

‘Presenting Missouri’

A Healing Earth Student Project
AP Environmental Science Students

St. Louis University High School

St. Louis, Missouri

February 2016

Contents

1.	Climate of Missouri	1
2.	Environmental Quality Concerns in Missouri	5
3.	Ozark Border	8
4.	Glaciated Plains Missouri	11
5.	The Osage Plain	14
6.	Missouri’s Lead Mining Industry	16
7.	Big Rivers	20
8.	Mississippi Lowlands	24
9.	The Air Quality of St. Louis	27
10.	The Ozark Region	32
11.	Seismology in Missouri	36

1. Climate of Missouri

David and Matt

The climate of a specific area can be determined by considering both the temperatures and the precipitation of the region. The state of Missouri's location within the center of the United States has caused the climate to be considered a continental type of climate marked by strong seasonality.¹ In this section, we will be analyzing the the factors of temperature and precipitation that contribute to the climate of the state of Missouri.

Latitude and Longitude and Elevation

38.5000° N, 92.5000° W

The highest point in Missouri is located on Taum Sauk Mountain and is 1,772 feet above sea level. The lowest point is located at St. Francis River and is 230 feet above sea level. The average elevation of Missouri is around 800 feet above sea level.²

Temperature

Missouri's inland location and the absence of a large body of water near the state has caused a continental climate throughout the entire region. A continental climate implies that a region will experience strong seasonality, meaning that temperatures will change drastically from one point of the year to the next. While summers will be characterized by high temperatures, winters will be characterized by low temperatures in a continental climate. In the summer, temperatures reach ninety degrees Fahrenheit on an average of forty to fifty days in the west and north and fifty-five to sixty days in the southeast.³ In the month of July, during the heart of the summer, the average temperature in Missouri is 89.4 degrees Fahrenheit, compared to the 86.5 degrees Fahrenheit average for the rest of the United States.⁴ Winters can be just as harsh as the hot and humid temperatures characterized by Missouri summers. On average, there are two to five days with below zero temperatures in the northern part of the state and one to two days with below zero temperatures in the southern part of the state. Below freezing temperatures are, on average, recorded in about 110 to 100 days in the northern and central part of the state while only reaching about seventy days in the southern part of the state near the bootheel in the southeast. While temperatures across the state in the summer stay relatively equal, during the winter, temperatures follow a northwest to southeast gradient with an average of twelve degrees Fahrenheit in the northwest and an average of twenty-four degrees Fahrenheit in the southeast.⁵

¹ Decker, Wayne L. "Missouri Climate Center." *Missouri Climate Center*. University of Missouri, n.d. Web. 09 Feb. 2016.

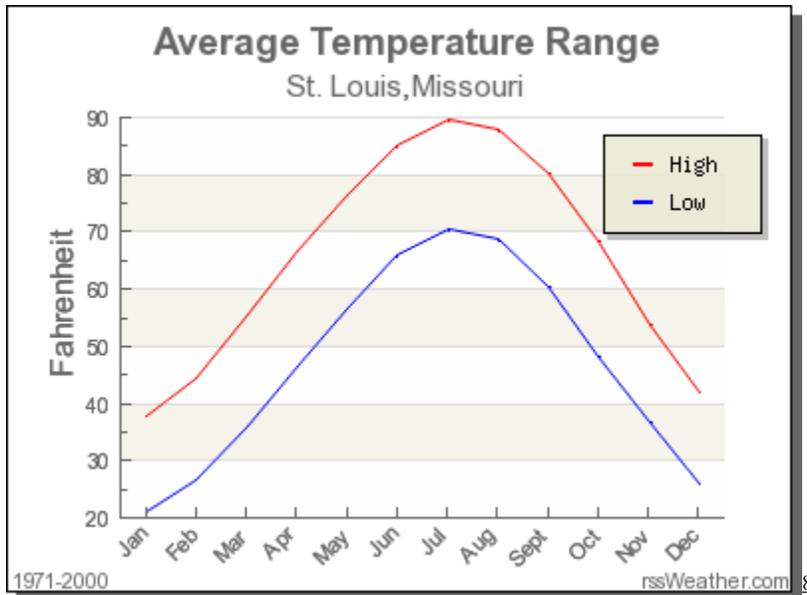
² Exner, Cleveland.com Rich. "Highest and Lowest Elevations by State: Statistical Snapshot." N.p., n.d. Web. 15 Feb. 2016.

³ IBID

⁴ "Missouri State Climate." *Missouri State Climate*. N.p., n.d. Web. 09 Feb. 2016.

⁵ Decker, Wayne L. "Missouri Climate Center." *Missouri Climate Center*. University of Missouri, n.d. Web. 09 Feb. 2016.

For the entire state of Missouri as a whole, the average January low temperature reaches to 19.7 degrees Fahrenheit.⁶ One major cause for these disparities in temperatures for the state is the presence of opposite air masses going from the northwest to southeast portions of the state. Dry, cool continental air masses are present in the northwest while humid, subtropical air masses reside in the southeast, dictating a diagonal gradient across the state where temperature differences can be observed. These differing air masses have caused a mean annual temperature gap of about ten degrees Fahrenheit, with the mean annual temperature being sixty degrees Fahrenheit in the northwest and fifty degrees Fahrenheit in the southeast.⁷



Precipitation

Missouri's inland location and the absence of a large body of water near the state has caused a continental climate throughout the entire region. A continental climate implies that a region will experience strong seasonality, which causes different forms of precipitation and different amount of precipitation from one point of the year to the next. Mean annual precipitation varies along the same gradient as temperature, from a low of 34 inches in the northwest to a high of 50 inches in the southeast.⁹ But, seasonal climatic variations in precipitation are much more complex. Seasonal climatic variations in precipitation means that the amount of precipitation in a specific region changes from one season to the next. In northwestern Missouri, seasonality in precipitation is very noticeable due to strong continental influences. For example, June precipitation averages five times greater than January

⁶ "Missouri State Climate." *Missouri State Climate*. N.p., n.d. Web. 09 Feb. 2016.

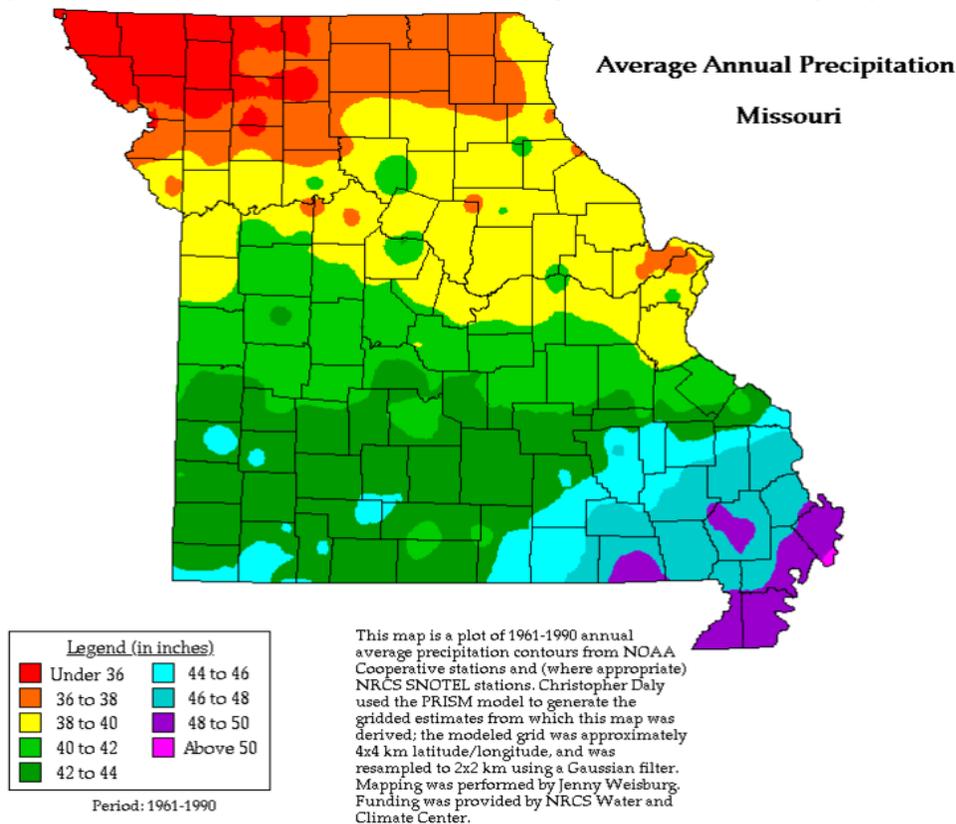
⁷ "What Is the Climate in Missouri?" *Travel Tips*. N.p., n.d. Web. 10 Feb. 2016.

⁸ "Climate for St. Louis, Missouri." *Climate in St. Louis, Missouri*. N.p., n.d. Web. 15 Feb. 2016.

⁹ Decker, Wayne L. "Missouri Climate Center." *Missouri Climate Center*. University of Missouri, n.d. Web. 09 Feb. 2016.

precipitation.¹⁰ In contrast, southeastern Missouri seasonality in precipitation is insignificant due to the greater influence of subtropical air masses throughout the year.

On average, Missouri receives 40.5 inches of rainfall every year, while the rest of the United States receives an average of only 36.5 inches of rainfall per year.¹¹ In the winter, precipitation is much less in Missouri compared to the rest of the country. Missouri only receives 14.1 inches of snow every winter, while the rest of the country averages 25 inches of precipitation throughout the winter months.¹² The seasonal climatic variations in precipitation of Missouri account for the changing precipitation amounts throughout the four seasons. Missouri averages 92 days of precipitation which is similar to the average amount of days of precipitation in the United States, which is around 100 days.¹³ Missouri is also very similar to the rest of the United States in the amount of days without precipitation. Missouri averages around 206 sunny days while the rest of the United States averages around 205 sunny days.¹⁴



¹⁰ IBID

¹¹ "Missouri State Climate." *Missouri State Climate*. N.p., n.d. Web. 09 Feb. 2016.

