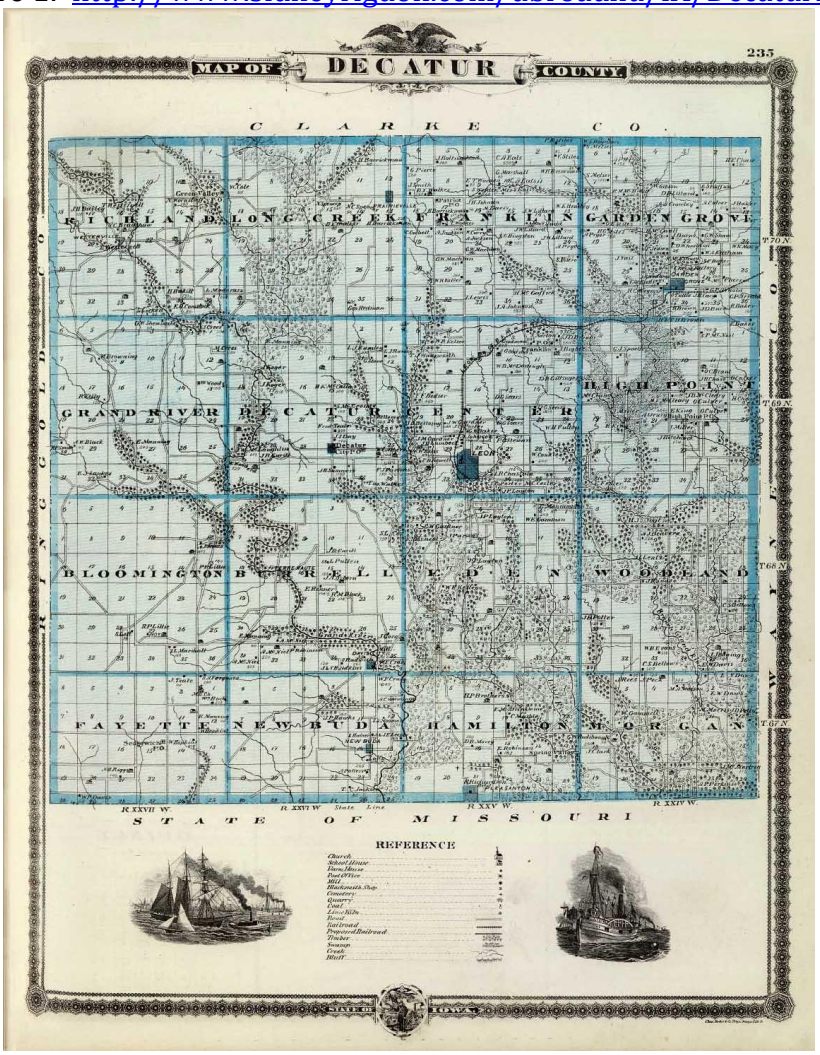
A Geological history of Iowa and Decatur County

Gayle Ramaeker
Geological Resources of Iowa

Figure 1: http://www.sidneyrigdon.com/dbroadhu/IA/Decatur2.jpg



Map from 1875

Abstract:
Decatur County has a rich a history that covers its lands, as does the state of Iowa. Over the last 3 billion years, give or take a few billion years, the land, as we know it today formed and reformed leaving us with the fertile soils and profitable limestone we raise our children on. People have come and gone from our state but the land is always there to support us. It is changing with the earth, and students need to know about our great land through the study of geology. Students will build the story of Iowa and Decatur County through various activities in and out of the classroom.

