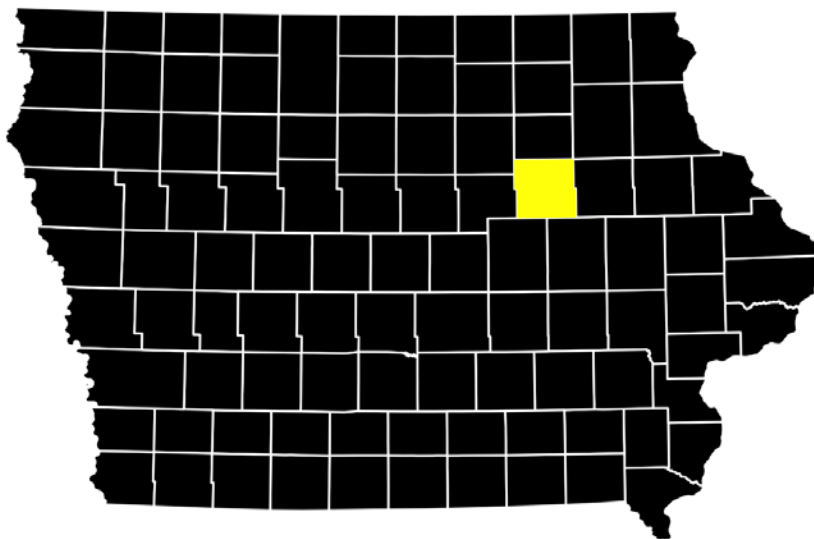


University of Northern Iowa

Black Hawk County Geology:
A field trip guide for a teacher



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3 May 2016

Signature Page

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Table of Contents

Abstract 4

Introduction 4

Summary Geology 4

Specific geology of Black Hawk County

Natural Resources of Black Hawk County

Applied Geology

References

Abstract

Blackhawk County (Figure 1) was named after the Blackhawk Indians and their chief after a battle. After being settled and becoming a stand alone county in 1843 it has flourished in a multitude of ways. It has rich farmland due to the Iowa Surface and the Wisconsinian glacier bringing and leaving glacial till for rich soil. It has many recreational opportunities for the local students and habitants can take part in and learn about their county. It is a supplier of limestone from local quarries and brick. The county is filled with opportunities and rich history ecologically and culturally.

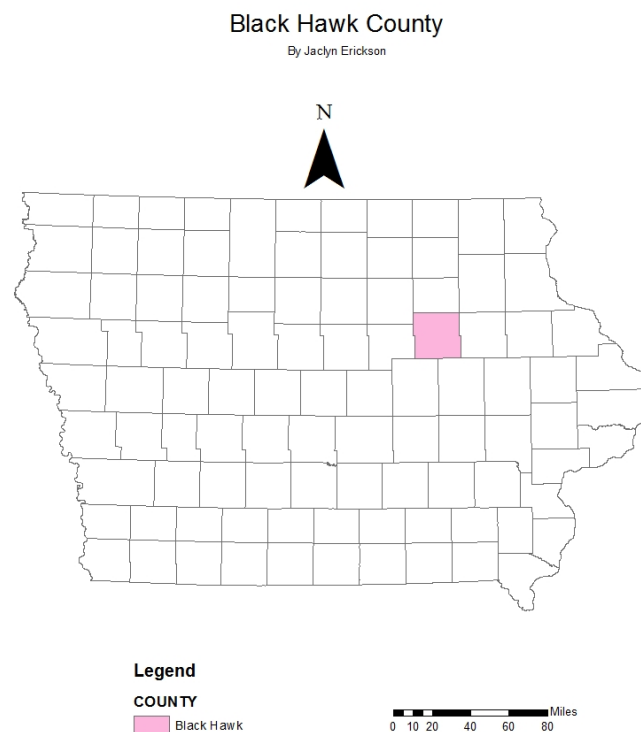


Figure 1 (Left)
location of Black
Hawk County in
Iowa.

Introduction

This project helps identify project ideas for an environmental science teacher to use on a field trip and provides information on a specific site, Hartman Reserve Nature Center located in Cedar Falls in Blackhawk County.

Blackhawk County is located in the North Eastern portion of Iowa. It contains a population estimate of 137,897 as of 2014 by the U.S. Census Bureau. The population is comprised of mostly Caucasian ethnicity and race.

Blackhawk County was established 17th of February in 1843 by Buchanan County. The counties Bremer, Grundy, and Butler were attached to Blackhawk County after it was established. The name was dedicated to the Native American tribe Black Hawk, after the chief rebelled against resettlement of the tribe. He actually never stepped into the county.

The cities in the county became important agriculture communities with its rich farmland. When railroads came in 1861 a controversy appeared, however in 1870 Waterloo became a great industrial hub because of the trains.

Along with great land and great opportunities for industries several famous people lived and came from Blackhawk County like the five Sullivan brothers and First Lady Hoover. The University of Northern Iowa later came to Cedar Falls with twenty-seven students. Now the college is known for teacher education and business. Blackhawk County

also sports many great recreational opportunities via parks and the Cedar River (Brief History of Black hawk County).

