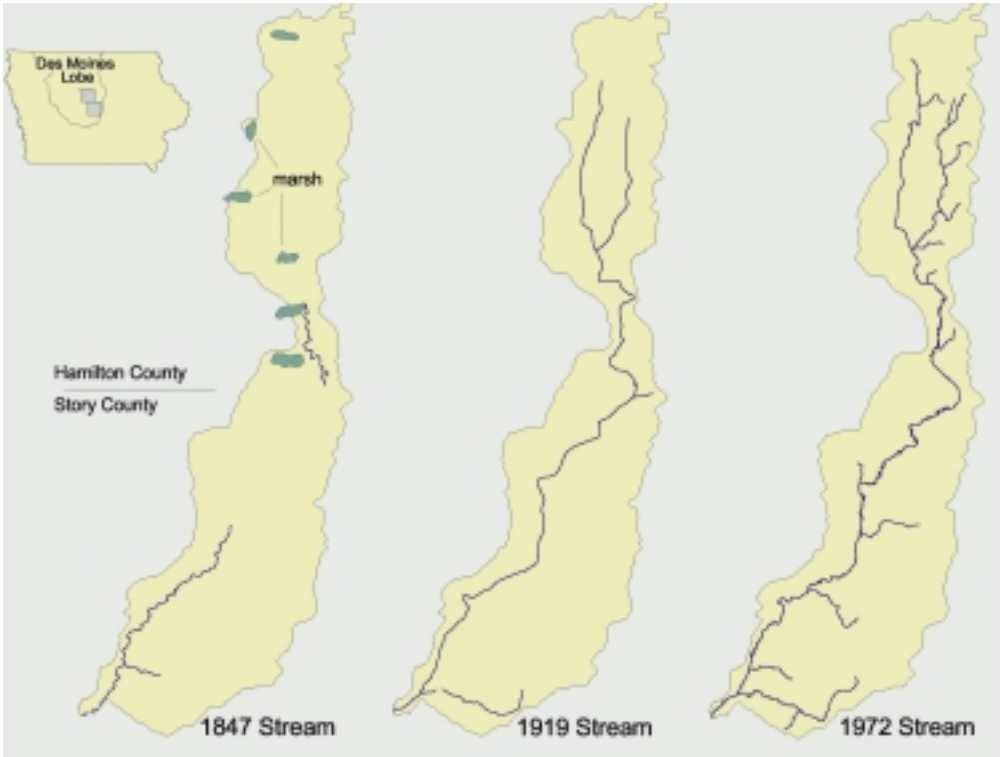
landscape extends as far as the eye can see. For nearly a century and a half, Midwest farmers drained, dredged, and tilled the wetlands and marshes on the Des Moines Lobe and across the greater Prairie Pothole Region. By 1900, landowners earnestly took part in the great endeavor to “improve” and “reclaim” these wet acres. Although estimates vary, it is generally agreed that approximately 99 percent of the original wetlands, marshes, and small streams of north-central Iowa were drained and plowed, while the larger streams and rivers were dredged and straightened to facilitate removal of surface water.

Today, artificial stream systems replace the more absorbent wetlands and marshes, and these streams flow in direct contact with Iowa’s vast agricultural landscape. Further, we have eliminated many natural stream meanders through straightening and channeliza-

tion. Drainage of wetlands and channelization of streams and rivers have promoted a hydrological imbalance. Today, in the upstream or headwater portion of small streams, water moves off the land much faster, allowing greater stream bank and bed erosion, creating increased transport and deposition of materials (including soil and agricultural chemicals), along with more severe flooding downstream. Draining of wetlands has lowered the water table, causing natural underground springs and small streams to cease flowing and shallow wells to be deepened. Most of these changes in surface and subsurface hydrology have occurred within a human lifetime.

Bear Creek, located in Story and Hamilton counties, is typical of small prairie streams on the Des Moines Lobe that have undergone drastic alteration of their surface and sub-surface hydrology.

Historic Development of Bear Creek



ogy (see maps above). This watershed contains none of the original wetlands or marshes that existed in the mid-1800s. Instead, intermittent and perennial stream segments have been formed, defining a new watershed hydrology.

Today it is difficult to imagine those original conditions of wet prairie described by early public land surveyors. Through researching historical informa-

tion about Iowa's small prairie streams, we gain a better understanding of the extent of alterations in the hydrology at the landscape scale, as well as valuable information to aid in restoration of wetland habitats.

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An aerial photograph of a narrow, winding creek cutting through a dense, vibrant green agricultural landscape. The creek flows from the top center towards the bottom of the frame. The surrounding fields are a rich, textured green, with some areas appearing slightly darker, possibly due to shadows or different crop types. In the far distance, a flat horizon line separates the green fields from a pale, overcast sky. A few small, dark structures are visible on the horizon.