Table of Contents

Part V: Introduction

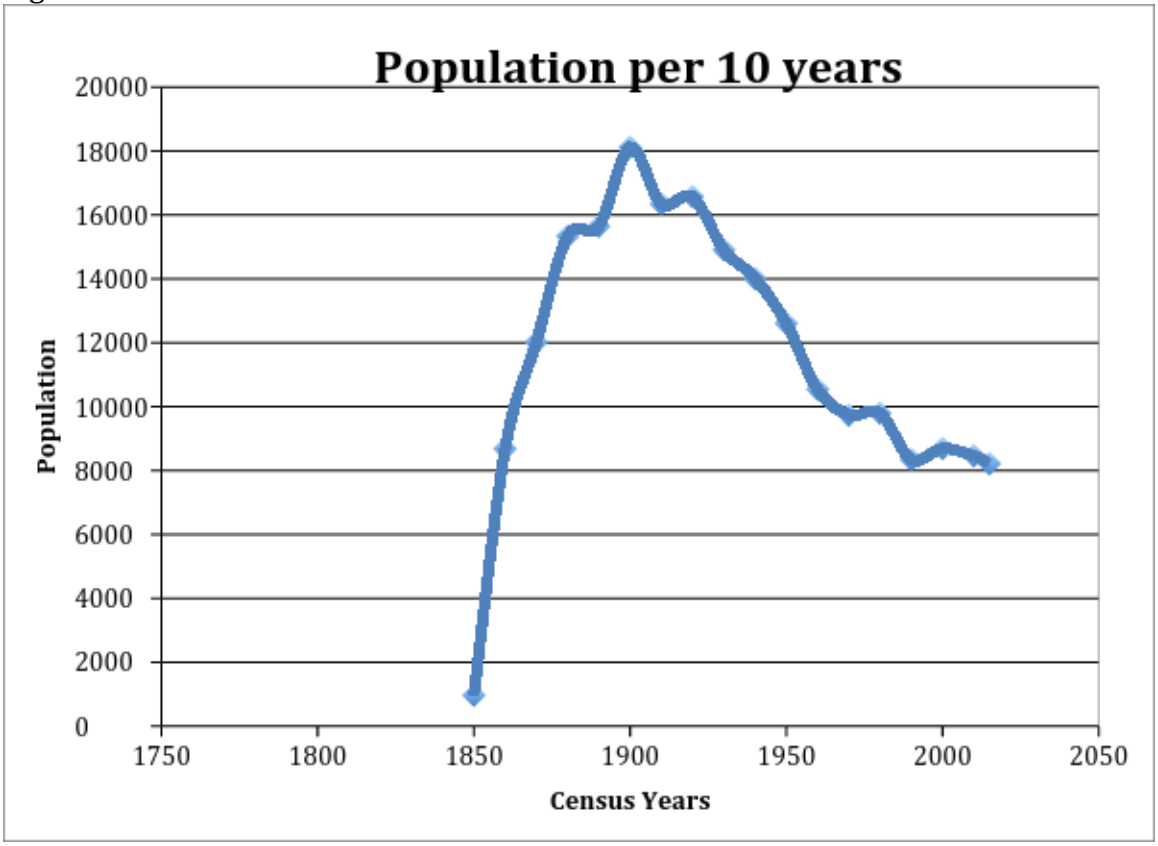
A. Over the past semester I have learned so much more information regarding the geology of Iowa than I knew before. My knowledge was limited to what I learned from teaching Earth Science and from life experiences. I have a much wider and deeper knowledge base and appreciation for geology after taking this class. The theme I have chosen for my project is water and its effects on Earth's materials and surface processes. Most, if not all of my students, do not know that Iowa was once a warm shallow sea. I am going to present fossils of small sea creatures found in Iowa as phenomena to them and from there they will do a series of investigations to figure out why. I would like to take them to the Decatur County Quarry to see if they can collect some fossils of their own. Through these investigations they will use the rock cycle and discover how the different types of rocks formed here in Iowa and also the different minerals we see here today. My unit is going to focus around the NGSS PE HS-ESS2-5: Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

B. Decatur County Iowa is located in south-central Iowa. The coordinates of Decatur are: 40°44'29" N, 93°46'51"W. According to the 2010 census, the population of Decatur County was 8,457, with a population density of 16/square mile (6/km^2). Decatur County was created on January 13, 1846 (Howell, 1915). Over the history of Decatur County the population has a generally negative population trend after a large population increase in 1900 due to the settlement of the area, see Figure 3 and Table 1 (http://www.census.gov/).