Summary Geology

Bedrock Geology of Iowa By Jaclyn Sanchez

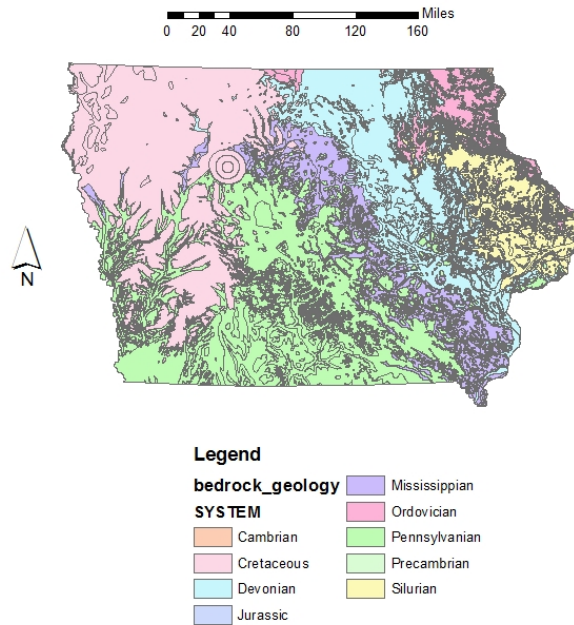


Figure 2 (Left)
Bedrock geology map
of Iowa.

Precambrian

The Precambrian (Figure 2) was the first period in the Paleozoic era. It lasted from 4.6Ga to 545Ma. Iowa's oldest bedrock, Sioux quartzite is from this era. The Precambrian rock is exposed in several areas throughout the United States. In Iowa, the exposed rocks are located in the northwest corner.

Some unique aspects of the Precambrian include the mid continent rift system and how it cuts through Iowa, as well as the Manson crater.

The mid continental rift occurred approximately 1.1MA, like the exposed rock the line of the rift is in the northwest sector of Iowa. In Carroll County a core was drilled 17.851 ft deep. It was called the Eischeid well. The geologists wanted to research the rift and the potential for petroleum. This well is the deepest on in Iowa.

Mason crater, located in north central Iowa, was found to be the third largest impact crater in the United States. It dates to be 73.8 million years old. The rocks found at the site were ideal for groundwater use (Anderson, 1998).

Cambrian

The Cambrian (Figure 2) occurred between 545MA to 485MA. Quartz, feldspar and some clay minerals made up the bedrock. During this period, the shallow seas from the Precambrian crossed over the lowering landmass and reached Iowa. Due to the advancing water, shorelines were created. There is an unconformity at the base of the Cambrian.

Sandstone, quartzose and feldspathic, are primarily the rocks in the Cambrian period. The Sandstone was mature meaning it was physically well rounded and sorted and chemically rich in quartz.

Among the six formations in the Cambrian the Jordan Formation is exposed along the Mississippi river, as well as the Upper Iowa River. The Jordan formation does cross into Blackhawk County, the sandstone is at 100 feet of thickness. It is not exposed.

Due to the increase in oxygen in atmospheric composition and the shallow seas the Cambrian was the Age of the Trilobites (Anderson, 1998).

Ordovician

The Ordovician (Figure 2) occurred between 485MA and 443MA. It was the time of warm and shallow seas and much of Iowa was covered by water throughout the majority of the Ordovician; leaving the rocks exposed present day in Northeast Iowa. There is an unconformity within the Ordovician between the formations St. Peter and Prairie du Chien. The Ordovician bedrock lies northeast to Blackhawk county and there is also some in north east and north central Iowa.

A unique occurrence was the Decorah Impact Structure in Decorah, Iowa. It happened 470MA and was discovered in 2008-2009. It is the third largest meteor impact structure, and cannot be seen with the naked eye.

Life in Ordovician suited marine creatures like brachiopods, bryozoans, corals, mollusks and other invertebrates (Anderson, 1998).

Silurian

Occurred between 419MA to 443MA. Within the Silurian (Figure 2) there were five transgression and regression phases. This age contained eight formations of the eight, six were comprised of dolostone, and the other two are made of limestone. Near the end of the Silurian age there was erosion and weathering creating an unconformity between the Silurian and Devonian.

The rocks have great economic value in regards to aggregates, building stones, and bedrock aquifers. In the Gower formation, specifically the Anamosa member, there is a stone with fine and uniform texture that is ideal for building stones.

Life in the Silurian contains coral, which includes solitary and colonial. Solitary corals include slipper and horn, and the colonial coral includes favosites and halysites. Other life includes brachiopods and crinoids (Anderson, 1998).

Devonian

This period lasted between 419MYA to 358MYA; there is an unconformity between the Devonian (Figure 2) and Silurian. Seas retreated and became abundant across Iowa during the middle Devonian, but the floor of the sea was bare. There were many transgressions and regression during the Devonian depositing what we know as the Lime Creek formation today, limestone, and leaving fossils in its wake.

It had thirteen formations that were deposited during the transgression and regression cycles including the little cedar which has high quality limestone due to the waves promoting CaCO_3 . The other two are Coralville, and shell rock formation. Two groups that are important to Blackhawk County include the cedar Valley group which includes Coralville and little cedar and Wapsinnicon which includes Bertram, Spillvilleotic, and Pinicon ridge.

Devonian life includes brachiopod shells both articulate and inarticulate, they are found in Limecreek formation and the Cedar Valley group. Bryozoans were moss animals and are one of the most common types of fossils found. Corals, echinoderms, mollusks, and stromatoporoids were present during this time period. There was a large fish fossil found that is named the Dunkleosteus which can reach 13ft (Anderson, 1998).