**SEDIMENT TRANSPORT STUDIES
AT WALNUT CREEK**

**Keith Schilling
Calvin Wolter**

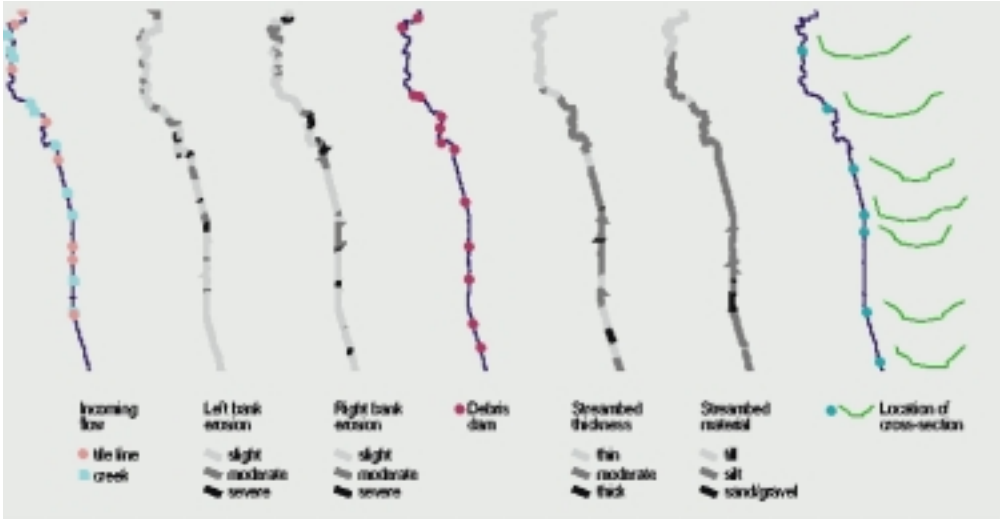
Driving through the rolling hills of Iowa today, it seems perfectly natural to look down at a bridge crossing and see a muddy stream flowing along steeply sloping stream banks. Some stream channels look like miniature Grand Canyons because they are so deeply cut, or incised, into their floodplains. But how natural is this? When European settlers came to the Iowa prairie they remarked on the clarity of Iowa streams and reported little difficulty crossing them in covered wagons. In many cases, today's deeply incised streams were little more than low swampy areas on the landscape.

So what happened? When settlers broke the virgin prairie, they set in motion a flurry of landscape modifications that included intensive row-crop production on upland slopes, stream channelization, removal of riparian vegetation, and agricultural tiling. Combined, these practices delivered great volumes of sediment into stream valleys and routed rainfall runoff more quickly downstream. As a result of these modifications, valleys accumulated thick deposits of sediment eroded from hill-slopes. Streams rapidly downcut into their beds due to increased water flow from runoff and tiles.

Today, sediment is generally considered to be the major pollutant affecting



Far left: Stream channelization and other agricultural practices have resulted in Walnut Creek deeply incising into its floodplain. This photograph, provided by the Neal Smith National Wildlife Refuge, dates before restoration activities began there in 1992. Above, top: Drainage tiles discharge water into Walnut Creek. Above: Along many wooded segments, trees undercut by flowing water have toppled into the channel. Above photos by Keith Schilling.



Iowa’s streams. The term “sediment” is used when referring to soil that is in transit across the landscape, whether it is slowly accumulating in valleys or rapidly carried by stream flow. High sediment concentrations in streams can have detrimental effects on water quality and aquatic habitat. In some watersheds, sediment is rapidly filling lakes and reservoirs.

In the Walnut Creek watershed in Jasper County, research as part of the Walnut Creek Nonpoint Source Monitoring Project is focused on evaluating sediment erosion and transport in a small Iowa basin. The Walnut Creek project began in 1995 as a monitoring program related to land restoration activities implemented by the U.S. Fish

and Wildlife Service at the Neal Smith National Wildlife Refuge. Large tracts of land in the watershed are being restored from row crop to native tallgrass prairie. As of 1999, more than 2,100 acres of the 12,895-acre watershed have been planted in prairie. Because the Walnut Creek watershed was intensively farmed in the past, the restoration and monitoring project is providing a valuable opportunity to study how sediment moves in a stream channel modified by these historic practices, and how quickly water quality can be improved by land management changes.

As part of the monitoring project, stream discharge and suspended sediment concentrations are monitored daily at upstream and downstream loca-

tions along Walnut Creek. The product of stream discharge and sediment concentration is “load,” a term is used to express the amount of sediment passing the stream gage each day (i.e., tons/day). Studies of sediment loads in Walnut Creek show that sediment moves very rapidly downstream in the channel in response to precipitation and snowmelt. In any given year, as much as 25% of the annual sediment total will be transported out of the watershed in a single day, and 90% will be transported in any 20 non-consecutive days. Approximately 60% of the annual sediment load will move downstream in the months of May and June, and 98% of the annual sediment load will be transported between the months of February and July. Approximately 10,000 to 20,000 tons of sediment will be transported downstream each year in the Walnut Creek channel.

Recently, an intensive survey of a 7-mile segment of Walnut Creek was completed to gain insight into sediment erosion and transport processes in the watershed. The survey was conducted using a combination of Global Positioning System (GPS) equipment and computer mapping software. Channel features were located and described, including stream bank conditions, streambed material and thickness, along with debris

dams, drainage tiles, cattle-crossings, and cross-section measurements. A portion of the resulting map is shown on page 8.