Table 1.

Census year	Population	%+/_	Census year	Population	%+/_	Census year	Population	%+/_
1850	955	-----	1910	16,347	-9.8%	1970	9,737	-7.6%
1860	8,677	799.2%	1920	16,566	1.3%	1980	9,794	0.6%
1870	12,018	38.5%	1930	14,903	-10.0%	1990	8,338	-14.9%
1880	15,336	27.6%	1940	14,012	-6.0%	2000	8,689	4.2%
1890	15,643	2.0%	1950	12,601	-10.1%	2010	8,457	-2.7%
1900	18,115	15.8%	1960	10,539	-16.4%	2015 Est	8,220	-2.8%

Figure 2.

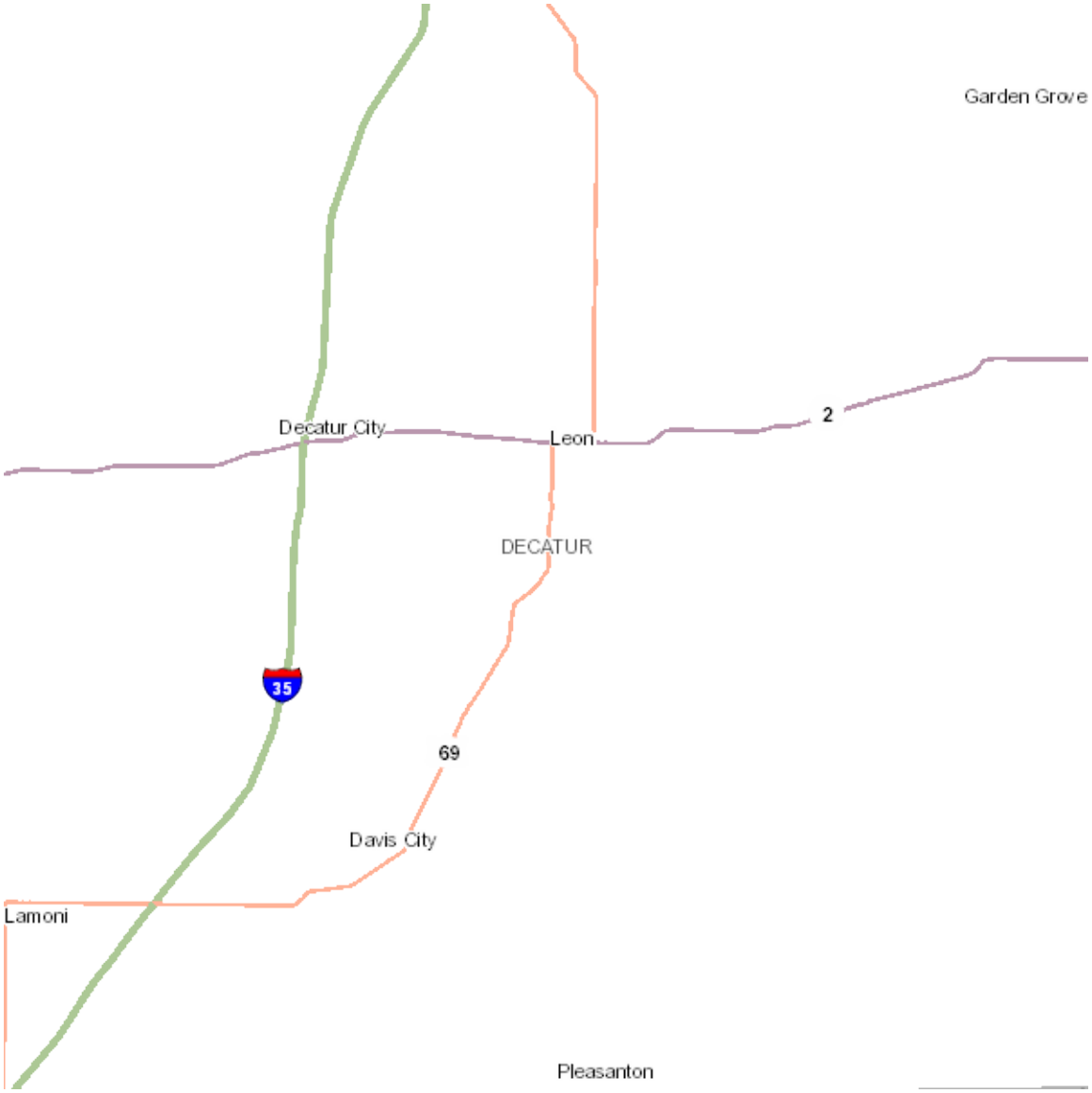


Decatur County has only three major highways that run through it (Figure 4), Interstate 35 runs down the middle of the county. In fact my family had to sell the government the land to build the interstate that hundreds of people travel every day. My great aunt and uncle tell the story of having to drain a very large pond where they kept goldfish that their children would bring home from various events. When they drained the pond there were hundreds of goldfish that fell over the spillway and it looked like a waterfall of sparkling oranges and golds! The two other highways are state highways, 69 and 2. There is a moderate watershed drainage system that flows in Decatur County, see Figure 3. According to the U.S. Census Bureau, Decatur County has 533.6 square miles (1,380 km^2). Out of that area 532 square miles (1,375.9 km^2) are land and the other 1.6 square miles (4.1 km^2) are water, which is composed of ponds, small lakes and a couple of rivers, as seen in Figure 3.

http://ortho.gis.iastate.edu/client_nhd.cgi?zoom=50&x0=435546&y0=4507252&gwidth=30000&gheight=30000&pwidth=600&pheight=600&layer=naip_2014_nc&wmtver=1.0

Figure 3. Watershed of Decatur County

Figure 4. Major Highways of Decatur County



C. The history of Decatur County dates back to January 13, 1846, named for Stephen Decatur who was a war hero in the War of 1812 (Howell, 1915). It was the last of 12 counties created by the act of Legislature of the Territory of Iowa (Howell, 1915). The boundaries of the county have never changed. It was inhabited by Sac and Fox Indians and was seceded by the Indians to the US Government October 11, 1842, but because Decatur was actually west of the cession line the Indians did not actual vacate the land until 1845. Pioneers then settled it. There was a settlement of Mormons that stayed the winter in 1847 (Howell, 1915). They wintered in what is now known as Garden Grove. Most of the company left when spring came and