¹² IBID

¹³ IBID

¹⁴ IBID

2. Environmental Quality Concerns in Missouri

Chris & Paul
February 2016

Between 1998 and 2012, total releases of pollutants in the state of Missouri have increased by 14%.¹⁵ With rising concerns from the general public and environmentalists, Missouri has set a charge to decrease the carbon footprint of its state, make life better not only for residents but wildlife as well, and increase efficient energy productivity. In 2014, Missouri decided upon four environmental areas to prioritize with its time, money, and workforce. First, Missouri is looking to improve water quality throughout the state. Second, the state would like to make its soils more sustainable and to have more productive growing seasons. Third, Missouri pledges to increase the diversity of the wildlife throughout the state. And finally, Missouri is aware that much of the state is privately owned, so they wish to provide landowners with further incentives for sustainable land use.¹⁶ For the purposes of this report, we will focus on the first three above areas specified by the state of Missouri.

Regarding water quality, Missouri ranks eighteenth in the country for most pollutants released into waters.¹⁷ 4,069 tons of sludge are released annually from public and private sources.¹⁸ There are thirty-six recognized toxic waste release sites within the state's watershed.¹⁹ Most are commercial and industrial sites registered under the mandatory National Pollutant Discharge Elimination System (NPDES), a branch of the 1971 Clean Water Act which requires that anyone wishing to release substances into waters obtain a permit and abide by the standards set in place. For instance, phosphorus emissions are limited to 0.5mg/L.²⁰

As for nonpoint sources of water pollution, a major example is the individual septic system, according to the Missouri Department of Conservation.²¹ Soils with inadequate absorption abilities are a common reason for failure of septic systems. Diseases associated with septic tank fluids include typhoid, hepatitis, cholera, dysentery, and leptospirosis, which affect both humans and animals.²² Another household emission, laundry detergent chemicals are found in 80% of springs and 58% of streams.²³ The NPDES states that landowners must register their land to spread it with manure, and stored manure must be enclosed.²⁴ Cattle on pasture land in Missouri can create an amount of waste equal to that of 1.5

¹⁵http://scorecard.goodguide.com/env-releases/state-trend-detail.tcl?fips_state_code=29&category=total_env

¹⁶<http://www.nrcs.usda.gov/wps/portal/nrcs/main/mo/programs/financial/equip/>

¹⁷http://scorecard.goodguide.com/ranking/rank-states.tcl?how_many=100&drop_down_name=Water+releases

¹⁸<http://mdc.mo.gov/your-property/greener-communities/missouri-watershed-inventory-and-assessment/white-river/water-qual>

¹⁹Ibid.

²⁰Ibid.

²¹Ibid.

²²Ibid.

²³Ibid.

²⁴Ibid.

million humans, or over 8 times the entire population of the watershed.²⁵ Failure to follow these policies results in the even more unequal distribution of nutrients throughout the watershed and beyond.

Moving to the second area of encouraged improvement—soil quality—we find that Missouri ranks fifth in the nation based on amount of chemicals released into the soil.²⁶ Fifty-three of Missouri’s one hundred fourteen counties have predominantly high pH levels—equal to or above 6.1 (see map at top-right, “fig. 3”). Sixteen counties have predominantly low pH levels, particularly in the Ozarks. High pH levels not naturally occurring likely result from the use of pumped irrigation water, which usually contains higher levels of calcium and magnesium, raising the soil pH.²⁷ While some of the soils with a lower-than-average pH may be naturally so, many are likely triggered by the overuse of fertilizer.²⁸

On the next two charts, phosphorus (P) and potassium (K) levels across the state are displayed. Phosphorus levels are predominantly low throughout the state (see “fig. 4”). Potassium levels throughout the state appear generally as expected (see “fig. 5” on page 3).

Fig. 3: Dominant Soil pH levels by County in Missouri (1996-2006)

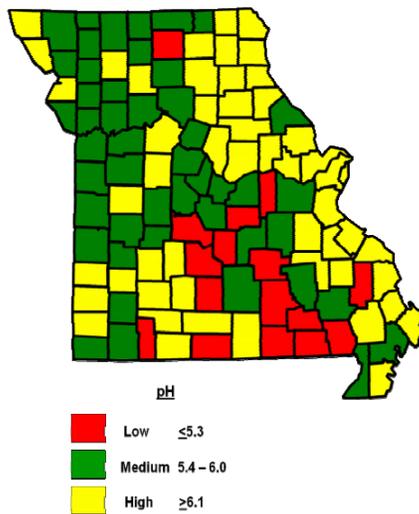
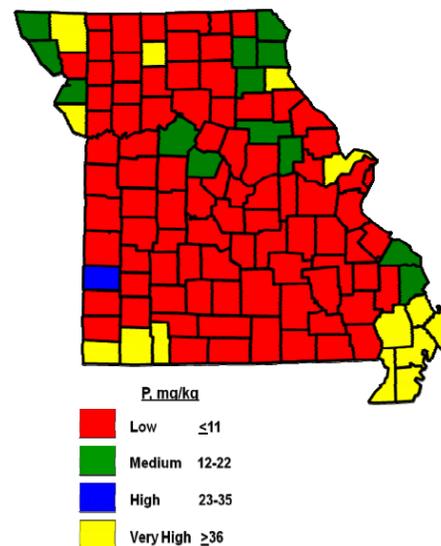


Fig. 4: Dominant Soil Test P levels by County in Missouri (1996-2006)



On wildlife, Missouri is currently home to thirty-seven endangered, threatened, and critical habitat species, as well as one species that is a current candidate for protection.²⁹ They include four mammals (all bats), three birds, one amphibian, seven fish, eleven clams, one snail, one dragonfly, one crustacean, and nine plants. Twenty-one aquatic and amphibian species are included in that list. Water-based organisms are often indicator species and thus more susceptible in the short-term to pollutants.

²⁵Ibid.

²⁶http://scorecard.goodguide.com/ranking/rank-states.tcl?how_many=100&drop_down_name=Land+releases

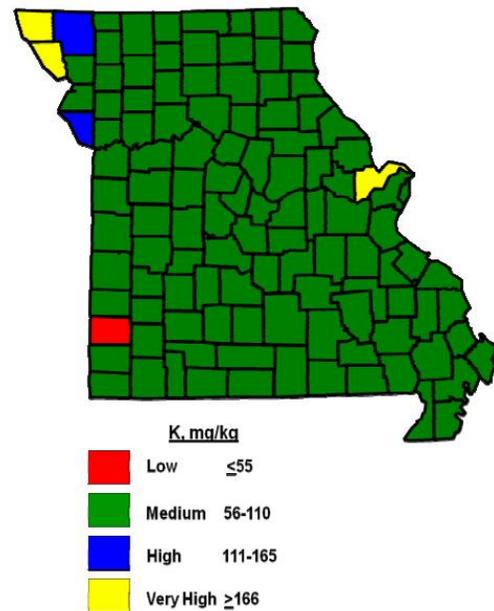
²⁷<http://passel.unl.edu/pages/informationmodule.php?idinformationmodule=1130447041&topicorder=6&maxto=10#>

²⁸Ibid.

²⁹<http://www.fws.gov/midwest/endangered/lists/pdf/MissouriStateList.pdf>

Regarding invasive species, major concerns currently include around eight species, in particularly the emerald ash borer, the Asian (silver) carp, and about twenty-five different plant species, most notably bush honeysuckles.³⁰ The emerald ash borer is an insect which bores into and kills North American ash trees. The insect recently triggered the removal of eight hundred historic ash trees on the grounds of the Jefferson National Expansion Memorial, also known as the St. Louis Gateway Arch.³¹ Asian carp are a family of fish introduced to U.S. aquatic farms in the 1970's to control the growth of unwanted plants and parasites.³² Since, they have worked their way into the Mississippi river system and established breeding grounds, outcompeting other bottom-feeders.³³ The fish, known to collectively jump out of the water at high speeds when disturbed, have become a nuisance for hunters and boaters as well.³⁴ The bush honeysuckle is a family of twining vines, only two subspecies of which are established in Missouri, that grow to up to twenty feet tall and block sunlight penetration to the soil, have roots that spread outward unlike other species, and have longer growing seasons than native vines.³⁵ These subspecies are also allelopathic, producing a chemical to prevent the growth of other plants in each plant's immediate surrounding.³⁶

Fig. 5: Dominant Soil Test K levels by County in Missouri (1996-2006)



Looking beyond the issues highlighted in this report, the state of Missouri is in fair or even good environmental health. Clean tap water is still derived (and processed) from local water sources, and Missouri continues to rank fifth in the nation in rice production and sixth in soybeans and cotton.³⁷ Progress has been made in species protection efforts, as in 2008 three Missouri-specific species were removed from the list.³⁸ The state seems to be progressing, though slowly, on its identified goals.

³⁰<http://mdc.mo.gov/your-property/problem-plants-and-animals/invasive-animals>

³¹http://www.stltoday.com/news/local/metro/emerald-ash-borer-advances-on-trees-here/article_2209e665-e453-5a2b-9466-7728cb619408.html

³²<http://www.nps.gov/miss/learn/nature/ascarpover.htm>

³³Ibid.

³⁴Ibid.