Streambank erosion was observed to be particularly severe at many outside meander bends, debris dams, and cattle access areas. Severe bank erosion is typified by bare or exposed soils, obvious slope failures, and mature trees falling into the stream. Debris dams consist of the fallen trees, beaver dams, or large piles of debris that divert streamflow into bank sides and result in increased erosion. About 50% of the annual sediment load in Walnut Creek is derived from streambank erosion.

Silt, derived from local glacial deposits, is the dominant streambed material in Walnut Creek, and it tends to accumulate behind debris dams and at cattle crossings. At some locations, silty muck in the streambed is more than 1 to 2 feet deep. In channelized segments of Walnut Creek, surface water often flows on top of glacial till with little or no loose streambed material present. Increased water velocity in straightened reaches scours the streambed and prevents accumulation of streambed materials. This data has been used to estimate the total mass of sediment contained within the Walnut Creek channel. Based on annual averages of stream



Neal Smith National Wildlife Refuge

The Walnut Creek watershed is being restored to native tallgrass prairie from a landscape once dominated by row-crop agriculture. Currently, more than 2,100 acres of prairie have been planted by the U.S. Fish and Wildlife Service at the Neal Smith National Wildlife Refuge in Jasper County.

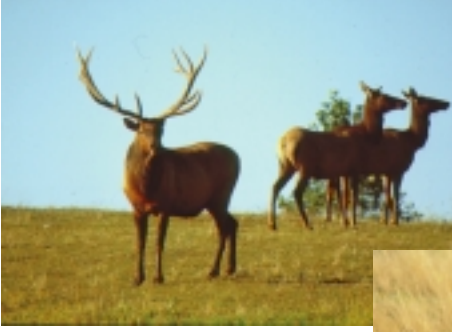
discharge and suspended sediment concentrations, and assuming no additional sediment inputs, it would take approximately nine years to flush the sediment stored in the channel bottom from the watershed.

Channel cross-section measurements made at numerous locations indicate that Walnut Creek has been incised as much as ten feet into its floodplain. This helps explain why sediment moves so rapidly downstream in the watershed. In

incised channels, high streamflows are contained within the channel, instead of dispersing out onto the floodplain, and result in rapid sediment transport. Channel downcutting also helps explain the high number of debris dams in Walnut Creek. Many trees undercut by flowing water have been easily toppled due to blowdown or disease.

Sediment monitoring and stream mapping in the Walnut Creek watershed, in conjunction with land restora-

Lowell Washburn



Neal Smith National Wildlife Refuge



Once-native plants and animals are thriving at the Neal Smith National Wildlife Refuge. Left: In the fall of 1996, elk and bison were re-established. Below: The colorful blooms of reintroduced native prairie species already adorn the Refuge hillsides.

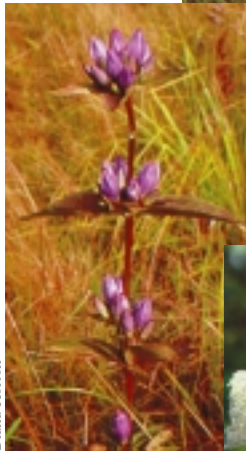
tion at the Neal Smith National Wildlife Refuge, is providing a valuable opportunity to see if a return to prairie will reduce sediment loads over time. Can we go back to the clarity and morphology of historical Iowa streams? Data collected so far suggests that improvements will take a long time to observe. In the meantime, remember that stream conditions today echo the agricultural legacy of our past. While farming methods and land use practices have improved dramatically over the years with the advent of modern conservation practices (i.e., contour planting, terraces, grassed waterways, no-till planting, and riparian buffers), much of the land continues to bear witness to earlier farming methods. Driving around Iowa today, take a look at the streams to see if you can spot incised channels, severe bank erosion, or debris dams in the channel and stop to consider how “natural” these stream systems really are.

Black-eyed Susans

Roger Hill



Diana Horton



Bottle gentian

New Jersey tea



Neal Smith National Wildlife Refuge

Why Watersheds are Important

A LESSON FROM THE ROCK VALLEY PROJECT

J. Michael Gannon
Elizabeth A. Shinall

Alluvial aquifers supply drinking water to approximately 23% of Iowans. In several regions of the state, alluvial systems are the only source of water suitable for drinking. These aquifers consist primarily of shallow, porous sand and gravel deposits along the floodplains and terraces of major stream valleys. They range in thickness from about 10 to over 100 feet.

In recent years, there has been a growing awareness of the vulnerability of alluvial aquifers to surficial contaminant sources. To help communities better protect their groundwater resources, the Iowa Department of Natural Resources has implemented a Source Water Protection Program. Part of this effort involves mapping the area of an aquifer that supplies water to a public well over a specific period of time. Stud-

ies near the northwestern Iowa town of Rock Valley in Sioux County will help to refine this process for communities that depend on alluvial aquifers.