continued to travel to Utah, however there were are few that stayed a few more years. Today there is a large population of Mormons in the Lamoni area. The Mormon community was very strong in the belief that education was what God wanted them to give the community. So, at a conference held in St. Louis, Missouri in 1869 it was decided that they were to educate "their own young men". So, on November 12, 1895 Graceland College was established and the first building started being erected. I actually attended Graceland University and graduated with my education degree in the spring of 2008 (Howell, 1915).

In 1914 there were 68 schoolhouses in Decatur County that employed 60 male and 46 female teachers (Howell, 1915). The average pay for the males was $9.45/hour and for females was $6.37/hour. The Decatur Township, however, was the only township that actually paid both males and females equally. Throughout the county there were 2,005 students educated in Decatur County in 1914 (Howell, 1915). In reality this number is probably larger than that of the number educated in the County today.

The Pioneers came to the region for the farmland availability and they stayed because there was water available. They were able to dig only 15-40 feet and found an abundant water supply (Howell, 1915). They also stayed because of the supply of limestone available for building. The land was ripe and ready for economic development. Today, Decatur County has a few limestone quarries where limestone is extracted and used mostly for road aggregate but some is also used for commercial products like concrete. The one natural resource that brings in the most money besides using the soil to grow beautiful crops; is the wildlife. Today, people come from all over the world to hunt in the tree lines of Decatur County, Iowa. There are many framers in our area who supplement their income by allowing hunters to hunt their land and stay in cabins on their properties. This is a very fast growing economic trend in Decatur County.