³⁵http://mdc.mo.gov/sites/default/files/resources/2010/08/9675_6621_0.pdf

³⁶<http://magnificentmissouri.org/about/invasive-bush-honeysuckle/>

³⁷<https://www.agclassroom.org/kids/stats/missouri.pdf>

³⁸<http://www.richmond-dailynews.com/2008/10/archive-2109/>

3. Ozark Border

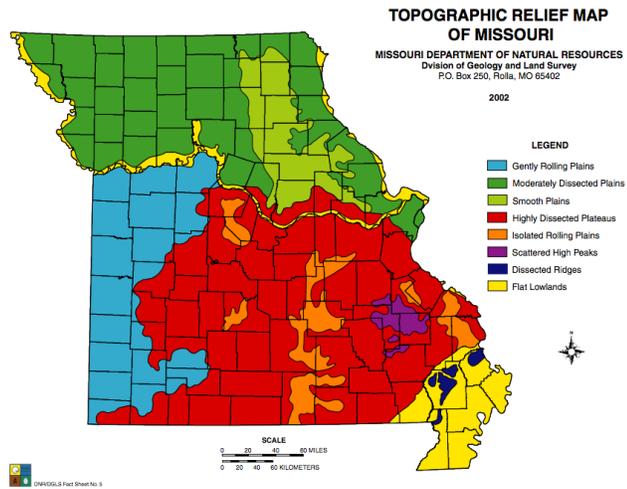
Ty and John

The Ozark Border runs from the Howard and Cooper counties, north and south of the Missouri River respectively. From there, the border follows the Missouri river to meet the Mississippi River in St. Louis, then continues south along the Missouri state border to the southern ends of Bollinger county and Cape Girardeau county. In the first figure, the Ozark Border represents the lighter brown portion of the map. For the most part, the width of the Border only stretches about one county on both sides of the Missouri River and one county west of the Mississippi River.



The main distinctive factor that separates the Ozark Border from surrounding regions is the topography. In the second figure, most of the region is composed of highly dissected plateaus, which is caused by the movement of tectonics plates and pushed the land upwards at a very slow rate, which is caused by the New Madrid Fault. The other parts of the region that aren't highly dissected plateaus are the northern areas and the surrounding area of the Missouri River. In the north lie the smooth plains and along the Missouri River are flat lowlands.

If you drive from St. Louis to Columbia, Missouri, a majority of the ride is going to be flat with only plain and cows on both sides of the highway. Going south towards Cape Girardeau is close to the same thing except south of St. Louis, the highways run through a bunch of rock which was excavated for the purpose of building highways. The Ozark Border is not a very developed region. Outside of St. Louis, Columbia, and Jefferson city, most of the towns are small and rely on the surrounding lands. These large cities in the Ozark border have a lot of asphalt and concrete for roads and buildings, where much of the other small towns have a two lane highway running through it and only a few exits with few restaurants and gas stations.



Another separating factor for the Ozark border is the type of soil that lies in it. Group D hydrologic soils are most commonly found in the Ozark Border region. Group

D soils are characterized by low infiltration rates and the highest potential for runoff. That makes sense since the the Ozark Border rides along the two largest rivers in Missouri. All the rain Missouri receives near the rivers runs off into them. That is the main reason that St. Louis and towns settled next to the rivers experienced flooding this winter. Most of the productive soil in this region is found deep beneath the ground. There are however other soils much shallower in the ground that have derived from bedrock. Much of the rock that composes the Ozark Border is limestone and sandstone.



Both of which can be used in the construction of roads and buildings.

The Ozark Border's rolling river hills make for an area of vegetation that mostly consists of plants common to a deciduous forest biome. The forests consist of the Ozark Border consist of many oak, hickory, and pine trees that thrive thanks to relatively productive soil and water from the various rivers of the region. Some of the plants in the region are

remnants of the last Ice Age, and find comfortable growing areas among the cool caves. Many of their relatives can't be found unless you travel a hundred miles north of the Ozarks. The Ozarks Border region is also home to some desert species of plants, which make their homes on dry, rocky glades.

Vegetation in the Ozark Border region also changes throughout the various seasons. In the spring, spring ephemerals, or short lived plants, bloom on the forest floor because the lack of leaves allows sunlight to hit the forest floor and the weather is just warm enough for them to survive. These consist mainly of trilliums, bloodroot, trout lily, and jack in the pulpit. In the summer, warm weather



and open air allows for pale purple coneflower, butterfly weed, asters, daisies and many others.



The Ozark Border has a wide variety of animals as well. The Ozarks alone are home to roughly two thirds of all threatened and endangered species in Missouri, Oklahoma, Arkansas, and Illinois. The region is teeming with whitetail deer and wild turkey, which make their homes in the forests of the region. Almost two hundred species of birds can be found in the area. European Starlings and House Sparrows are

among the most common birds in the region, but various herons, raptors, owls, and many others can be found as well. The rivers and lakes of the region also make home to various reptiles, such as many species of snakes and lizards. Roughly a hundred fish species live in the region, with largemouth bass, white crappie, and blue catfish being some of the most prominent. Roughly half of the fish in the region live only in this region or have very limited distribution elsewhere.



<http://atlas.moherp.org/missouri/natdiv/>

<http://dnr.mo.gov/geology/adm/publications/docs/map-TopoMo.pdf>

Transactions of the Missouri Academy of Science. “The Natural Divisions of Missouri: An Introduction to the Natural History of the State”

<http://dnr.mo.gov/env/wpp/tmdl/docs/2186-fishpot-ck-tmdl-v2.pdf>

<http://mdc.mo.gov/your-property/greener-communities/missouri-watershed-inventory-and-assessment/bourbeuse-river/geolog>

<https://thelibrary.org/loclist/periodicals/ozarkswatch/ow104a.htm>

“Key features of the Eastern Ozark Border ecoregion are moderately dissected hills, sheer bluffs, and rocky soils.” <http://dnr.mo.gov/env/wpp/tmdl/docs/2186-fishpot-ck-tmdl-v2.pdf> pg. 3

Group D hydrologic soils most common in ozark border at least near fishpot creek

<http://www.nps.gov/ozar/learn/nature/animals.htm>

<http://www.nps.gov/ozar/learn/nature/plants.htm>

http://ozarks.cr.usgs.gov/ozark_environment.htm

<http://www.nps.gov/ozar/learn/nature/loader.cfm?csModule=security/getfile&PageID=3073778>

<http://fishing.mdc.mo.gov/reports/lake-ozarks>

4. Glaciated Plains of Missouri

Connor & Samuel

<http://images.library.wisc.edu/EcoNatRes/EFacs/NAPC/NAPC07/reference/econatres.napc07.rthom.pdf>

Glaciated plains are geographical regions that have been made due to a glacier passing through them. They are most often used for agriculture as they have rich, dark soil. In Missouri, glaciated plains are located mostly above the Missouri River—the plains are both North and South of the Missouri River in the Westernmost region of the state. The glaciated plains cover



58,298 km², or 22,509 mi², which equates to 32.3% of Missouri's total area.³⁹ The topography in this region is younger than the other areas in Missouri. Prairie lands and deciduous forests make up most of the region. Soils are formed from either loess and glacial till or alluvium. Loess is a windblown, in this case blown from the Great Plains, sediment that usually contains clay, sand, and silt. It runs 25 to 100 feet deep in some parts of the glaciated plains.⁴⁰ The small streams that are so common in this area have eroded much of the original surface. Characteristic animals of the region include the following: bigmouth shiners, plains leopard frogs, massasauga

rattlesnakes, horned larks, Franklin's ground squirrels, and badgers. Characteristic flora of the region includes the following: snow trillium, choke cherry, bluejoint grass, and pussytoes.⁴¹

Prior to the glaciated till plains of Missouri being formed, the northern region of Missouri supported much more than merely rolling grasslands with sparse forests. Northern Missouri's deep, fertile soil once supported many different ecosystems—savannas, woodlands, and prairies.⁴² Another name for the northern plains of Missouri is the Central Dissected Till Plains; each of those words mean something. Central refers to the Missouri plains being located in the center of the United States' Midwestern plains. Dissected explains the cutting into the shapes of valleys and hills by erosion. Till is a type of soil that is a mixture of clay and sand among other

³⁹ Richard Thom and James Wilson, "The Natural Divisions of Missouri: An Introduction to the Natural History of the State," Missouri Department of Conservation, Accessed February 10, 2016, <http://images.library.wisc.edu/EcoNatRes/EFacs/NAPC/NAPC07/reference/econatres.napc07.rthom.pdf>.

⁴⁰ "Missouri's Northern Plains." Missouri Department of Conservation. November 22, 2010. Accessed February 10, 2016. <http://mdc.mo.gov/conmag/2005/10/missouris-northern-plains>.

⁴¹ *ibid*

⁴² "Missouri's Northern Plains."

things dropped off by the glacier when it came through this area. Finally, plains as a land description means a relatively flat and wide-open piece of land.

The region of Glaciated Till Plains in Missouri is broken up into three sections—western, central, and eastern—each of the three different in their drainage, topography, and ecosystem diversity. The western section of the glaciated plains is characterized by loess covered topography; it is the driest climate in the state. It covers 16,441 km², or 6,348 mi², and includes the small section of the glaciated plains under the Missouri River. Over half of the area, 56.4%, used to be prairie, before it was settled. Steep loess mounds along the Missouri River are a striking feature of the area. The elevation in the extreme northwestern is about 370 m, or 1,200 ft. The flora of this region is similar to that of the the Great Plains. Hairy and blue grama, large-flowered penstemon, soapweed, and downy painted cup can all be found in abundance. The hognose snake can only be found in this region of Missouri.⁴³ This western section houses four smaller rivers, the Platte, Nodaway, Crooked, and Little Blue rivers.

The central region, known as the grand river section, of the glaciated plains is the largest section, covering 21,103 km², or 8,148 mi², and extends from the northern border of the state to the Missouri River. It contains some loess, but also glacial till. The topography is moderately dissected. The streams in this area flow into the Grand and Chariton rivers and form extensive lowlands. The topography is differentiated by types of soils and river drainage systems. This area houses more deciduous forest and less prairie than is typical of the glaciated plains, though prairies are often found along the Grand and Chariton rivers.⁴⁴ A few marshes are also present in this area.