In many alluvial settings, there are tributaries entering the floodplain. These tributaries can supply significant water recharge to the aquifer and thus affect the groundwater quality within an area designated for protection. To help evaluate the effects of tributary watersheds on alluvial aquifers, two five-foot hand-driven wells were installed in the channel of Rogg Creek, a tributary of the Rock River just southeast of Rock Valley (see map). Rogg Creek flows within 400 feet of one of Rock Valley's municipal wells and has a watershed of approximately 16 square miles. Land-use in the Rogg Creek watershed is primarily row-crop production along with several livestock facilities. Both are potential sources of contamination and typical of many Iowa watersheds.

The wells were driven through the channel sediments of Rogg Creek and into the valley alluvial deposits of the Rock River floodplain. Monthly water-level measurements were collected from the wells and from the creek. In the eight months between July 1999 and April 2000, the site closest to the valley margin had creek levels (outside the well) between 1.0 and 2.2 feet higher



The town of Rock Valley draws its water supply from wells in the Rock River alluvial aquifer. Studies show that part of the recharge to this aquifer comes from Rogg Creek and its watershed. The water quality implications of this relationship will be helpful as the community works to protect the source of its groundwater supply. (Rock Valley, Iowa 7.5' topographic map, U.S. Geological Survey, 1968)

than the groundwater levels (inside the well). This shows that surface water from Rogg Creek is recharging the shallow aquifer near the Rock Valley municipal well field.

These results suggest that land-use practices in a watershed not only have the potential to impact the quality of its surface creeks and streams, but they also

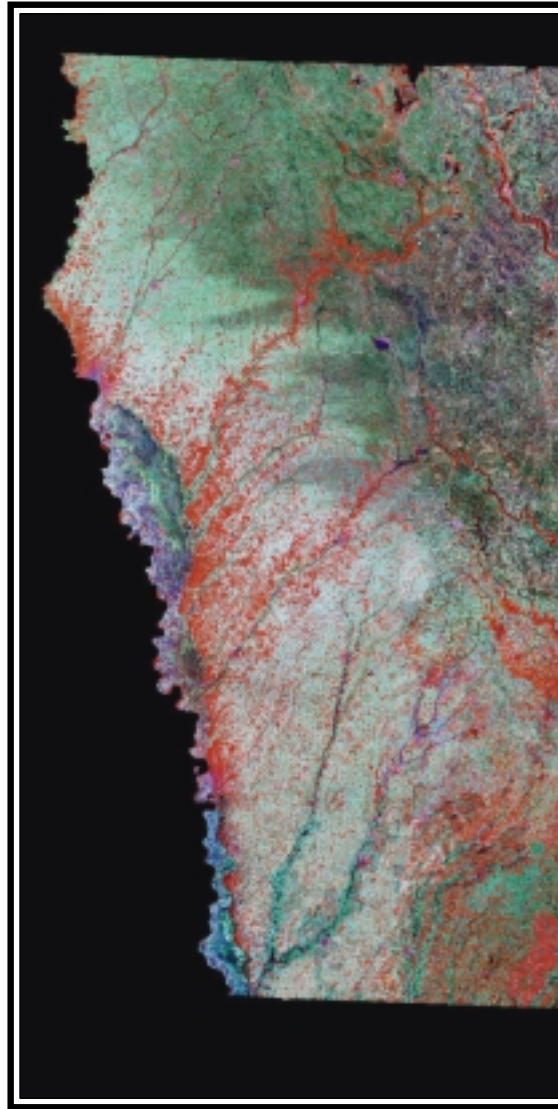
have the potential to impact the groundwater quality of an alluvial aquifer down-gradient of the watershed. In future studies the recharge volume from Rogg Creek will be measured, as will the impact of this recharge on the water quality of Rock Valley's alluvial aquifer.