Part IV: A Summary of The Geological History of Iowa

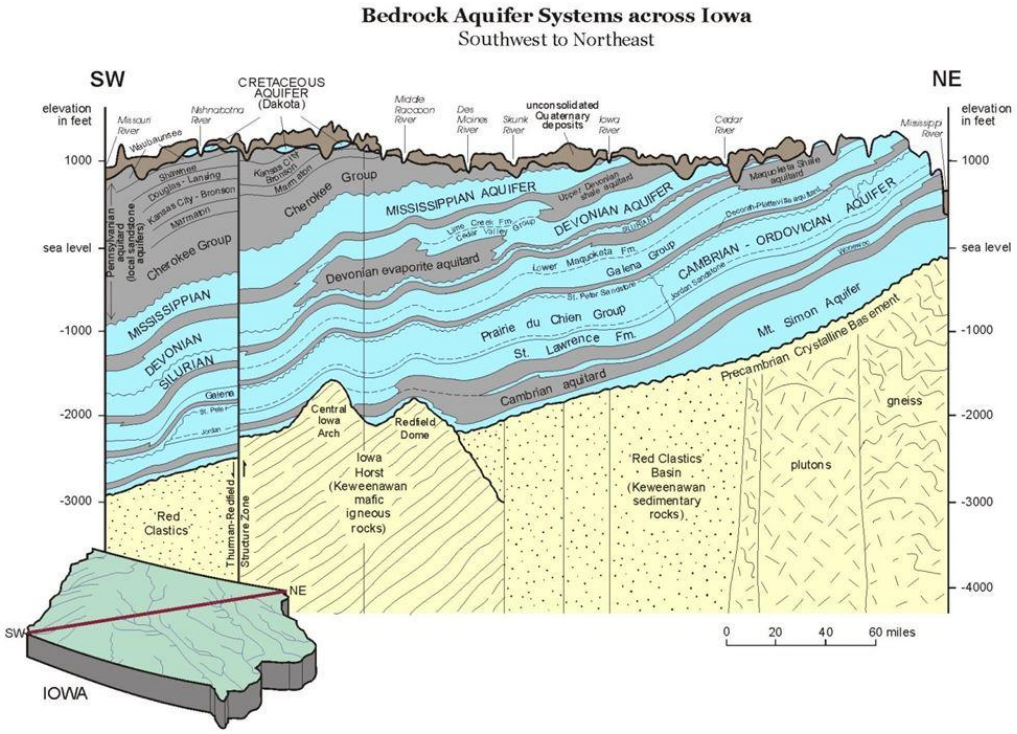
The timescale of our Earth's history can be a very difficult concept to grasp. If the Earth's history were to be applied to a calendar year with January 1st being the first day of the Earth's history then the Precambrian would be around 88% of the year. The Precambrian lasted for around 4.6 billion years, which on a calendar will take us from January 1st to November 18th. The Paleozoic era would go from November 19th to December 13th. The Paleozoic lasted 545-245 million years, which is represented by approximately 3 weeks on a calendar year. The next 2 weeks on the calendar, from December 14th to December 27th would represent the next 245-65 million years in the Mesozoic era. The Cenozoic era is going to be from December 28th to December 31st. The last 3 hours of the last day are going to be the Pleistocene at 2 million years to 11,200 years. The Holocene, where we are today, is represented by the last 1.1 minutes of the last hour of the last day (Heinzel, 2016). Humans have then existed the last second of the last hour of the last day on our calendar year. (http://uni.edu/carrchl/wp/iowalandscapes/iowas-geologic-past/)

During the Precambrian era igneous and metamorphic rock were laid down here in Iowa. This was nearly 3 billion years ago. The oldest exposed bedrock is the Sioux Quartzite, which was laid down between 1.64 to 1.76 billion years ago (Anderson, 1998). These are found in the northwest corner of the state. After this time the Midcontinent Rift System nearly tore the North American content apart. There is a lot of evidence in our bedrock that point to this violent event. There are extrusive basalts, mafic intrusives for example (Anderson, 1998). The only way these could be in our rock record is if they had come up from under the Earth's crust.