Mississippian

The Mississippian period (figure 2) was in the Carboniferous era, it was 358 MA to 323 MA. Within the Mississippian there were ten transgression and regression cycles. There are an abundant amount of fossils that range in size during this time, and are well preserved. The predominant rock was limestone, however there are other rocks that are associated with this period in each of the formations. The limestone makes up the Mississippian aquifer that is a source for good ground water. The State of Iowa's rock came from this period, the geode.

There are nine formations in the Mississippian period in Southeastern Iowa, they are as follows from youngest to oldest: Pella, St. Louis, Warsaw, Keokuk, Burlington, Wassonville, Star Cave, Prospect Hill, and McCraney. In the Star Cave formation there is an abundance of oolitic grainstone, and it is rich in crinoids. One of the best-known formations is the Burlington formation, because of crinoidal limestones in the bluffs on the Mississippi river. Warsaw formation received its name from James Hall in 1857, after Warsaw, IL. There is an unconformity in between the Mississippian and the Pennsylvanian, there is 30 million years missing!

In Iowa there is no state fossil, however according to Wayne I. Anderson it should be a crinoid due to their abundant presence. Crinoid could be mistaken for a plant, because of their limbs and stalk. However, the crinoid was an invertebrate that filter fed. Other fossils that are found today from that time period were other different types of echinoderms that included blastoids, echinoids, and the rare starfish. Brachiopods, mollusks, and corals were a presence as well.

Globally, during the Mississippian period the first reptiles, and mammal like reptiles appeared, Pangaea began to form, and the ice age began at 299 MA. There were also extensive coral deposits present (Anderson, 1998).

Pennsylvanian

The Pennsylvanian (figure 2) was from 298 MYA to 232 MYA. At this time the seas have retreated and there is an unconformity between the Mississippian and the Pennsylvanian due to erosion and uplifting, both are part of the Carboniferous. However, there were still shallow seas around Iowa whenever there was a shore shift. The shore shifts left behind non-marine and marine fossils and creating sandstone.

In eastern Iowa, Pennsylvanian rock lies on Devonian instead of Mississippian rock. A major group is the Cherokee group that contains the Swede Hollow, Floris, Kalo, and Kilbourn formation. Cylcothem is a major limestone that means it is mud textured and can have skeletal calcarenites.

The formation of coal was prevalent in this time period because of the accumulation of vegetation materials. Due to the shore shifts there were shallow swamps creating peat formation, which is a contributor to coal. There are three types of coal Anthracite, which is the best; bituminous and sub-bituminous, the latter is located in Iowa however it has a high sulfur content due to acid rain; finally lignite which is poor.

Prevalent fossils include scale trees, which were contributors to the coal beds. Rushes, ferns, and seed ferns were prevalent in the swamp areas and were contributors to the coal beds too. Cordaites trees were large early gymnosperms and reached heights

more than 100ft. Marine life included brachiopods algae, and Fusulinid foraminifera (Anderson 1998).

Mesozoic

Mesozoic era lasted between 232 MYA to 66 MYA, it consists of the Triassic, Jurassic, and Cretaceous period. It is also known as the age of the Dinosaurs. During the early Mesozoic time period Iowa was above the sea level, and one is unable to find the traces of the Triassic period in the State. There is also no evidence of the Jurassic period, unlike in the west where the areas were under seas and you can find evidence of the period. The Cretaceous period has a gap as well in Iowa. Currently there are deposits only found in Western Iowa. Erosion has removed information from these times.

Fort Dodge Gypsum has traces of minor red, green, and gray clastic rocks. It was at this time that the Manson Impact Structure hit in today's Decorah 73.8 MYA leaving behind soft water for the area's residents.

Other rocks found from the Jurassic period that include shale, siltstones and sandstones. The Cretaceous had shale, sandstones, and mudstones through the late end of the period. The Dakota formations have marine deposits in the Sioux City, Iowa area.

Life forms include dinosaurs! There was much diversification and variation among the animals and other reptiles. It was during this time there was the first appearance of birds and mammals, as well as flowering plants, gymnosperms (Anderson, 1998).

Cenozoic

This era is divided into two periods tertiary, lasted 65 million years, and quaternary, lasted 1.65 million years. Iowa was above sea level for the Tertiary period, and the rock record was erased from due to erosion. Any vertebrates found from this period are found in alluvial sediments in southwestern Iowa, including three toed horses and rhinoceroses. The climate was temperate and glacial stages throughout, transporting till to areas where the glaciers traveled.

The Quaternary period had multiple glacial stages including the pre-illinoian, illinoian, and wisconsinan. Pre-Illinoian swept over the entirety of Iowa, the Illinoian only touched the southeastern border of Iowa, and the Wisconsinan created what we call the Des Moines lobe.

The Des Moines Lobe, formed by the Wisconsinan, has moraines, kettles, and kames are littered throughout the areas due to the glaciers melting. There is no loess cover due to their being fresh glacial till, because the Wisconsinan is the most recent glacial stage.