The eastern section of the glaciated plains drains directly into the Missouri river to the south and Mississippi river to the north. It is the second largest section of the glaciated plains, covering 18,656 km², or 7,203 mi². The area is mostly flat and is full of claypan soils. In this region the plains can be found in the high ground while bottomland forest communities mostly line the rivers. Unlike the first two regions, this one drains into the Mississippi River. In the extreme northeastern portion the elevation runs at around 150 m, or 500 ft while the rim of the region to the southeast, along the border of the Ozark region, has an elevation of about 270 m, or 900 ft.

The final region of the glaciated plains of Missouri is the Lincoln Hills section, a small pocket of land along the Mississippi River. Its area is only 2,014 km², or 788 mi². Unlike the other sections, this area has mostly bedrock geology, suggested that it was less affected by glaciers than the other areas. This means that unlike the rest of glaciated plains it contains barely any prairie lands. The region has many steep areas and lots of exposed bedrock. Caves and passages are not uncommon. Like the eastern section, this part of the glaciated plains drains into the Mississippi River. The flora and fauna has characteristics of the Ozark region of Missouri. Amethyst shooting star, wild sarsparilla, and red-berried elder are all common plants. The long-tailed salamander and Pickerel Frog are amphibians that are also common in the Ozarks.

⁴³ “The Natural Divisions of Missouri: An Introduction to the Natural History of the State.”

⁴⁴ “The Natural Divisions of Missouri: An Introduction to the Natural History of the State.”

Some of these prairies, deciduous forests, and river basins have been irrigated and plowed and are now used for farming purposes. Farming in the glaciated plains regions is mostly corn and soybeans; cattle and pigs are the most common livestock.

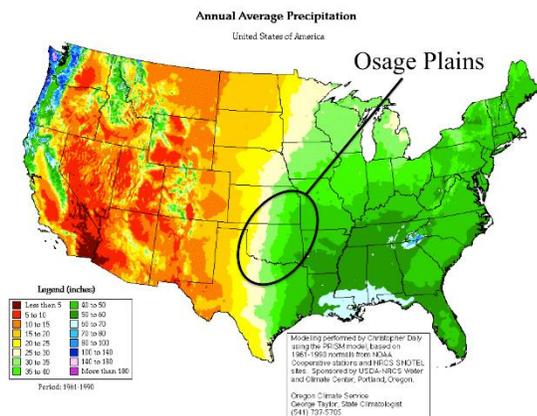
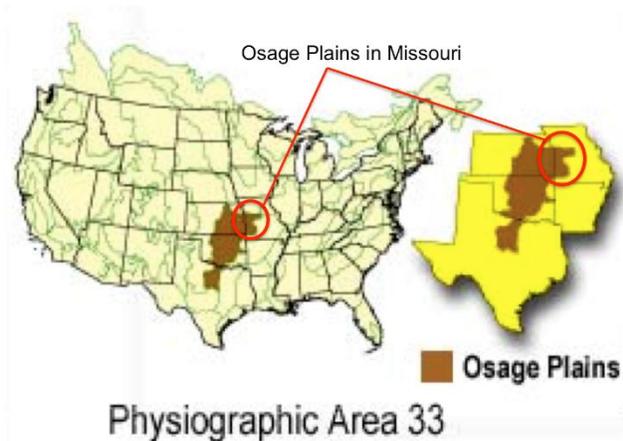
5. The Osage Plain

Michael and David

The Osage Plain is one of the six major geographical regions of Missouri. It lies on the very western border of the state, and continues to the south and west into the states of Kansas, Oklahoma, and Texas. The plain is a prime example of the prairie ecosystem that used to be prevalent in much of the central United States: flat, fertile land dominated by a variety of tall grasses. The Osage Plain forms the eastern border of the vast Great Plains that stretch all the way to the Rocky Mountains in the west.

The origins of the plain date back millions of years, to the Cretaceous Period, when much of central North America was submerged beneath what has come to be known as the Western Interior Seaway, a body of water that split the continent in half. Over the millennia, the shallow sea deposited sediments in the region, as well as carbonates and a variety of Pennsylvanian soils.⁴⁵ As conditions across the globe shifted, the Western Interior Seaway gradually receded, leaving behind the rich, well-graded lands that had once been its seafloor. In addition, a lack of “tectonic activity” in the region for millions of years only maintained the land’s smooth topography, leading to the relatively flat plains that can be seen today.⁴⁶

As a result of its distance from the Rocky Mountains, the Osage Plain receives more rain than other similar regions to its north and west. This is in large part due to the diminished effect of the rain shadow produced by the western mountains; averages range from approximately 25 inches per year to 45 inches per year in others, with rainfall in Missouri being on the higher side.⁴⁷ However, like much of the surrounding area, the Osage Plain is still inclined toward a continental climate, characterized by temperatures that vary wildly over the course of the year, with hot summers, cold winters, and well defined seasons.⁴⁸ Although the temperature changes



⁴⁵ "Osage Plains | Encyclopedia of Oklahoma History and Culture." *Osage Plains | Encyclopedia of Oklahoma History and Culture*. Web. 10 Feb. 2016.

⁴⁶ *Ibid.*

⁴⁷ "Precipitation Maps - Western Regional Climate Center." *Precipitation Maps - Western Regional Climate Center*. Web. 14 Feb. 2016.

⁴⁸ "Osage Plains | Encyclopedia of Oklahoma History and Culture." *Osage Plains | Encyclopedia of Oklahoma History and Culture*. Web. 10 Feb. 2016.

throughout the year, the average annual temperature remains around 60°F, facilitating a fairly long growing season.⁴⁹

The Osage Plains are characterized by their generally flat or gently rolling plains. The Osage Plains have had plenty of access to water which has led to very productive carbon-rich soil. This soil led to flourishing plant life in this region. The plant life of the area mainly consist of the prairie grasses. These prairie grasses include big and little bluestem, Indiangrass, and switchgrass.⁵⁰ One strategy for containing the prairie grasses This soil is equally good for agriculture, so, sadly, much of the original prairie has been converted into farmland used to grow wheat, corn, and soybeans.

Over the millennia, many different groups of people have called the plain home. Firstly was the group after which the area is named: the Osage. The Osage were a Native American tribe that primarily lived along the rivers of the region, leading a lifestyle partly based in agriculture and partly based in hunting bison.⁵¹ In addition to the Osage, other tribes, such as the Kaw and the Omaha, also resided in the region, some pursuing lifestyles more nomadic than those of the Osage, more closely resembling the tribes of the western Great Plains.⁵² However, as the United States expanded westward, most indigenous peoples were stripped of their lands, replaced by homesteaders and pioneers from the east who converted the rolling prairies into fields of crops. Agriculture remains one of the primary economic activities in the plains, though oil production in the area has also been met with success.

⁴⁹ Ibid.

⁵⁰ "Osage Prairie." *Osage Prairie*. Web. 14 Feb. 2016.

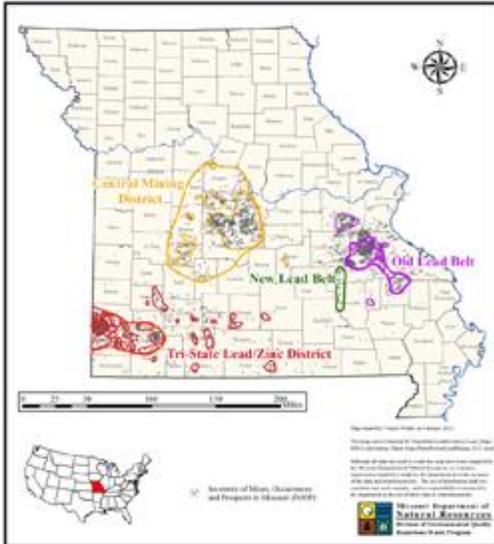
⁵¹ "Osage." *American History*. ABC-CLIO, 2016. Web. 14 Feb. 2016.

⁵² "Osage Plains | Encyclopedia of Oklahoma History and Culture." *Osage Plains | Encyclopedia of Oklahoma History and Culture*. Web. 10 Feb. 2016.

6. Missouri's Lead Mining Industry

Austin and Jacob

There are three main Missouri lead mining districts: The Southeast Missouri Lead District (SEMO), Tri-State District, and the Central District. For most of the 19th and 20th centuries the Missouri lead mining industry has been the largest and most profitable industry in the world. Today it still remains a leader in the lead mining industry.(1) Missouri's state mineral, as expected, is the principal lead ore mineral, Galena.(2)

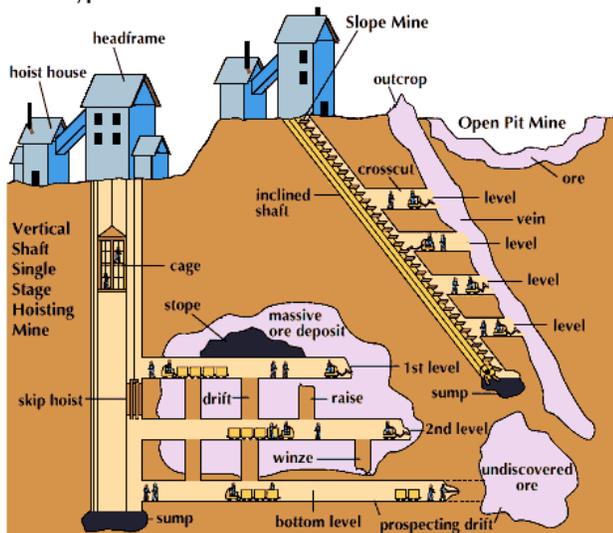


How does lead mining work? Well the process starts when a mining crew drills and blasts at limestone to hollow out an area. Most mining companies use the room-and-pillar mining technique whereby rooms are cut into the lead bed leaving a series of pillars, or columns of lead to help support the mine roof and control the airflow. "These "rooms" stand at least 14 feet high to 32 feet in diameter".(3)

