

PONDEROSA PINES IN THE BLACK HILLS OF SOUTH DAKOTA

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12/7/17



TABLE OF CONTENTS

General Geography of the Black Hills and Ponderosa Pines	1
Elevation	2
Aspect	3
Geology	4
Soil Depth	5
Types of Soils	6
Soil K-Factor	7
Development	8
Bibliography	9

GENERAL GEOGRAPHY OF THE BLACK HILLS AND PONDEROSA PINES



**Map of the Black Hills*

The Black Hills is an island in the middle of an arid plain, that measures 50-70 miles. Consider an outlier from the Rocky Mountains, it is home to a plethora of geological formations; some of which make our national monuments, like Mt. Rushmore. Many of the rocks and granites date back a billion plus years.

Being an 'island' in the middle of an arid plain, it has a much different climate than the surrounding region. It has distinct season, cold winters, and warm summers. With it's humid climate, brings much more precipitation compared to surrounding regions.

With this combination of geological formation and composition, as well as modified climate, the Black Hills is home to lots of different vegetation; one of them being the Ponderosa Pines. The pines are spread across the Western USA, but are also largely in the landscape of the Black Hills.

The Ponderosa Pines dominate the Black Hills, and have only expanded since fire suppression done in the 20th century. There black shade is what gives the hills their name. Within the study site, they comprise about 24,993 acres. The Black Hills are a great location due to the elevation being a high haven in a fairly barren landscape. It also is composed of many soils that are permeable. This permeable soils allows the trees from being over irrigated, which can be a problem when it comes to the Ponderosa Pines.

The pines have a deep tap root, and is heliophytic, meaning it is attracted to the sun. It is noted in the "Plant Guide" by USDA that a 50% increase in shade has a large effect on growth.



**Image of a Ponderosa Pine*

ELEVATION

Suitable Elevations for Ponderosa Pines; Black Hills, SD



Source: EROS Data Center

Map produced by: Tyler Dardis

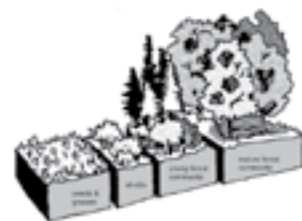
**Map of elevations suitable for Ponderosa Pines*

When looking at elevation in relation to where Ponderosa Pines grow, there is a fairly clear line where they become productive. This line seems to be at 1,250 meters. Below that, there are limited to no pine growth; though there does seem to be more than usual on the hogback ridge.

It was also noted by Sheppard and Battaglia that due to the Black Hills microclimate, the high elevated regions receive more precipitation compared to lower elevations.

Finally, the USDA “Plant Guide”

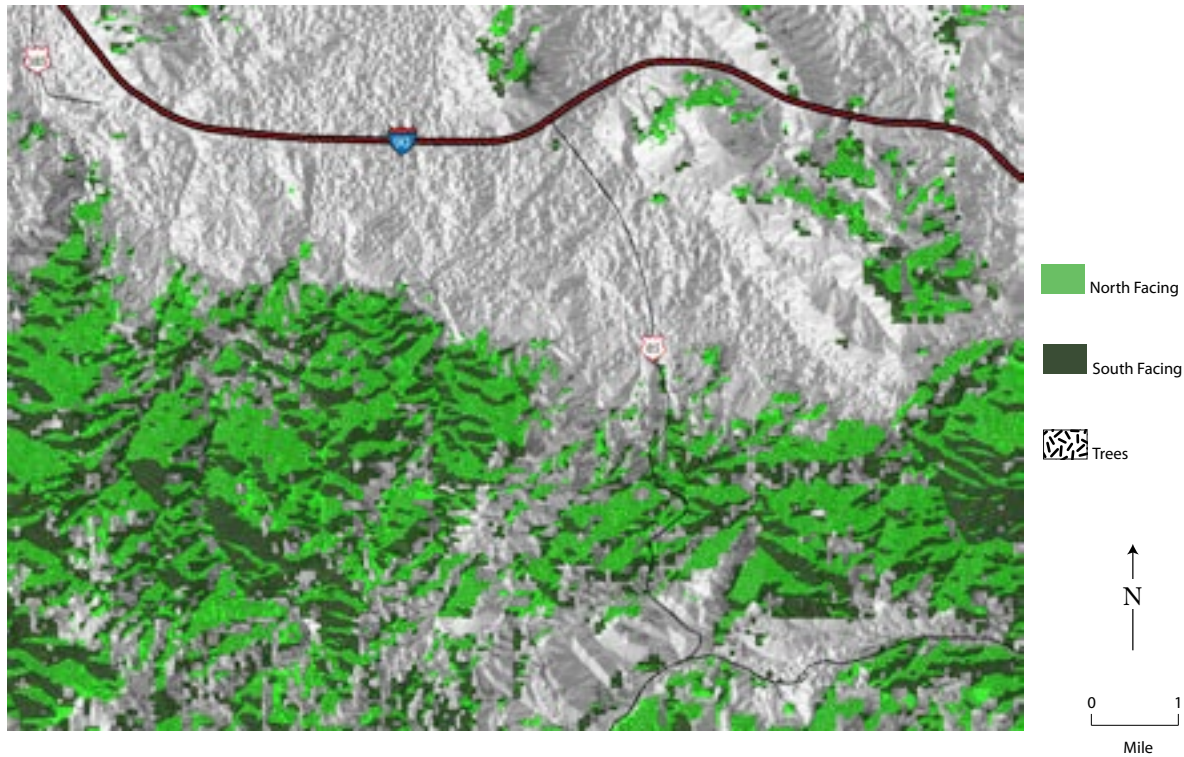
states that Ponderosa Pines grow anywhere from sea-level to 3,000 meters. The pines that grow at high elevations are mid-successional species; which defined by ecoplexity.org, means “the forest is dominated mostly by well-developed full-canopied trees, numerous shrub species, and a somewhat diverse developing plant understory.”