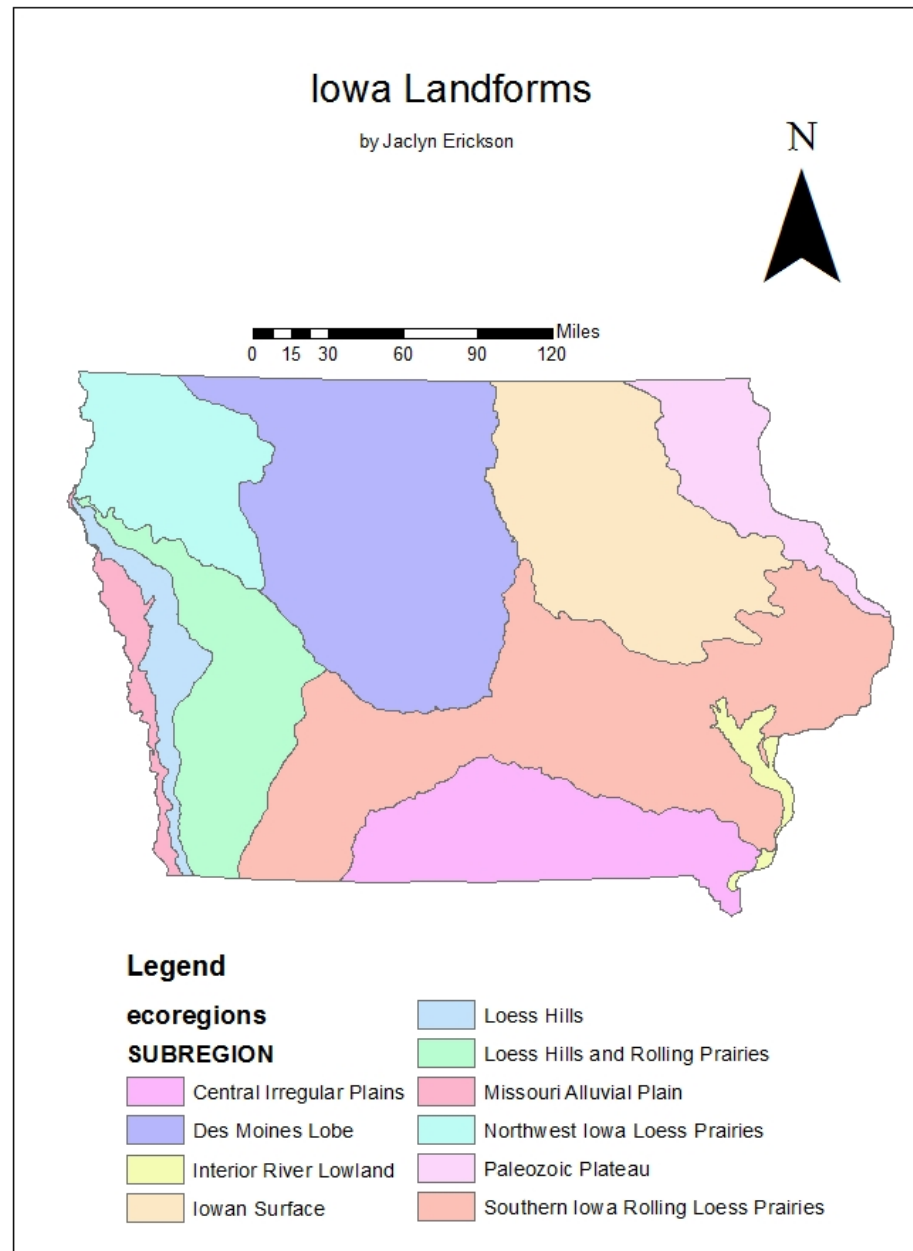
The alluvial plains of Mississippi and Missouri Rivers are wide and sandy lowlands. They created alluvial fans by Iowa and Cedar River valleys. An example of this can be found in George Wyth Park by the Cedar River.

Loess Hills, have a thick cover of loess, hence the name of the landform, is located in Western Iowa. As a result has high drainage density, rapid surface runoff, and gully development. Terraces or cat steps can be found in the area.

Southern Iowa Drift plain, borders the Loess Hills and has moderate loess coverage and the bedrock is exposed in certain areas. As the name suggests is located in Southern Iowa, covering the majority of the area. The youngest surface in the plain is from the Holocene age and has postglacial alluvium.

The Iowan Surface has a gently rolling terrain and contains a thin layer of loess that may not even be present in certain areas. Resulting in the bedrock being near the surface. There are scatter boulders throughout the land that were left behind from the glaciers. Other land formations include pahas and karsts (figure 3) (Anderson, 1998).

Figure 3 (Right)
Land Forms and
evoregions in Iowa
due to glacier
movements.



Black Hawk County

Geology

Black Hawk County is located in northeast Iowa. It is in the Iowa Surface (figure 4), meaning it has rolling landscapes it was created by a glacier in the Wisconsin period of glaciations. The land is eroded away and appears cut in areas where the pre-Illinoian glacial deposits used to be. When the Iowa surface was created it was quite cold, meaning there was freeze-thaw activity. The Iowan Surface contains four interesting geological features in Black Hawk county: elongated ridges and Paha, elliptical hills; sporadic areas of glacial presence; pebble band; ice wedge casts (Walters 1996).