The crew then extracts the ore, which roughly contains about 4% lead, and transports it to a mill for the ore to be processed. At the mill, the ore is ground fine to the consistency of sugar. Next a floatation process separates the lead from other minerals based on their density. The final step is to dispose of the tailings, or leftover mining material. The Doe Run Company, a prominent and powerful private mining corporation in Missouri, claims to store the tailings "on-site in ponds to protect groundwater where the solid

portion of the tailings settle to fill the ponds over time".(4) However, most tailings include many hazardous and life threatening chemicals such as arsenic, mercury, and left over traces of lead. Many scientists agree that disposing of tailings in ponds is potentially hazardous, as it can lead to contaminated water released into the atmosphere as acid rain and polluting our current water sources and endangerment of wildlife due to the toxic chemicals.(5)

Some Types of Mines



The Southeast Missouri Lead District contains the highest concentration of Galena (lead (II) sulfide) in the world. It is galena that is used to produce lead for

common uses such as lead-acid batteries that are used just about everywhere in the world. The figure on the left is the ore galena. Lead is an extremely toxic mineral that acts as a fatal poison when humans are exposed to it for extended periods of time—



© Dakota Matrix

lead poisoning. Lead is a mineral that is not naturally broken down by any natural organisms, so when a living organisms are exposed to lead, the toxic mineral remains in their system, building up over time to a possibly fatal level. SEMO has therefore experienced a variety of environmental concerns due to the high levels of lead mining on the area. The high levels of lead mining have directly caused the contamination of nearly all of the drinking water sources in the area. This contamination has not only jeopardize the health of humans in the area, but also other wild life. The lead exposure levels magnify

itself up the food chain. The lead builds up as it gets consumed by each organism in the food chain. The magnification is extremely hazardous for those who hunt game in the area, which happens to be a large portion of the population. Birds and deer that are further along in the food chain contain dangerous levels of lead that has built up. The lead in SEMO is affecting all life in the area and has completely devastated the environmental ecosystem that once stood stable. The U.S. Fish and Wildlife Service's estimate 10.8 millions dollars to create a few wetlands in contaminated areas and restore some mining damage— not even the full cost of repair for the area. (6)

The Tri-State Missouri Mining district is located in the far south-eastern portion of the state of Missouri. Mining and production of lead in the Tri-State District started back in the 1850's and has continued ever since. This mining region extends itself well into the Oklahoma and Kansas, but the highest concentration of galena still resides in the Missouri's section of the district. (7) The District produces about 50% of the United States lead supply. (8) The Tri-State District ranks second in the world as a lead producer, right behind it's close neighbor SEMO. The Tri-State district's mining has of course led to many environmental concerns in the area. The "Tri-State Mining District, that encompass multiple Superfund sites, has contributed to the destruction of thousands of acres of land, and hundreds of miles of contaminated streams". The Tri-State District's high levels of lead mining have produced environmental impairments very similar to it's neighbor SEMO. Unlike SEMO however, the Tri-State District has no restoration plan currently in congress like SEMO's. So the Tri-State district currently has no efforts being put forth to restoration and decontamination of local streams and lakes.(9) Action to restore the environmental travesties created by the huge mining corporations in the Tri-State and SEMO mining districts should be taken. But so long as lead mining remains to be as profitable and abundant the mining will continue.

Congress will hopefully eventually pass some bills that impose restrictions on major mining companies that improve the negative impact mining has on its surrounding environment.

The Central District is certainly the least prominent of the three mining districts referenced. The district spans across a 600 square mile area centered around the Lake of the Ozarks and across multiple different counties. After 1910, the district produced barite with lead as a by-product as a result. Numerous deposits of barite, lead and zinc were produced throughout the district's usage until production ended in 1950. Mineralization was found as vein and fracture fill, breccia cement, solution channel and "pocket" fill, replacement of host rocks, filled sinkholes, and as a residual material. In many cases the old lead pits were used as an exploration guide for barite mining, and led to considerable recovery of the remaining galena which was thereafter smelted for lead.(10) In addition to galena and barite, the ores contain some copper as chalcopyrite, malachite and azurite (copper oxides). The barite contains up to two percent strontium. Clearly, the large variety of ores lessened the success of the district as they were unable to hone in on one specific mineral to spend their efforts on.

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- 5 ibid
- 6 "U.S. Fish and Wildlife Service: Environmental Contaminants in the Midwest Region." *U.S. Fish and Wildlife Service: Environmental Contaminants in the Midwest Region*. N.p., n.d. Web. 15 Feb. 2016. <http://www.fws.gov/Midwest/es/ec/index.html>
- 7 ibid
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- 10 ibid

7. Big Rivers

Andrew and Justin

Missouri features the convergence of two of the largest rivers in the United States: the Missouri River and the Mississippi River. In the early 1900's, the desire to settle in the midwest United States created the demand for the Missouri River's channel modification. Before settlement, the river was braided, meaning it consisted of small channels that diverge and converge several times (see Figure 1 below). As a result of the deepening of the river channel between 1879-1972, 50% of the original surface was lost because the river's path morphed.⁵³ During this time period, much of the habitats surrounding the river, such as marshes, forest, and plains, were converted into agricultural land. The Mississippi River, however, hasn't undergone extensive change like the Missouri River. The primary change to the Mississippi's flow is the addition of locks and dams that promote shipping.⁵⁴ This system of locks and dams has created large pools of water, which allow barges to more easily navigate up and down the river. The drawback, however, is that the locks and dams disallow sediments to be deposited over the entire floodplain because the river is directed into one singular channel.⁵⁵ These big rivers divide Missouri into four specific river sections, all with their own unique geography, soil, vegetation, and fauna. Though these river sections vary in characteristics, it is not a permanent difference; the rivers continually undergo change.

The Missouri River is broken up into two sections: the Upper Missouri River and the Lower Missouri River. While both sections are a part of the same river the geography that surrounds each of the sections can be vastly different. For example, the resettlement terrestrial vegetation was comprised of about one third prairies while the Lower Mississippi is void of almost all prairies. The start of the Upper Missouri River can be designated as anything before the Gavin's Point Dam near Sioux City, Iowa which is the last of the 15 hydroelectric dams on the river. The Lower Missouri River is the 840 mile section before it merges with the Mississippi River just above Saint Louis. In comparison to the Mississippi River, the Missouri has a much higher content of silt which allows you to distinguish the two rivers when they merge (see Figure 6 below). Seaside crowfoot and spurge are two plants that are generally restricted to the Upper Missouri River (see Figure 7 and 8 below). Common plants also include reed and great bulrush. Some characteristic animals of the region are flathead chub, dock, western silvery minnow, and the western massasauga rattlesnake. The Lower Missouri River's predominant vegetation was bottomland deciduous forest while prairies made up only about 0.4% of the vegetation⁵⁶. The more common plants found in this area are swamp white oak, spicebush, and deciduous holly while the common animals are the flathead chub and freshwater drum⁵⁷.

⁵³ *Transactions of the Missouri Academy of Science*. Columbia, MO: Mo. Acad. of Science, 1975.

⁵⁴ *Transactions of the Missouri Academy of Science*.

⁵⁵ "Locks and Dams and River Navigation." *Big River Citizens Education Guide*(n.d.): n. pag. Department of Natural Resources. Missouri Department of Natural Resources. Web. 10 Feb. 2016.

⁵⁶ *Transactions of the Missouri Academy of Science*. Columbia, MO: Mo. Acad. of Science, 1975

⁵⁷ IBID

Similarly to the Missouri River, the Mississippi River is divided into an upper section and a lower section. Geographically, the Upper Mississippi section starts at the lower end of the Des Moines River in Iowa, which flows into the Mississippi River at the northeast corner of Missouri. The river section continues south, containing all of the bluffs and flood plains near the river, and ends north of the Mississippi's confluence with the Missouri River. As for the lower region of the Mississippi, it begins with the intersection of the Mississippi and Missouri rivers and stretches to Missouri's southern border with Arkansas (see Figure 2 below)⁵⁸. There are three main differences between these two regions: turbidity, original vegetation, and fauna. The turbidity of the water refers to the cloudiness or discoloration of the water, which is related to water quality. The Upper Mississippi River section possesses less turbid or clearer water compared to the Lower section.⁵⁹ This makes sense because the Upper region is north of the Missouri River intersection and doesn't have any major river sediments or big city pollutants entering the Mississippi, whereas the Lower section does. Along with turbidity, the original vegetation of these regions differ. The term "original vegetation" refers to the land as it was prior to its settlement and development. The Upper section of the Mississippi was mainly deciduous forest with occasional prairie land. This type of vegetation featured plants such as bulrush, white oak, and silver maple (see Figures 3-5 below). The Lower Mississippi region is primarily swampy forest, containing oak trees, raccoon grapes, and swamp privet.⁶⁰ With the contrasting vegetation and turbidity of the two Mississippi River sections, there are also differences in animal life. Both regions have bass, bluegill, and catfish, but a few Upper region specific animals are the spottail shiner, carpsucker, Illinois mud turtle, and the Blandings turtle.⁶¹ The Lower Mississippi region is home to the mimic shiner and bowfin fish.⁶²

⁵⁸ *Transactions of the Missouri Academy of Science.*

⁵⁹ *Transactions of the Missouri Academy of Science.* Columbia, MO: Mo. Acad. of Science, 1975.