**Example of forest succession*

ASPECT

North v. South Facing Ponderosa Pines; Black Hills, SD



Source: EROS Data Center

Map produced by: Tyler Dardis

*Map of effects of shale on Ponderosa Pines

The aspect, and location of the trees is not by luck or coincidence. By looking at the map, you can see there is a fair bit more pines on the north facing slopes, compared to the south. This has to do with a few factors. To begin, if we look at the pines heliophytic nature (attached to the sun), there should be more on southern facing slopes. One reason this is not the case is due to fire suppression during the 20th century.

To expand on this, the northern facing slopes start to get more and more dense because of the lack of fires. Since the south-

ern facing slopes had direct sunlight, they would have less moisture to absorb. This then made northern facing slopes a more productive area because of the availability of moisture; even though they are not in the sun zones.

The ratio of north to south facing slopes is 2.2:1.

GEOLOGY

Effects of Shale on Ponderosa Pines; Black Hills, SD



Source: EROS Data Center

Map produced by: Tyler Dardis

**Map of effects of shale on Ponderosa Pines*

When looking at the Geology and soils required for Ponderosa Pines, they need soils that are able to drain, and are not composed of clay. When looking at the map above, you can see the impact that shale has on the pines. Shale is composed of clay materials and is not easily permeable.

Ponderosa Pines can be over irrigated, and with Black Hills being susceptible to high amounts of precipitation in the growing season, it can be a disaster for these trees. The shale acts as almost a stopping point for the pines, with very few if any

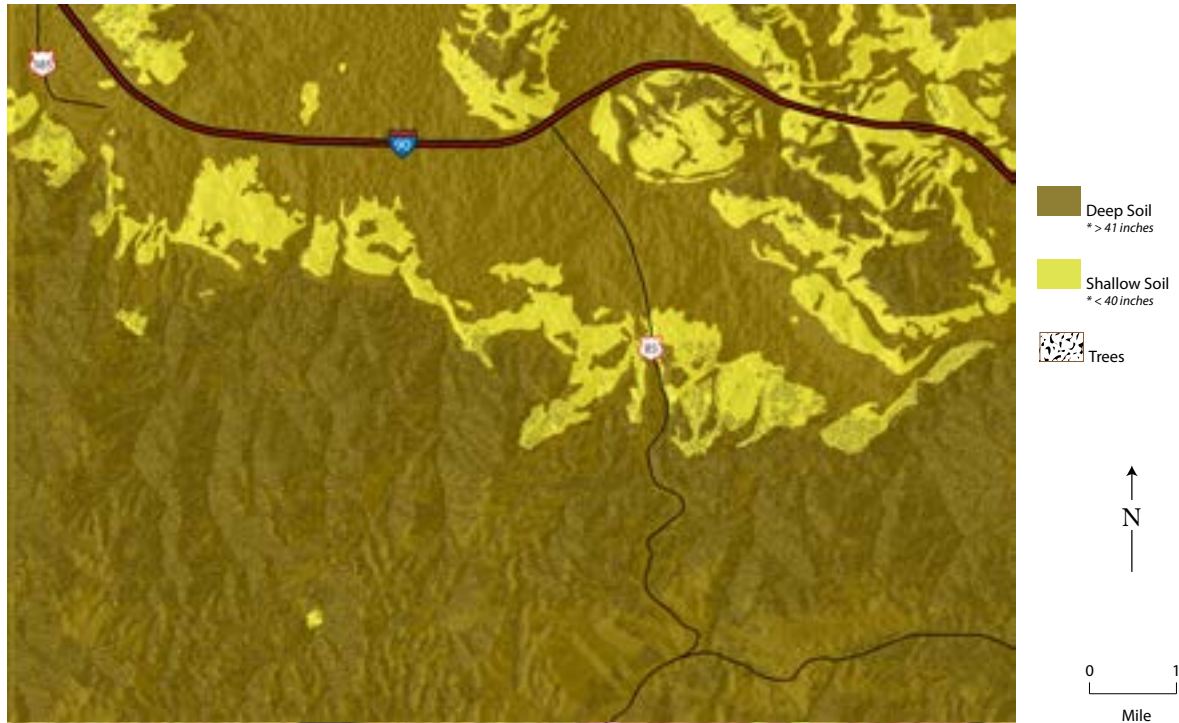


**Image of a shale rock*

growth happening on this area of the hills. Instead the pines grow well on limestone and sandstone, for example.