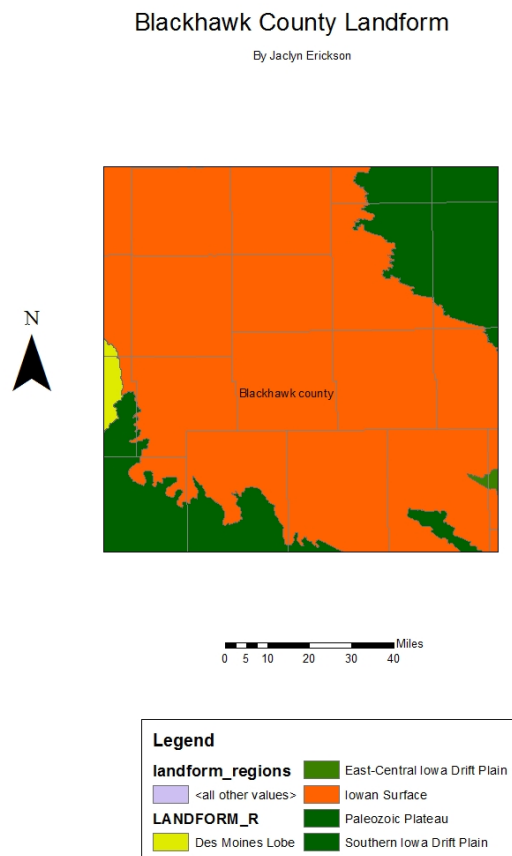


Figure 4 (Left)
Landforms
located in or
near Black
Hawk County.

The Iowa surface developed through stream and other water removal of surface sediments. During the Wisconsin glacial stage there was quite a bit of loess deposits. The Paha mentioned previously are made of loess and eolian sand providing slope (Figure 5) to Black Hawk County's landscape (Anderson et al, 1972). It borders the Des Moines Lobe and Paleozoic Plateau. A similar feature it shares with the latter is karst features with bedrock close to the surface. There are also sinkholes and depressions where the underlying limestone by groundwater collapsed (Prior, 1976).

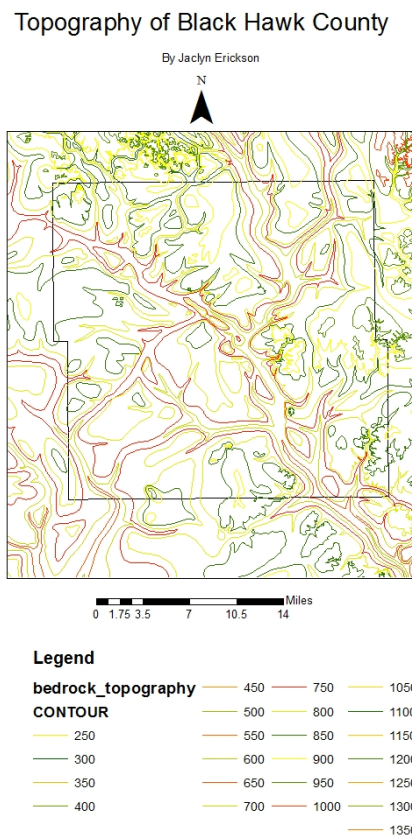


Figure 5 (Left) map depicting topography of the County.

The bedrock geology contains limestone rocks from the Silurian and Devonian periods. The Devonian rocks come from the Cedar Valley and Wapsinicon groups (Figure 6), along with the formations of Cedar Valley. The formations are Little Cedar, Coralville, Lithograph City, and Shell rock. There is a nice outcropping of Devonian rock in Spring Creek (Afrey, 1905).

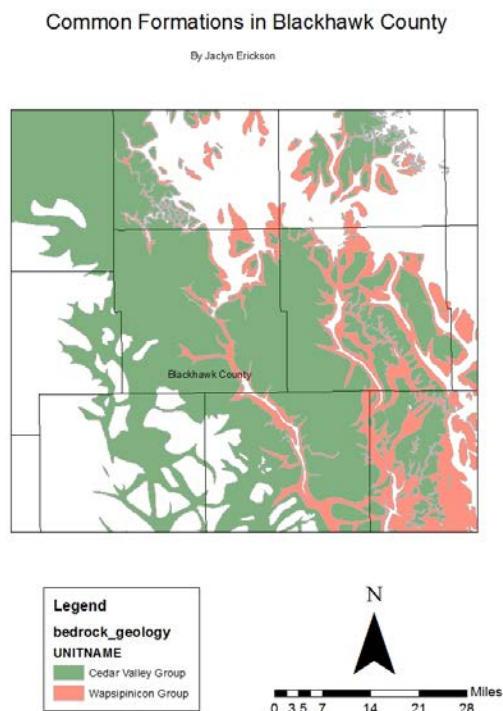


Figure 6 (Left) Major Devonian groups Cedar Valley and Wapsinicon located in the County.

The rocks from the Silurian and Devonian ages make up the aquifers in Black Hawk County. Supplying water to all the towns and city within the areas. The aquifer consists of carbonate rock, including limestone and dolostone (Walters 1996). The water supplied from those aquifers are abundant and of good quality (Anderson et al, 1972). The largest

amount of groundwater for the Cedar Falls and Waterloo area is found in or near the river valleys in sand and gravel deposits. Allowing more water being removed without drastically lower the water table, because the closeness of the river. Those types of resources are called alluvial aquifers to be discussed more in the Natural Resource section (Emmert et al, 1996).