⁶⁰ IBID

⁶¹ IBID

⁶² IBID



Figure 1



Figure 2

Silver maple leaf



Figure 3



Figure 4



Figure 5

Figure 6

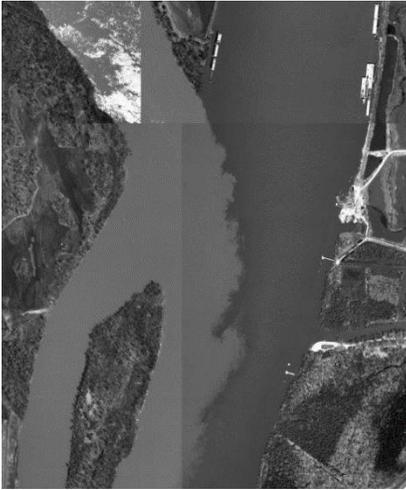


Figure 7



Figure 8



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8. Mississippi Lowlands

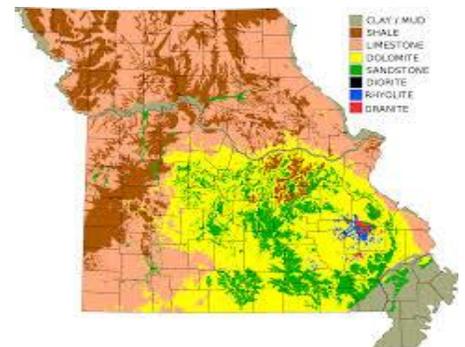
Sam and Justice

The state of Missouri is essentially divided up into six distinct geological regions. These consist of Glaciated Plains, the Osage Plains, the Ozark Border, the Ozarks, the Big Rivers, and the Mississippi Lowlands. Our group will be discussing the Mississippi Lowlands which are located in the Southeastern portion of Missouri along the Mississippi River.⁶³



This area is essentially a floodplain, a basin into which the Mississippi River can flood. Due to erosion over long periods of time, the area has become flatter. Compared to the Ozarks directly to the West of the Lowlands, the area is generally quite flat with hills that rise slowly rather than sharply as in the plateaus of the Ozarks. The terrain is less elevated in the Lowlands because it acts like a basin which water flows into often.⁶⁴

The lowlands' soil is made up primarily of clay and mud due to the flooding and erosion of rocks from the river.⁶⁵ The land formations are most recent in the Lowlands as well, due to the constant sedimentary activity from the river. Clay minerals act as "chemical sponges" which hold water and dissolved plant nutrients weathered from other minerals. Due to clay's ability to hold minerals and water so well it is perfect for forming a flood basin. Clay can take in many good and many bad particles, such as water, nutrients, salt, pollutants, etc. This makes clay very fertile sometimes, and very harsh on vegetation in other cases, depending on what is absorbed and how hardy the plant is.⁶⁶



I drove through the Mississippi Lowlands on my way home from Alabama on Saturday. The area has plentiful farming activity. Actually, it is the most farmed region in the state with soybeans and rice being particularly



⁶³ <http://extension.missouri.edu/p/G9479>

⁶⁴ https://topocreator.com/download_city_a.php

⁶⁵ http://www.ehow.com/about_6401797_clay-soil-formed_.html

⁶⁶ <http://www.oakton.edu/user/4/billtong/eas100/clays.htm>

plentiful.⁶⁷ Also, as we eluded to earlier, the area is largely a drainage basin for the Mississippi River (see photo). There were sandbags along the highway for around twenty to thirty miles to prevent water from getting on the roadways.⁶⁸

The indigenous, not crop growth in the area is rather limited. The area is home to standard types of grasses, shrubs, and trees. These trees are almost entirely deciduous as opposed to some of the evergreens you might encounter should you continue to drive South. The flora in the area includes tupelo, bald cypress, snowbell, pumpkin ash, and corkwood.⁶⁹ Pictured to the left is a bald cypress tree. In the more hilly areas of the lowlands, the trees are mostly beech with sine holly and black chokeberry plants.⁷⁰



The fauna of the area includes animals such as the Mississippi mud turtle, spring cavefish, western mud snake, green tree frog, prothonotary warbler, rice rat, and swamp rabbit.⁷¹ Most of these animals are small and camouflaged due to the open spaces of the Mississippi Lowlands. If instead, these animals were larger and more easily seen, they would like be preyed on by larger predators or killed by humans. The camouflage coloration of the animals is generally a muddy brown, sometimes mixed with colors like dark green, perfect for the clay/mud makeup of the ground and water, and the dark vegetation around it.



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⁷⁰ http://msucare.com/news/print/sgnews/sq13/images/sq20130204_trees_cypress.jpg

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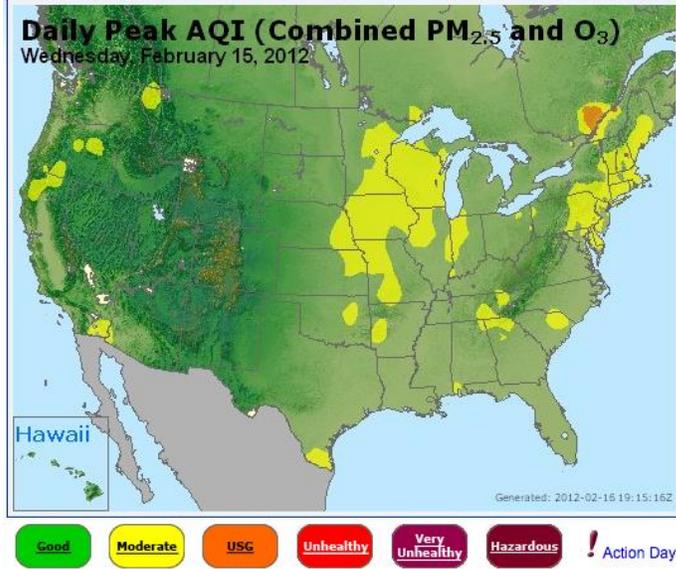
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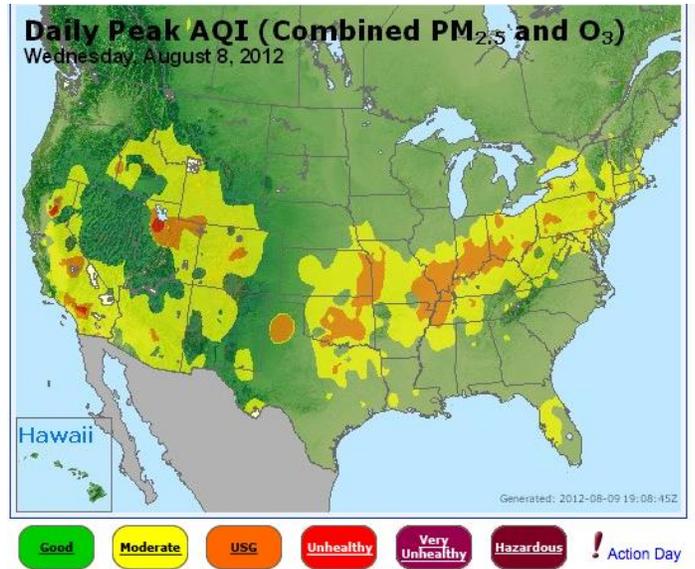
9. The Air Quality of St. Louis

by: Michael and Tim

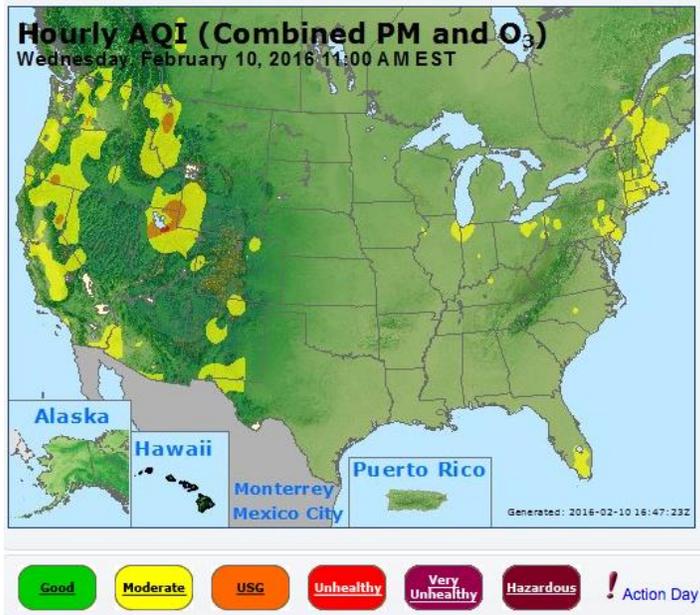
Air quality Winter 2012



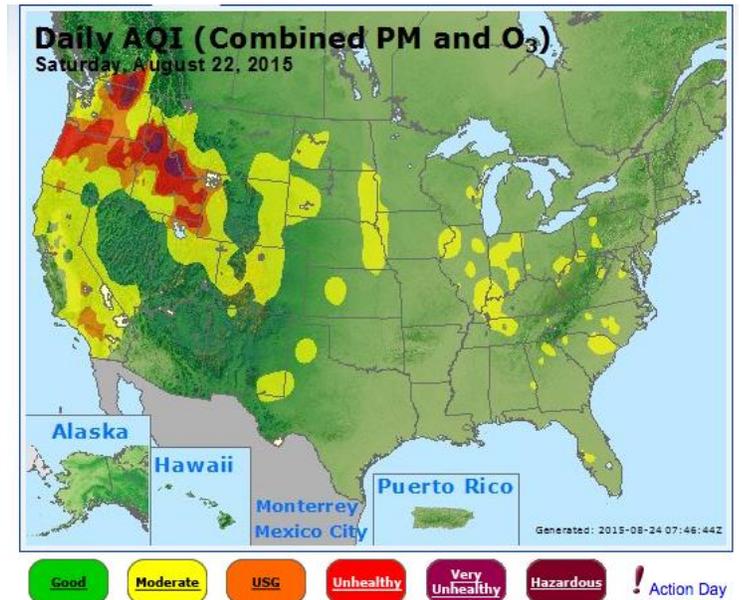
Air quality Summer 2011



Current Air Quality, Winter 2016



Air quality of summer 2015



Maps courtesy of http://www.airnow.gov/index.cfm?action=airnow.local_city&cityid=105

Everyday when many students drive home from school they drive under the science center. The science center is really just what it sounds like, a center for science that hosts schools and visitors on a daily basis. A portion of the center extends across the highway and on this portion of the building is a sign that reads, “today’s air quality is…” Under this reading is a circle representing the quality of the air that day whether it be a green-good air quality day, a yellow-moderate day, or a red-unhealthy day. Most days it is green but on the days it is not it makes you think about why the air quality isn’t green.