Satellite Image of Iowa

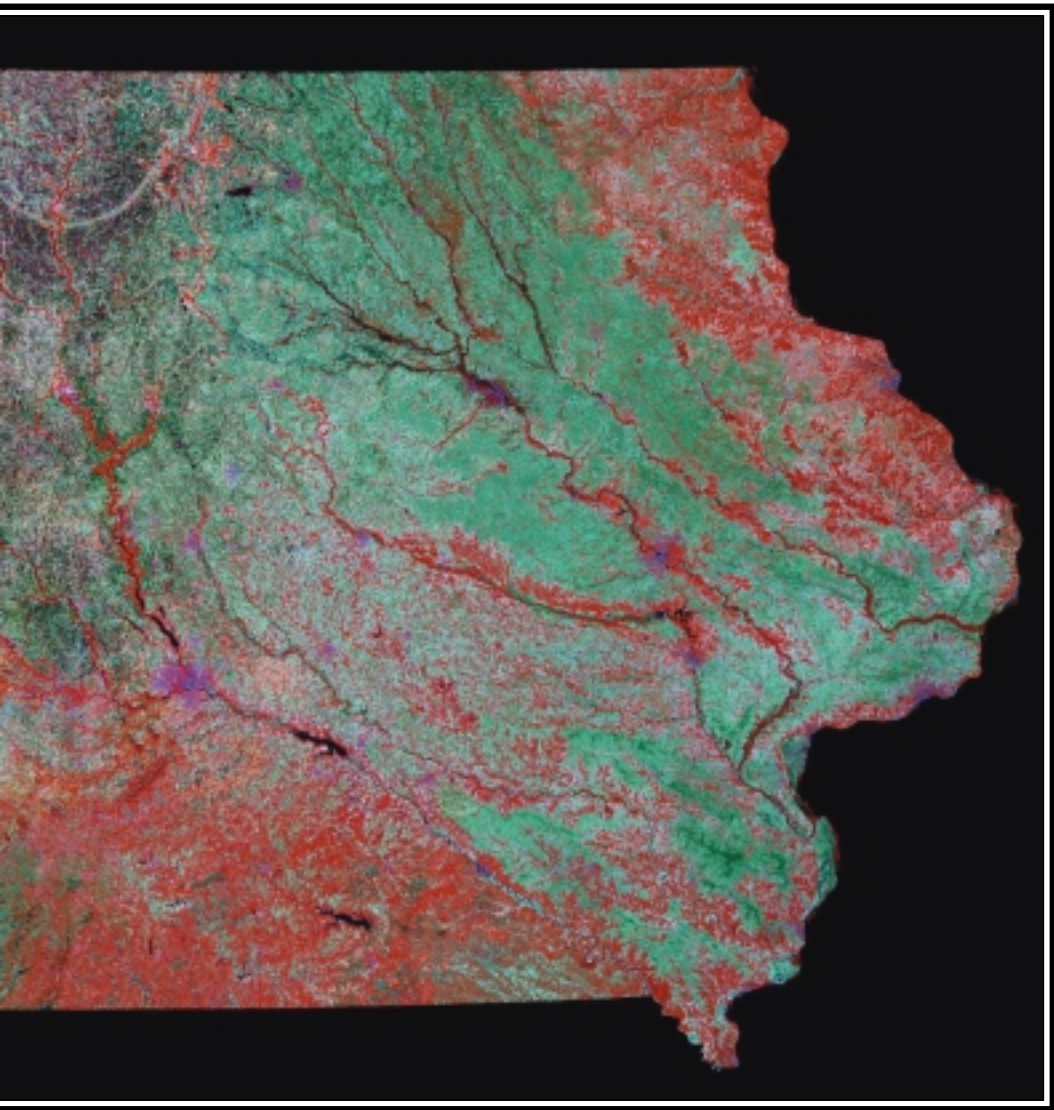
Mark A. Alexander
James D. Giglierano

As seen from above, a view of Iowa is very striking and changes dramatically with the seasons. In winter, snow and low sun angle cause the shape of the land to stand out in stark relief. Spring is heralded by the pale green of young grasses and the darkening of row-crop soils from tillage. Our state becomes a deep-green sea of vegetation during the summer and later changes into a patchwork quilt of autumn colors and dry, crisp textures during fall harvest. Sixty percent of Iowa's surface area is visibly altered each spring by farming activity. Springtime conditions across Iowa are shown in this view from 438 miles above the Earth.

This color-infrared scene is a mosaic of 12 Landsat Thematic Mapper images taken between April and June, 1989 to 1993. Features on the ground have different colors due to spectral responses of materials to different wavelengths of light. Water appears black, while vegetation reflects in shades of orange to red.



Note the drainage patterns across Iowa and the riparian vegetation zones along stream corridors such as the Wapsipicon, Cedar, Iowa, Des Moines, and



Little Sioux rivers. Bare soil varies between dark blue (wet) and light blue-green (dry). Wet streaks across north-west Iowa are caused by recent rain.

Urban areas, such as Des Moines left of center, are purple. Other areas of interest are the forests and pastures of north-eastern and south-central Iowa.

Springbrook State Park

WATERSHEDS PAST AND PRESENT

Greg Ludvigson
Stephanie Tassier-Surine

Within the quiet beauty of Springbrook State Park lie landscapes and geologic deposits that provide compelling testimony to the erosive power of rivers and their capacity to transport sediment

over long distances. River systems that once flowed here include a watershed that originated during the most recent glaciation of Iowa, and an older, larger drainage basin that included much of the eastern United States.

Springbrook State Park, established in 1926, is situated just east of the Middle Raccoon River. The river's course across Guthrie County marks the boundary between two strikingly different landform regions of Iowa – the Des Moines Lobe to the northeast and the Southern Iowa Drift Plain to the southwest. Steeply rolling wooded slopes of the Southern Iowa Drift Plain are the product of extensive erosion of glacial



Springbrook Lake, covering 17 acres, was created in the 1930s by Civilian Conservation Corps workers who impounded the drainage of Kings Creek watershed. The wooded hillslopes help prevent erosion and maintain water quality in this recreational lake.



Photos on pages 16–17 by Roger Hill

From the park's scenic trails and shorelines, one can contemplate the cool moist presence of a low glacial ice front lying just east of the park 14,000 years ago.

materials that were deposited during several glacial episodes between 2.2 and 0.5 million years ago (Pre-Illinoian). To the northeast of the Middle Raccoon River lies more open, level agricultural land characteristic of terrain that was constructed by the most recent glaciation (Late-Wisconsinan).