According to Wayne Anderson's book Iowa's Geological Past, during the last Precambrian and the Cambrian Iowa underwent lots of weathering and erosion due to its elevation above sea level. By the end of the Cambrian, however, Iowa was covered in water and was a shallow sea (Anderson, 1998). Throughout the Ordovician water flowed over the lands producing shales, carbonates, and phosphate-rich beds (Anderson, 1998). There have been different fossils found throughout our rock record. During the Devonian and the Silurian seas coral structures lived on the seafloor. Evidence of this has been found in eastern Iowa including chain coral, Pachyphyllum, Lithostrotionella, horn coral, stromatoporoids, different species of Brachiopods, mollusks, primitive fish, Crinoids, shelled arthropods, just to name a few.
(http://www.iihr.uiowa.edu/igs/fossils-in-iowa/).

The Mississippian was the last time period that Iowa was covered in water. During this time period sand, mud, and silt was laid down by the movement of the water at different times and can be seen today as sandstone, siltstone, and shale (Anderson, 1998). The limestone laid down during the Mississippian is quarried extensively today because of its remarkable purity (Anderson, 1998). The aggregates that are produced from the Mississippian limestone are used for building projects, roads, and many other commercial products (Sherman Lundy, BMC Aggregates). The Mississippian rock also is an important source of groundwater (Figure 2).

Figure 2: http://www.iowadnr.gov/Conservation/Geology



Moving up the timeline to the Pennsylvanian, the rock record begins to show another huge economic product in Iowa, coal. Due to the movement of the water in and out over the land coastal swamps formed during the Pennsylvanian. This allowed for the lush vegetative growth over the years, which in turn was buried and formed peat. Layers upon layers of peat and sediments were laid down on top of each other causing the increasing pressure to later change the peat to coal. Iowa's coal underwent substantial mining in the late 1800s and early 1900s (Anderson, 1998). The issue with the Iowa coal is that it has a high sulfur content causing the quality to not be as good as other coals found in other

places in North America. Again because of the carbonates found in the water that covered Iowa the Pennsylvanian limestones quality is excellent. It is quarried for commercial projects as well.

In Iowa the Mesozoic Era, which consists of the Triassic, Jurassic, and Cretaceous periods, are almost all missing from the rock record due to the tremendous amount of weathering and erosion that took place during this time (Heinzel, 2016). There is no Permian or Triassic rock record in Iowa and the Jurassic record are limited to the Fort Dodge Formation. The Cretaceous time period was one of interest in Iowa due to the fact that a meteorite struck Iowa nearly 73.8 million years ago (Anderson, 1998). This impact structure is one of the best-preserved and largest impact structures in the world (Ray Anderson, 2016).

During the Cenozoic Era there is evidence to support two major periods, the Tertiary and the Quaternary (Anderson, 1998). First, the Tertiary time period was a period where Iowa was above sea level and was exposed to a tremendous amount of weathering and erosion. This time period lasted for about 65 million years. The last 2.5 million years of the tertiary time period was a time of glaciation. Because of this, the soil record shows that the ice sheets blanketed the ground with glacial drift all over the state. Thanks to the melt waters and other sediments left behind, Iowa's beautiful landscape and fertile soils have developed over time due to the weathering of the glacial drift (Anderson, 1998).

It is thanks to the Geological history of Iowa that we have the natural resources that we have today. We have a thriving Limestone Industry and our soil is some of the best in the world. Our economy thrives around agriculture and without the rich history that Iowa has our beautiful state would be very different today.