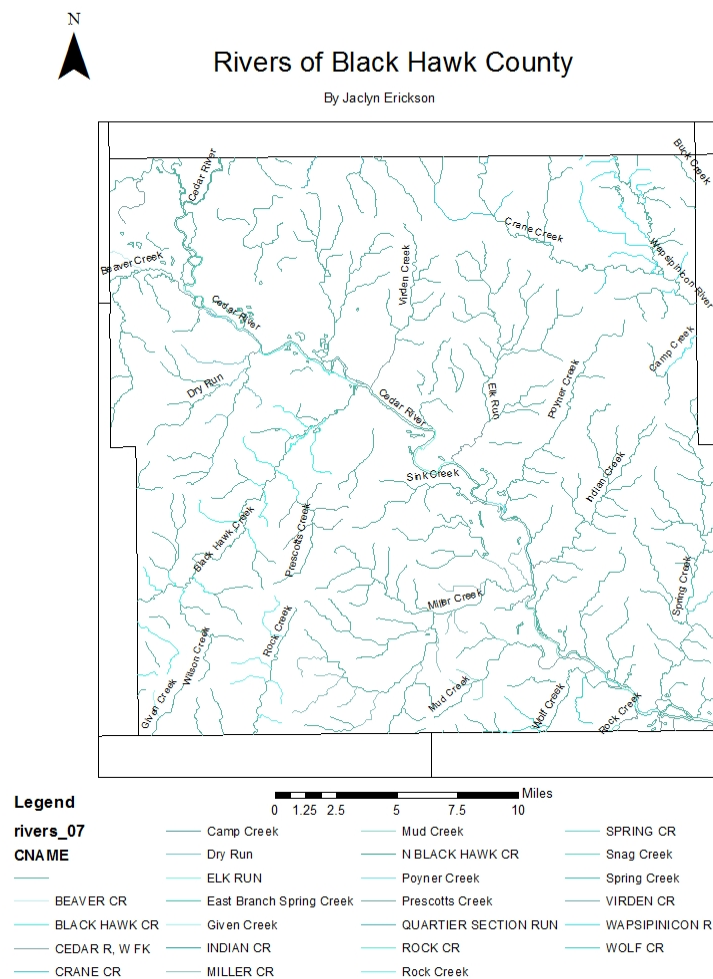


Figure 7 (Left)
Rivers and
major water
bodies located
in Black Hawk
County.

The rivers present in Black Hawk County of alluvial morphology, the meandering rivers are transporting sediment (Figure 7). In addition to the flowing rivers, the lake at George Wyth State Park and East Lake were enlarged to increase recreational opportunities and provide drainage. This is an example of human development and fluvial drainage, which are landscape determinants. (Anderson et al. 1972)

Soil forming factors include parent material, climate, plant and animal life, relief, time and human influence. In Black hawk County the parent material consist of alluvium, loess, glacial drift, and Aeolian. The relief comes from the gently rolling slopes due to the Iowan Surface. There are seven major soil groups in the County. Tama-Muscatine-Garwin is a nearly level and gently sloping seemingly well drained to poorly drained soil. Dinsdale-Klinger-Maxfield is a nearly level to moderately sloping and moderately well drained to poor in comparison to Readlyn-Tripoli is nearly level to very gently sloping and somewhat poorly drained. Sparta-Olin-Dicksnson is a nearly level to moderately steep, and excessively to well-drained sand and loam soils. There is also loamy alluvial land that is learly level and gently sloping with excessively to poorly drained soils. Lastly, Marshan-Sawmill-Bremer, which is nearly level and poorly drained silt and loam soils, it is located on the bottomlands (Soils Survey of Black hawk County, 1978).