Approximately 15,000 years ago, this glacier advanced into Iowa and left behind distinctive surficial deposits that are now referred to as the Des Moines

Lobe. The Late-Wisconsinan ice sheet reached its southernmost extent, marked by the terminal Bemis Moraine, around 14,000 years ago. During this time, the Middle Raccoon River was diverted into an ice-marginal position along the advancing edge of the Des Moines Lobe. However, the immediate segment of river within the park itself diverges from the usual ice-marginal position and most likely existed in its present location prior to the ice advance.



A large boulder of reddish Sioux Quartzite rests on the valley floor of Springbrook Creek. This glacially transported rock was uncovered as erosion removed the surrounding finer grained glacial deposits. The nearest source of this rock is in Iowa's far northwest corner (Lyon County).

The Des Moines Lobe glacier remained active in north-central Iowa until approximately 12,000 years ago. This was 5,000 to 8,000 years later than the major Wisconsinan glacial activity northeast of Iowa, and well past the period of maximum glacial cold about 16,000 to 21,000 years ago. The Des Moines Lobe was actually a late surge of

glacial ice that occurred during a period of already warming climatic conditions. The ice mass was probably relatively thin in Guthrie County, perhaps only a few hundred feet thick, and may have been even thinner along its outer margins. The ice surge, extending here to the edge of Springbrook State Park, likely was enhanced by lubricating melt-

Scenic exposures of iron-stained sandstone are part of the Dakota Formation, which originated 100 million years ago in a large westward-flowing river system that reached to the western slopes of the Appalachian Mountains.



Photos on pages 18–19 by Clay Smith

waters that flowed at the base of the glacier. Fossil plant material collected from the Saylorville Reservoir area north of Des Moines indicates the pres-

ence of a spruce-larch forest in this general vicinity.

Additionally, in the Springbrook area, the glacier's flow may have been compressed by a rising land surface beneath the ice. This causes shearing, thrusting, and deformation within the ice mass, which tends to mix materials and concentrate more porous sediment near the land surface.

The narrow, steep-sided valley of the Middle Raccoon River was excavated relatively recently, approximately 14,000 to 13,000 years ago as the river carried greatly increased volumes of glacial

meltwater from the Des Moines Lobe. Outwash gravels from this process are evident in gravel pits throughout the valley. They contain large boulders of glacially transported debris that were subsequently deposited by massive meltwater discharges. Within the park, these glacial boulders, composed of igneous and metamorphic rock from Canada and Minnesota, protrude from the valley floor of Springbrook Creek, a tributary to the Middle Raccoon River (photo, p.18). These boulders lie in immediate juxtaposition with exposures of underlying river deposits of the Cretaceous-age Dakota Formation that outcrop in the valley wall – a compact and subtle indicator of a remarkable story of two river systems and two vastly different watershed environments contained within this single locale.

Steep valley sides along the Middle Raccoon River and its tributary streams cut into and expose these Cretaceous rock outcroppings (photos, p.19). They consist of coarse-grained sandstones, pebbly conglomerates, and silty clay-rich mudrocks of the Cretaceous Dakota Formation, a rock unit present over much of western Iowa. These 100 million year-old sedimentary rocks were deposited by large westward-flowing rivers that built an aggrading alluvial plain, and, in the process, buried an

older continental surface beneath hundreds of feet of river sediment. Quartz and chert gravel in the Dakota Formation conglomerates were eroded from eastern source areas located hundreds of miles upstream and were transported as coarse-grained river sediment into Guthrie County as part of a continental-scale watershed with headwaters in the western slopes of the Appalachian Mountains.

As seen in outcrops today, many of these rock types display crosscutting relationships that are characteristic of complex river channels. The large braided river systems ultimately drained into the Western Interior Seaway that was located hundreds of miles farther west in what are now central Kansas, Nebraska, and the Dakotas. The mouths of these rivers opened into expansive marine estuaries. Laminated mudstones, showing rhythmic tidal influences, from the head of one of these large bays were recently discovered just upstream from Springbrook State Park in the Middle Raccoon Valley.

Such discoveries provide new insights into the diverse depositional environments and watersheds that were once present in Guthrie County and also improve our regional understanding of the ancient geography of the mid-continent during Cretaceous time.

WATERSHED EXHIBIT AT SPRINGBROOK EDUCATION CENTER . . .



Photographic Services, University of Iowa

The Springbrook Conservation Center is located about 55 miles northwest of Des Moines, near Guthrie Center, and is adjacent to Springbrook State Park. This year-round facility is operated by the Iowa Department of Natural Resources and is a popular destination for educators, students, and those interested in learning more about natural resource issues. Now visitors can see new exhibits that examine the concept of watersheds and water resources here in Iowa. A large statewide relief map depicts Iowa's river systems, watersheds, and drainage divides, beginning with the Missouri-Mississippi Divide across Iowa.

Just installed is a three-dimensional model of a watershed (shown above), based on the landscape and geology of the Springbrook region. Sound effects, lighting, and scale models enable a viewer to follow the water cycle, including the flow of rainfall across the landscape and its movement as groundwater below the land surface. It provides an opportunity to observe the many ways in which land use and human activity can impact the quality of surface and groundwater supplies. These exhibits will enhance the value of Springbrook for educators and visitors for years to come.