The air quality of St. Louis, Missouri has improved over the years according to the maps of air quality above. Air quality tends to be worse in warmer months seeing that the maps are littered with darker colors in the summers as compared to the winters. The trend looks as if the midwest has made more improvements to their air quality since 2011-2012 than the east and west coasts have.

The air quality of an area is measured by AQI. The AQI Index is the standard of reporting air pollution values. Most days in St. Louis are green, which is good, but sometimes a yellow or orange day will find its way into the mix. These non-green days are especially bad for those with asthma or respiratory issues.

Forecast	AQI Range	Weather Conditions	Health Information
Green (Good)	0 - 50 AQI	Cool summer temperatures, windy and/or cloudy, recent rain or cool front	None
Yellow (Moderate)	51 - 100 AQI	Temperatures mid 70's or above, light winds, sunny skies	Very sensitive individuals, people with respiratory disease should <u>limit</u> prolonged exertion outdoors
Orange (Unhealthy for sensitive groups)	101 - 150 AQI	Temperatures 80's or above, very light winds, sunny skies, hazy, hot	HEALTH NOTICE: Sensitive children and adults and people with respiratory disease, such as asthma, should <u>limit</u> prolonged, moderate exertion outdoors.
Red (Unhealthy)	151- 200 AQI	Hazy, hot (90's) and humid	HEALTH ADVISORY: Sensitive individuals, people with respiratory disease should <u>avoid</u> exertion outdoors. Others should limit prolonged or vigorous outdoor exercise

chart courtesy of <http://www.cleanair-stlouis.com/air-quality-index.html>

Much of air quality issues that St. Louis faces today originate from the practices that took place at the beginning of the 20th century. As St. Louis became more industrialized there were no regulations or laws in place to limit what businesses were allowed to throw away or release into the atmosphere. As a result, St. Louis became progressively more affected by pollution as the century went on. In the 1930’s air pollution began to become an issue that St. Louis could no longer just ignore as black coal smoke began to envelope the city.⁷²

St. Louis has been steadily improving its air quality conditions. The area has been working to pass legislation for years in order to finally meet federal air standards. “The St. Louis region was designated in 1992 by the Environmental Protection Agency as a moderate “non-attainment” area for ground-level ozone and fine particulate matter. However, the air quality in

⁷²"Focus St. Louis." Regional Air Quality. Accessed February 15, 2016. <http://www.focus-stl.org/?page=RegionalAirQuality>.

the region has improved somewhat, and in 2012, the region was re-designated as a marginal non-attainment area, based on the current 2008 standard.”⁷³

Although St. Louis is improving its air conditions, there are still many health risks that we are aware of. Due to our current air pollution many St. Louis residents expose themselves to the potential health risks of asthma. “The FOCUS St. Louis Environmental Sustainability Roadmap published in 2009 states that while the region’s air quality had steadily improved over the last 15 years, St. Louis still experienced an average of 13 days per year where ozone measurements exceeded the health-based standard, at the time ranking sixth, tied with Cleveland. In fact, the St. Louis region over the past decade has consistently ranked in the top ten cities for asthma risk. In 2011, the Missouri Department of Natural Resources decided not to fund the St. Louis City and the St. Louis County Air Pollution Control Programs. Instead DNR is doing the work itself, believing that it can fulfill the responsibilities of the local programs at significant cost savings. According to an August 19, 2011 Post Dispatch article, DNR officials are confident they can do the same job with less money. Air-quality advocates such as the St. Louis Clean Air Partnership are also concerned. What’s at stake is the quality of the air we breathe, and the health of the public, especially those suffering with asthma and related ailments.”⁷⁴

There are many groups currently working to confront St. Louis air pollution issues. “Aside from the Missouri and Illinois Departments of Natural Resources, the St. Louis Clean Air Partnership and the American Lung Association have played a major role to ensure that the St. Louis region has clean air. The Sierra Club of Eastern Missouri and the Illinois Environmental Protection Agency have also worked to improve air quality in the region.”⁷⁵

In 2013 St. Louis was ranked as the 12th worst U.S. metropolitan area for particulate pollution with an emphasis that ozone was the problem. The American Lung Association released the report with this ranking and sadly cities in general don’t improve upon their grades from previous years as was the case in 2013 from previous years. The American Lung Association did say that the overall long term trend of improving air quality in St. Louis is looking good. ⁷⁶

Here are some facts on St. Louis and air pollution.

- St. Louisans make 7.2 million vehicle trips each day. Of these trips, 5.3 million are single-occupancy trips.
- In 2013 alone, St. Louisans drove over 67 million miles per day.

⁷³ "Focus St. Louis." Regional Air Quality. Accessed February 15, 2016. <http://www.focus-stl.org/?page=RegionalAirQuality>.

⁷⁴ "Focus St. Louis." Regional Air Quality. Accessed February 15, 2016. <http://www.focus-stl.org/?page=RegionalAirQuality>.

⁷⁵ "Focus St. Louis." Regional Air Quality. Accessed February 15, 2016. <http://www.focus-stl.org/?page=RegionalAirQuality>.

⁷⁶<http://news.stlpublicradio.org/post/report-shows-increased-air-pollution-st-louis-region-long-term-trend-still-improving>

- The most recent mobility study from the Texas Transportation Institute found that St. Louis area motorists spent over 49.6 million hours in traffic, wasted 21.6 million gallons of fuel and doled out \$1.1 million in congestion costs in 2011 alone. [[Source 2012](#)]
- One person riding in a Vanpool/Carpool instead of a car can save the environment 225 pounds of harmful emissions every year.
- The highest rate of asthma hospitalizations and emergency room visits in Missouri were in Kansas City Metro and St. Louis Metro regions. [[Source 2012](#)]
- According to the Missouri Department of Health and Senior Services, about 10.2 percent of adults in the St. Louis metro region are living with asthma. [[Source 2014](#)]
- Some areas of St. Louis are estimated to have 15-20% of children who suffer from asthma, and up to 50% of children experience some type of asthma-like wheezing or chronic cough.

Facts courtesy of <http://www.cleanair-stlouis.com/air-quality-facts.html>
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10. The Ozark Region

Joe and George

Missouri Natural History

2-11-16

When many people hear about the Ozark region they think of the Lake, and while that is a part of it, the region is much larger. The Ozark region is approximately 50,000 square feet in size; roughly the size of the state of Florida with approximately 33,000 square feet of this region located in Missouri. It covers ninety three counties in four states: Missouri, Arkansas, Oklahoma, and Kansas. The borders of the Ozark Region are marked by major rivers, “the Mississippi River on the east, the Missouri River on the north, and the Grand River on the southwest.”⁷⁷ The Ozark region exhibits unique topography, soil conditions, flora, and fauna.

The Ozark region prides itself on being one of the purest, most untouched places in the United States. Including riverways, forests, and lakes, the Ozark Plateau home to some of the most diverse wildlife in the midwest. Representing a vastly undiscovered region, and containing many national parks with conservation efforts, the Ozarks are an important part of Missouri’s geography. The unique topographic features came about millions of years ago when the area was totally submerged under water. The region was “continuously uplifted” again and again until the hilly valleys and beautiful scenery emerged and formed what we see today. The effects of weathering and other conditions has shaped the Ozark region into more than just a plot of land; it is now the pinnacle of Missouri beauty, abundant in natural resources. The National Scenic Riverways Park is a landmark in the region, home to the Current and Jacks Fork rivers, providing kayakers a crystal clear, cold river to float. Other recreational activities could be camping, biking, and hiking. The multitude of fish in the rivers makes fishing for trout, bluegill, and other sea creatures a breeze. Other animals include rabbits, badgers, deer and snakes. there have been a few reports of black bears and mountain lions, though they are not very common in Missouri. Due to all the undeveloped area in the Ozarks, the population is low. Only a few small towns are in the region, maintaining the diverse wildlife culture. The valleys, rivers, and exclusive features make the topography of the Ozark region a joy to witness.

The Soil of the Ozark region is made up of large amounts of limestone, and isn’t suitable for farming. A lot of the land in the Ozark region is legally protected and clovers are naturally growing. Some describe the soil as a “Clover Soil” because of the abundance of clovers growing. Beneath the thin top layer of soil there can be found large amounts of rock and clay. The rock found in the Ozark region is some of the oldest rocks found in the midwest region. The reason for the existence of old rock that hasn’t eroded is that it is a rock called chert. Chert isn’t very susceptible to erosion, so many of it still remains while other rocks such as limestone have eroded. Chert was used by ancient civilizations as cutting tools and points on arrows because of its sharp structure.

The soil of the Ozark region isn’t the same in all parts. While most of the area is made up of infertile stony-clay soil, other parts are made up of fertile, loess-capped soils. Loess soil is a very unique aspect of the Ozark region because it only covers “approximately 10% of the

⁷⁷ <https://thelibrary.org/lochist/periodicals/ozarkswatch/ow104a.htm>

Earth's surface.”⁷⁸ Loess soil is “composed largely of silt-size grains that are loosely cemented by calcium carbonate.”⁷⁹ Loess soils are generally deposited by winds and can be found in valley regions and around large plains. Those areas are where much of the population has settled.