Soil Survey of Black Hawk County

By Jaclyn Erickson

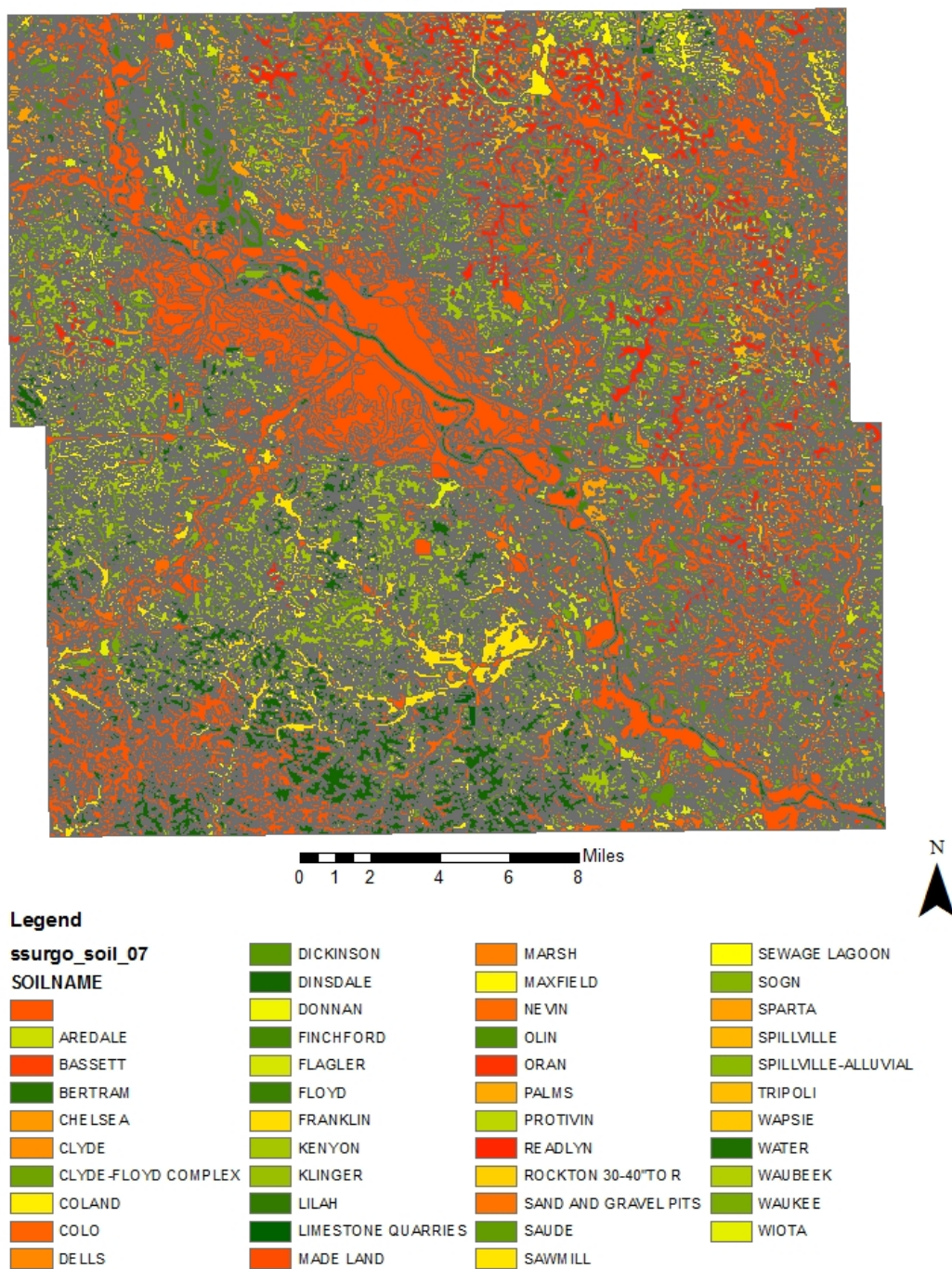


Figure 8 (above) Soil Survey information map of Black Hawk

Natural Resources of Black Hawk County

There are quarry operations and rock outcrops that help support local supply and demand. Quarries that have been used quite frequently are located La Porte City, Waterloo, and Cedar Falls. Berry quarry, in Eagle, is a supplier of limestone for the area. The county limestone cannot be used for roads it is too pliable. Limestone is from the middle Devonian cedar valley group (Anderson, 1992). Brick clay is from the glacial clay deposited in from the glacial ages unto the Iowa Surface (Anderson et al, 1972).

Alluvial aquifers are an important natural resource in the county because of the porosity of the alluvium allowing more water storage. The aquifers are quite extensive and thick beneath the Wapsinicon and Cedar Valley formations (Emmert et al, 1996).

In 1993 there was mercury and lead contamination to the soils. The soil was removed to control the spread of the toxins. Groundwater samples were collected to assess the conditions and if the chemical leached through the soil and into the water supply, there was no affect or presence of the two contaminants (Anderson, 1996).

The Cedar Valley Lakes used for aggregate pits are being restored and reclaimed into the original lakes and wetlands. The pits were dredged and hauled away. The project increased recreation economic opportunities by attracting tourism by the new trails and waters for canoeing and wildlife viewing (Lundeen, 1996).

Like all of Iowa, Blackhawk County is apart of agriculture. The county primarily grows corn and soybeans, but also has hay and feed lots (Fouts & Highland, 1978)

Applied Geology

There are many areas around the Cedar Falls and Waterloo area that would serve as a prime field trip site for an environmental science teacher to take their students. Project based learning is a proven tool in the classroom to help students face a project that might contain a multifaceted problem that the students will face and solve, putting them in a real world context. It will help them apply information learned at school in the project they create and hopefully promote personal growth (Schwering, 2015).

The project will revolve around the field trip sites and involve information learned in the class prior to the site visit. The students will be creating a project question based off their prior knowledge and the site. They will be following the scientific method in order to create their research project, create a list of materials and a plan of action for the day of the field trip.

Possible sites can include Hartman Nature Reserve, George Wyth State Park, Turkey Ridge Forest, Cedar River by 1st and Main Street, and the IOWATER sample site by the University Northern Iowa dome on Hudson (Figure 9).