IOWATER

MAKING A SPLASH WITH VOLUNTEER MONITORING

Richard A. Leopold

Lynette S. Seigley

photos by Clay Smith

As we enter the new millenium, water quality continues to be one of Iowa's top environmental concerns. To help address this issue, a volunteer water monitoring program known as IOWATER was established in 1998. It provides an opportunity for Iowans to take an active role in protecting and restoring Iowa's waters by monitoring the quality of streams across the state.

So why monitor? Information is needed to answer the most basic questions about Iowa's water resources. What is the condition of the state's surface water and groundwater resources? How has Iowa's water quality changed through time? Is water quality improving, remaining the same, or declining? While Iowa has increased its funding for a statewide water monitoring program, most of the state's 72,000 miles of



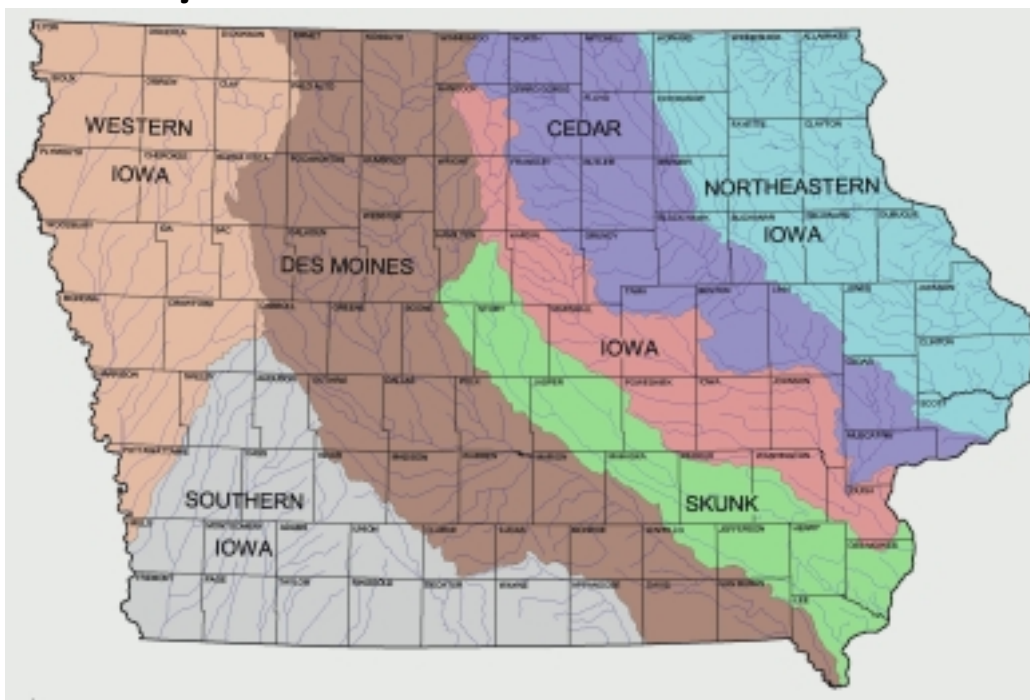
Volunteers are trained to test Iowa's waters for nitrate, pH, phosphate, and dissolved oxygen.



streams remain untested. With the help of trained volunteers, we can begin to acquire some valuable information on the quality of Iowa's water resources.

Although volunteer monitoring in Iowa is not new, IOWATER is a new citizen-based program directed by the needs of local communities. It focuses on solutions and is interested in results. The program is flexible, allowing local groups to design their own monitoring plans, including site selection, monitor-

Seven Major Watersheds of Iowa



ing frequency, and which parameters to monitor. Plans will vary, from a fifth grade class testing water once a year, to a conservation club testing several sites in a watershed on a monthly basis, to a concerned farmer testing a stream along his adjoining fields during spring planting. IOWATER uses a watershed approach, integrating land use, soils, and drainage basins (see map above) with water quality. IOWATER is committed to developing local working partnerships and sharing information and resources among state and federal agencies.

All of us live in a watershed. One of the first things volunteers are encouraged to do after selecting a monitoring site is to familiarize themselves with the surrounding watershed. What lies within a watershed directly impacts a stream's water quality. How is the watershed's land used? Is most of it urban or rural? Do paved parking lots move water quickly into the stream? What type of vegetation grows along the stream? Does most of the land receive fertilizer and pesticide applications? Being familiar with a watershed and its



land use can help when interpreting the water quality data.

During the year 2000, volunteers were trained at 18 workshops across Iowa (photos, p.24-25). Indoor and outdoor sessions included a “State of the Water” address, how to start a monitoring plan, networking and media relations, the “how” and “why” of stream monitoring, and how to handle the data.

Workshop participants are provided with all the equipment needed to start monitoring. They are trained to identify the benthic or bottom-dwelling organisms (benthic macroinvertebrates) that live in streams, to chemically test the water, and to evaluate the stream’s habitat. Bottom-dwellers and other organisms such as mayflies, caddisflies, and leeches occur in streams across Iowa and have different tolerances to pollution. These organisms serve as “environmental thermometers” of the water in which they live. The presence or absence of certain organisms provide information about the health of that stream. Repeated sampling of benthic organisms at a site can help identify changes in water quality. For example, a decline in



the number of organisms with a low tolerance for pollution at the same time as an increase in organisms with a high tolerance for pollution may be an indication that water quality is declining.