Part VII: Geology of Decatur County

A. Bedrock Geology

While doing research for this project I was unable to find any recent information about Decatur County's Bedrock. All references are from the late 1800s and early 1900s. Decatur County has very heavy limestone known as the Bethany Limestone. They were named this because of the outcrop in Bethany, Missouri, which is just south of Decatur County. In 1898 H.F. Bain came to Decatur County to study the geology there because of the lack of information about the land. He found that the limestone found in Decatur County is Missourian limestone, and therefore laid down before the glaciers came down. He observed that the watershed is about the same then as it was before the glaciers covered the land (Bain, 1898).

There are three groups or formations in the Missourian series, Lansing Group, Kansas City Group, and the Bronson Group. The Lansing and the Kansas City Groups are composed of limestone and shale that were deposited due to the marine settings that were predominant during this time period. The Bronson Group also is limestone and shale, however it also has some minor coal. This coal is high in sulfur so it is not really useable coal (Anderson, 1998)

B. Fossils

According to Wayne Anderson the Missourian limestone was deposited during the Pennsylvanian and the land was still covered in water at that time. The bedrock is so far under the soil that we don't see many fossils in Decatur County. The fossils that should be there include but not limited to: brachiopods, foraminifera, calcareous algae, condonts, and some fish remains (Anderson, 1998)

Part VIIII: Unit Lesson Project

Geology and (your theme) / Geology APPLIED to your chosen theme

Phenomena: Changing Rivers
Over time rivers change their course due to a number of different factors. Some of these factors can include but not limited to: erosion, human interference, bedrock shifts, and other factors.

To study Iowa's rivers, we need to first study the underlying bedrock and look to see how it got there and what it is made of.

Lesson level Phenomena: Why are there marine fossils in Iowa?
To answer this question I want to take my Earth Science class to a quarry in Decatur County. I want them to collect fossils and for them to discover, as I did, that what we say is just rock, is more than just rock.

What does this tell us about the bedrock and why rivers can change their course over time?

> The limestone was put down while the land was still covered by water, so water actually caused the bedrock to be the way it is.

Lesson level Phenomena: Soils
So, now they know about the bedrock, what do we know about the soil? How did it get there, what is it made of?

I want to take my students out to Slips Bluff, which is a small county park not far outside of Lamoni. I want them to make observations about the land and its shape compared to the land not far from there. They should be able to see some layering in the bluffs. I will make sure it is ok for them to collect sample rocks and soils so they can see first hand that it is glacial till and loses that came in after the seas receded.

What does this tell us about soils in Decatur County and why rivers change their course over time?

> The soils were brought here and made fertile by frozen water. We have large stones, why are they here? We have sand, sandstone, and black soil. All of which was brought here thanks to water, either liquid or frozen.

Lesson Level Phenomena: The Grand River
Is the Grand River in the same place as it was 100 years ago and how can we tell? Is it changing its path?

I am going to find old maps of the area, much like the ones I have in this paper, and we will speak with experts and look for evidence that shows us either yes, it is moving or no it is not moving. If it isn't moving, then do all rivers stay static over time or have some of them moved? We will then research other rivers that have moved and do explorations to find out why.

Assessment:
Write a paper giving evidence from our investigations to how water helped form our land.

Part X: Reference Page

Books:

Anderson, Wayne I., 1998, *Iowa's Geological Past Three Billion Years of Change*, University of Iowa Press, p. 63-269

Bain, H.F., 1898, *Geology of Decatur County*, p 258-309

Howell, J.M. Prof and Smith, Heman C. 1915, *History of Decatur County Iowa and Its People*, volume 1, The S.J. Clarke Publishing Company, Chicago, p. 10-360

Websites:

http://www.sidneyrigdon.com/dbroadhu/IA/Decatur2.jpg
http://www.census.gov/
http://ortho.gis.iastate.edu/client_nhd.cgi?zoom=50&x0=435546&y0=4507252&gwidth=30000&gheight=30000&pwidth=600&pheight=600&layer=naip_2014_nc&wmtver=1.0
http://uni.edu/carrchl/wp/iowalandscapes/iowas-geologic-past/
http://www.iihr.uiowa.edu/igs/fossils-in-iowa/
http://www.iowadnr.gov/Conservation/Geology