Cedar Fall High School Location

By Jaclyn Erickson

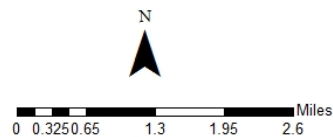
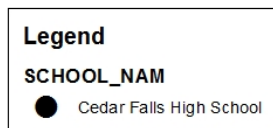
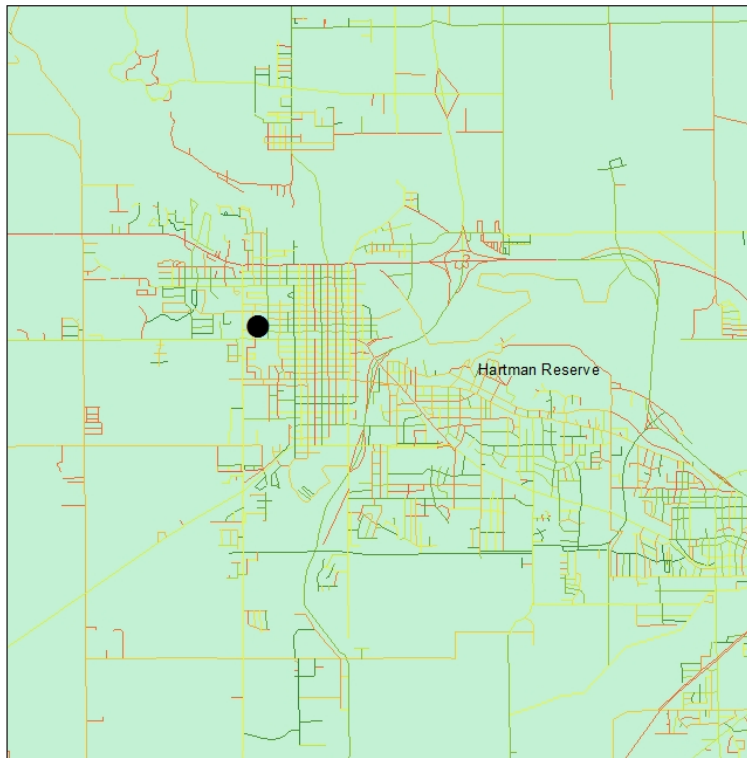


Figure 9 (Left)
Cedar Falls
High School
location in
relation to
Hartman
Reserve.

Project Discussion

In this paper I focused on Cedar Falls high school as my “school” because the school currently has one environmental science class that happens during 6th period. Today in schools, students and teachers are unable to take field trips due to funding and school scheduling. In order to go on the field trip it must be passed for approval by administrators,

then it can be moved down to the transportation to get a bus for the afternoon. The bus needs to be reserved at least a month in advance.

The field trip time would happen immediately after lunch at 12:26pm and be back by 2:40, because the students are released by 2:55pm and need to unload all materials. We cannot go during power hour, because it is their lunch time and time to go see teachers for assistance. Some students may get their food through the school, and would not be able to provide their own lunch. You can also no longer charge to students to go on the field trip the funding must be provided. As a result, for this example I will be using Hartman Reserve, which does not charge to hike their trails, there are a multitude shelters throughout the park and bathrooms at the nature center.

There are currently about 22 students in the class, meaning I would need at least one more adult to chaperone, ideally 2 to 3 more allowing each adult to go to the prairie, forest, or lake and keep an eye on the students. We would have a 30 minutes travel and transition time there and 30 minutes back. Only permitting approximately 1 hour and 15 min, which is why it is imperative for students to have a plan of action giving each group member a job and responsibility of data to gather and record. The direct lake trail will take approximately twenty minutes to travel to the lake at a normal relaxed pace. There is a sandy outlet allowing better collection sites for water samples and vegetation observation.

Projects can revolve around vegetation density, water sampling, tree species collection, different slopes, soil core comparison, or different rocks that can be found.

Project Example

Question: What spring ephemerals are present at Hartman reserve forest: lowland versus upland ecosystem?	
<i>Lowland</i>	<i>Upland</i>
Bluebell	Dutchmens breeches
Solomens seal	Trout lily
Observation notes: I found that there were a variety of different herbaceous plants on the forest floor, and depending where I was collecting data there were different species at that location. Photos were taken to document each plant.	

Hartman Reserve History and Management

The land was bought in 1938 and the nature center was built on a bluff in 1941, allowing a great spot for interpretive programs, and a large multiuse room. The site became official in 1976 when it became the Hartman Reserve Nature Center. There is a circle drive that allows parking for cars and buses. Hartman Reserve contains a variety of ecosystems on the land including prairie, forest, streams, and lakes.

They are very active in the management and reconstruction of the land. Lucy's meadow is a reconstructed prairie that gradually becomes woodland, it has a prairie outlook that allows great observation access. Oaks and other trees were planted on the edge to create a savanna and burns occur to thin the trees and invasive plants. It would be a great site to view diversity in soil, plants, and root systems.

Hardwood forests are the dominant ecosystem at the park. There is a large population of *Quercus alba* as well as *Carya Ovata*, *Prunus serotina*, *Ostrya Virginia*, and

Acer Saccharum. Due to the stand of oaks there are special management plans in place at the reserve to conserve the trees from presettlement times, by thinning the canopy promoting oak and hickory growth. Acer saccharum, or sugar maple, is present along water bodies on the land (Watson, 2006).

There overall management plans include decreases heavy tools to prevent tree scarring, also pruning and cutting during growing season. The primary invasive species include reed canary grass and honeysuckle. A specific garlic mustard plan is in place due to a large patch found in 2012, they have tips to identify and remove the plant and how to avoid transporting the seeds. To help with soil erosion and water percolation they use and maximize trail use to avoid compacting ground and soil in the reset of the work and impacting soil negatively. Culturally and historical areas that are found will be carefully handled. Along with the forest water bodies are found throughout the park including lake Manatt, Shirley Lake, Lost Lake, Bullfrog Bayou, and the Cedar River (Weimer & Herring, 2013).

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