The chemical quality of streams is highly variable and is influenced by season, time of day, weather, and land use. Unlike biological monitoring, results



from chemical monitoring are a snapshot in time of a stream's quality. For IOWATER, chemical monitoring involves use of a dissolved oxygen kit and chemical test strips for nitrate-N and nitrite-N, phosphate, and pH. In addition to chemical parameters, physical measurements include water temperature, as well as stream width, depth, and velocity. Water clarity is also measured using a transparency tube.

Assessing stream habitat is important in tracking changes through time. What is the composition of the streambed? What is the condition of the stream banks? Is sediment eroding from the banks and affecting the habitat of benthic organisms in the stream, or is the sediment affecting the transparency or water clarity? By collecting various types of data, one can begin to assess the health of a stream. And by monitoring a site through time, collected data reveals whether water quality is improving, declining, or remains unchanged.

Upon completion of the 10-hour



workshop, participants are certified Level 1 IOWATER citizen monitors. Additional Level 2 and 3 training includes more specialized water testing methods. Over 500 participants, including people from local, state, and federal



Aquatic insects, snails, and leeches are used as indicators of a stream's general health. These organisms can serve as "environmental thermometers" to indicate if a stream has been impacted by pollution.

The habitats of these organisms vary from the bottoms of rocks to floating vegetation.



agencies; educators, from kindergarten teachers to college professors; farm and commodity groups; city and county planners; conservation organizations; and interested volunteers have attended workshops in 2000. The diversity of these participants will be a strength as coalitions form and establish monitoring programs of their own around the state. Visit the program's web site (www.IOWATER.net) for information on attending a future workshop in your area.



IOWATER is promoting clean water by giving local groups the tools needed to encourage advocacy on water quality issues. A public database provides volunteers a place to submit their data and to access data collected by other volunteers in their watershed and across Iowa.

What's in the future? IOWATER

Photo right: Stream width, depth, velocity, and temperature may be measured at the same time chemical and biological sampling are done.





Water clarity is affected by the amount of suspended sediment and is measured with a transparency tube.

will provide ongoing statewide networking through additional workshops, periodic newsletters, and annual conferences. Although currently focused on flowing streams, the program will be expanded to include lake and wetland monitoring in the near future. It may broaden even further to include air, soil, groundwater, or other natural resources.

IOWATER is a vital component of our new statewide water monitoring program. Citizens who participate in the monitoring process will benefit the environment by becoming actively involved in local water-quality issues and by assisting in restoration of Iowa's waters.

And they'll have a little fun and some muddy exercise to boot! One thing is certain, IOWATER is here to stay, "making waves of difference" across Iowa!

IOWATER is a statewide partnership including volunteer monitors, Area Education Agencies, Community Colleges of Iowa, Iowa Assoc. of Naturalists, Iowa Conservation Education Council, Iowa Dept. of Agriculture and Land Stewardship, Iowa Dept. of Natural Resources, Iowa Environmental Council, Iowa Farm Bureau, Iowa Resource and Conservation Development, Iowa State Univ. Extension, Iowa Student Environmental Council, Izaak Walton League, Natural Resources Conservation Service, Trees Forever, and the Univ. of Iowa Hygienic Laboratory.

WATERSHEDS & TIME HORIZONS

The book *IOWA - Portrait of the Land** brought into focus the natural resource issues we face today as a consequence of our history of using Iowa's land. Two of the most prominent issues are soil loss and water quality. To deal effectively with these matters, we need to understand how the basic processes of land and water work across natural spans of earth and time.

People generally know only the modern landscape and just that segment of it experienced during the months and years of their lifetime. Geologists, on the other hand, work daily with the evolution of dozens of ancient landscapes and with future landscapes as well. The concept of watersheds is basic to this process, as is the interconnectedness of change, whether it occurs over short or long periods of time. A 100 million-year-old outcrop of Cretaceous sandstone at Springbrook State Park and the sediment load that moved down Jasper County's Walnut Creek between last February and last July have a lot in common.

Today, Geological Survey Bureau geologists increasingly apply their understanding of events that persist through geologic time to the problems of land and water that Iowans face on a human time-scale. The studies described in this issue of *Iowa Geology* all illuminate some aspect of watersheds and time-horizons as they apply to water quality and soil loss in Iowa. This scientific activity can help to inform and clarify the public debate on these issues as well as lead to better natural resource and environmental decision-making.

Jean Cutler Prior
Editor

*This 92-page full-color book was released by the Iowa Dept. of Natural Resources on Earth Day, April 22, 2000. It tells the story of the state's natural resources, including their history, current status and trends, and a challenge for the future, all in readable prose and with numerous photos, illustrations, and maps. Copies are available for \$5 each from the address/phone on the inside front cover or by calling (515) 281-5918 in Des Moines.



Roger Hill

Springbrook State Park