Another aspect of the Ozark region is its flora. The Ozark has a wide variety of areas for different plants to grow. The mountains and wooded areas are made up of white oak and shortleaf pines. There are also many smaller trees such as the redbud and dogwood. Along the river banks the most common types of trees are sycamore and cottonwood.

There are many caves and other damp regions in the Ozark, that unique climate allows for the growth of the “walking fern.” Walking ferns are typically found in cool damp places: around caves, near fresh water springs. Other plants that grow in freshwater include watercress and the less common ivy leaved duckweed.

Many of the open fields in the Ozarks have been taken over by foreign grass such as red fescue. There are still many native grasses, on in particular is the Big Bluestem (pictured to the right). The Big Bluestem grows best in acidic soil and generally grows to 5-8 feet tall. Some common wildflowers in the area include the fire pink, larkspur, purple coneflower, and the columbine. There have also been recent discoveries of rare wildflowers such as the monkshood (picture to the right). Tim Smith; a Botanist at the Missouri Department of Conservation believed it to be a “wildflower that is very different from any others we have in the state” and described it as “a blue flower that has a hood at the top of the flower.”⁸⁰



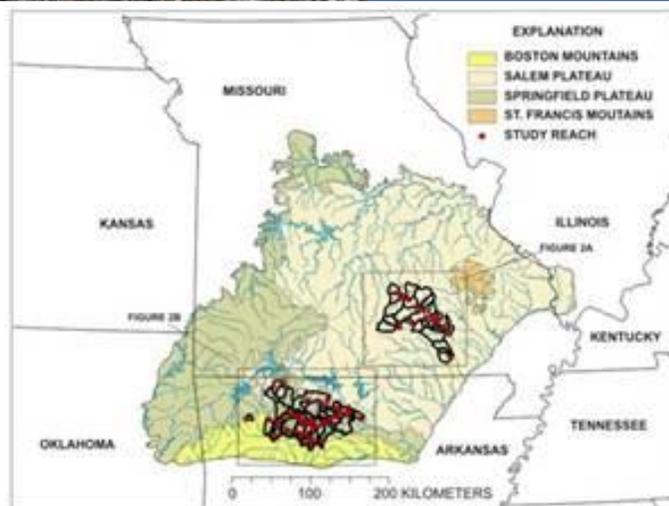
Fauna (animal diversity) is also an important aspect of the Ozark Region. “Over 200 species are largely restricted to the Ozarks, of which approximately 160 species occur nowhere else in the world.”⁸¹ Many of the animals in this region are common to the normal forested region like deer, reptiles, and small critters such as squirrels and birds. The diverse wildlife however can be attributed to the variations of these “typical” creatures. Mountain lions, black bear, wild turkey, and bald eagles are but a few of the examples of the many animals that populate this region. The extraordinary impact these animals have on the region is sometimes underappreciated, and the beauty they bring to the Ozarks can be found nowhere else in the world, making this place a wonderful relaxation spot.

⁷⁸ gec.cr.usgs.gov/archive/eolian/task2.shtml

⁷⁹ www.britannica.com/science/loess

⁸⁰ <http://www.nps.gov/ozar/learn/nature/monkshood.htm>

⁸¹ http://ozarks.cr.usgs.gov/ozark_environment.htm



<http://mdc.mo.gov/your-property/greener-communities/missouri-watershed-inventory-and-assessment/bourbeuse-river/geolog>

Within the Ozark region soil types are variable, generally having infertile, stony clay soils in some areas and fertile, loess-capped soils in others (MDNR 1986). Stony cherty soils characterize much of the Ozarks. Clarksville is excessively drained and formed in cherty dolomite and limestone residuum. On the surface the soil is a very cherty silt loam underlain by very cherty, silty clay loam (Allgood, F. P. and I. D. Persinger 1979). Lastly, Coulstone is a deep, somewhat excessively drained soil formed in sandstone and cherty dolomite on side slopes of ridges.

Chert info:

http://www.kgs.ku.edu/Extension/ozark/OP_factsheet1.pdf

Links:

http://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/missouri/reconozarkMOAR1914/reconozarkMOAR1914.pdf

<http://dnr.mo.gov/pubs/pub655.pdf>

11. Seismology in Missouri

Joe and Andrew

The New Madrid Seismic Zone (NMSZ) is the most active fault line in the United States. The fault line stretches from the southern United States through Missouri, with the most activity along the south-eastern corner of the state.⁸² Small earthquakes



happen every day in this area and, while they are typically small enough that humans do not notice them, the movement can still be recorded on seismographs. Since the daily earthquakes are very small, Missourians' lives is generally unaffected by the earth's movement. However, judging by the fault's size and depth, it is clear that it has the potential to cause widespread damage.⁸³

It is because of this potential for damage that Missourians are taught earthquake preparedness and proper procedures in the event of an earthquake. Because the fault is so close and so deep, it is important to be prepared, just in case an earthquake larger than the daily ones occurs. Preparing and planning is necessary for earthquake safety, and that is why Missouri schools and businesses continually rehearse and revise their responses to the challenges a major earthquake could pose.⁸⁴

A popular and effective response to a large earthquake is to “drop, cover, and hold on”. This mostly pertains to people who are in modern, structurally sound buildings, and it states that, when an earthquake hits, everyone should get on



⁸²<http://www.hometowndailynews.com/2016/02/07/earthquake-awareness-month-in-missouri-focuses-on-preparedness/>

⁸³ <http://dnr.mo.gov/geology/geosrv/earthquakes.htm>

⁸⁴ http://sema.dps.mo.gov/earthquake_preparedness/

the floor, crawl under a table or desk with sufficient coverage, and hold on to something for stabilization.⁸⁵ In the same fashion as fire, flood, and tornado safety, earthquake safety is important and valuable and has the potential to save lives in the event of an emergency.

One such emergency was on February 7, 1812, when Missouri was struck by one of the largest earthquakes ever to hit the nation. It was actually the third and largest earthquake in a series of powerful earthquakes in 1811-1812.⁸⁶ The magnitude

of this particular earthquake was so immense that it altered the flow of the Mississippi River and reportedly rang church bells hundreds of miles away. The damage from these combined earthquakes, and especially the final one, was historically catastrophic.

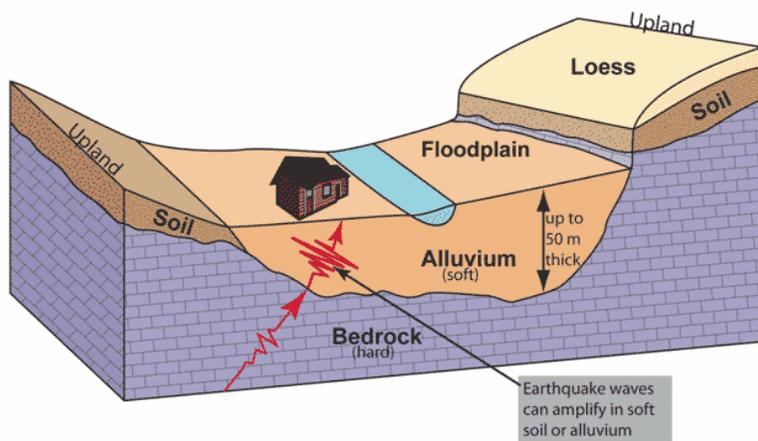
Because of these earthquakes that culminated

in February 1812, the month of February is dubbed "Earthquake Awareness Month" in the state of Missouri. The month is an opportunity to educate people about the real risk of another catastrophic earthquake occurring in the NMSZ. After all, the study of this seismic zone does not predict when an earthquake will strike but, rather, informs people that a potential large earthquake still poses a threat to the area.



⁸⁵<http://www.hometowndailynews.com/2016/02/07/earthquake-awareness-month-in-missouri-focuses-on-preparedness/>

⁸⁶ <http://earthquake.usgs.gov/earthquakes/states/events/1811-1812.php>



Studying active NMSZ faults are fairly difficult because they are not expressed at the ground surface where they can easily be observed.⁸⁷ The faults are hidden beneath 100-to 200- foot thick layers of river deposits called alluvium. Fault scarps and traces erode in soft alluvium in a short amount of time, quickly hiding any evidence

of a fault and thereby making it almost impossible to study and analyze them. Other faults, such as those in California, are much easier to study because rocks are near or at ground surface.⁸⁸ The knowledge we obtain about some NMSZ faults are through seismograph readings from small frequent earthquakes. Currently we have St. Louis University, University of Memphis, the U.S. Geological Survey, and University of Kentucky controlling and monitoring 30 seismograph stations for the NMSZ faults and the Central U.S.

Due to harder, colder, and drier nature of the earth's crust in the Central U.S., earthquakes in the region damage approximately 20 times more land than those that occur in California. Although large earthquakes occur less frequently in the NMSZ than they do in California, the long term average quake threat, in terms of square miles affected per century, would be about the same.⁸⁹

The fault that runs through Missouri has had significant historical significance in the past, and even now it possesses the potential for another massive event. In the face of all this, Missouri has learned more about the NMSZ and has become better prepared in emergency protocol.

<http://dnr.mo.gov/geology/geosrv/geores/techbulletin1.htm>

<http://dnr.mo.gov/geology/geosrv/earthquakes.htm>

<http://www.hometowndailynews.com/2016/02/07/earthquake-awareness-month-in-missouri-focuses-on-preparedness/>

<http://www.cusec.org/earthquake-information/new-madrid-seismic-zone.html>

⁸⁷ <http://dnr.mo.gov/geology/geosrv/geores/techbulletin1.htm>

⁸⁸ <http://dnr.mo.gov/geology/geosrv/geores/techbulletin1.htm>

⁸⁹ <http://dnr.mo.gov/geology/geosrv/geores/techbulletin1.htm>