SOIL DEPTH

Soils Depths Suitable for Ponderosa Pines; Black Hills, SD



Source: EROS Data Center

Map produced by: Tyler Dardis

**Map of suitable soil depths for Ponderosa Pines*

Ponderosa Pines are most successful in deeper soil. The breaking point seems to be approx. 40 inches. Though there are some pines growing in soil less than 40 inches, it is marginal, and tapers off.

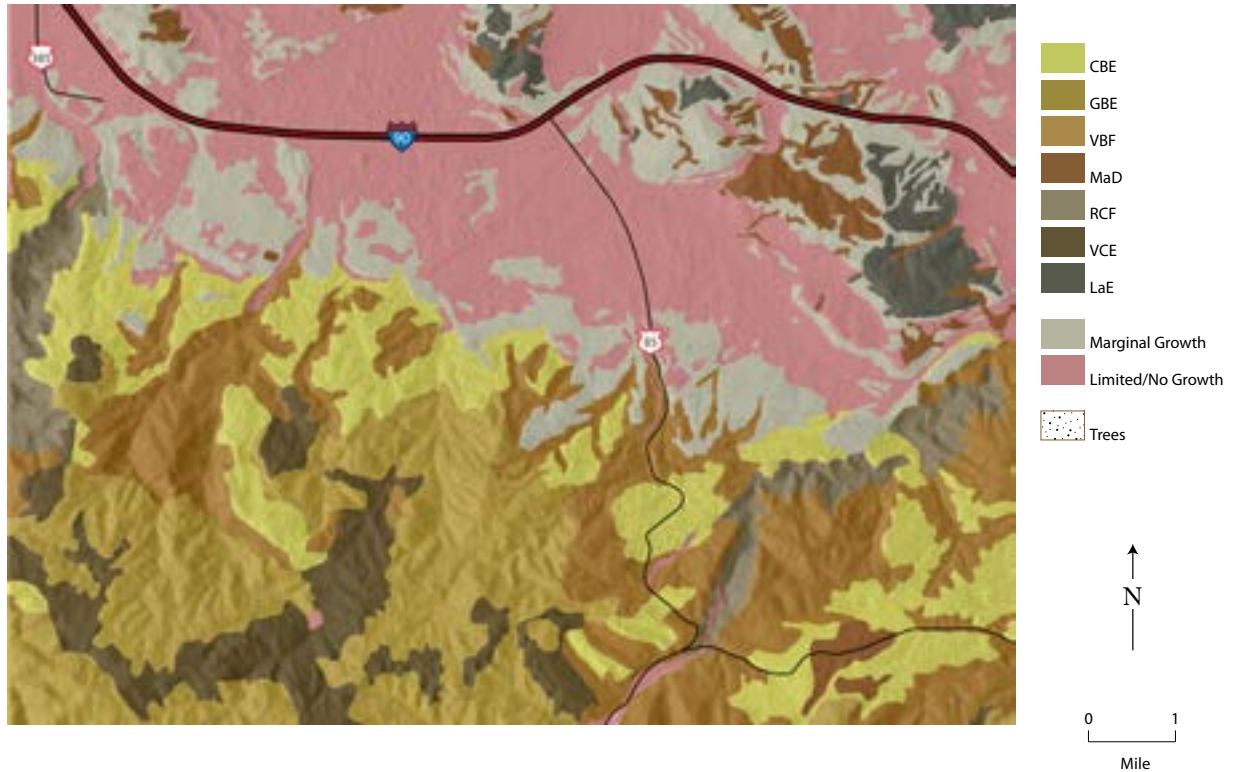
The reason for this need is because of the Ponderosa Pines deep tap root. With this deep soil, the pine is able to grow deep and absorb 100s of gallons of groundwater per day; according to Martin D. Mitchell in “The Black Hills: Sketches of a Western Landscape”.



**Image of Ponderosa Pine tap root*

TYPES OF SOIL

Soil Types Suitable for Ponderosa Pines; Black Hills, SD



Source: EROS Data Center

Map produced by: Tyler Dardis

*Map of suitable soils for Ponderosa Pines

Using the Lawrence County Soil index, and information, you can identify all of the soils that are suitable for the Ponderosa Pines, as well as what gives them the quality to be suitable. The soils that were suitable included: CBE, GBE, VBF, MaD, RCF, VCE, and LaE (see Soil Index for more info). There were a handful of other soils that had marginal growth, and also the limited/no growth.

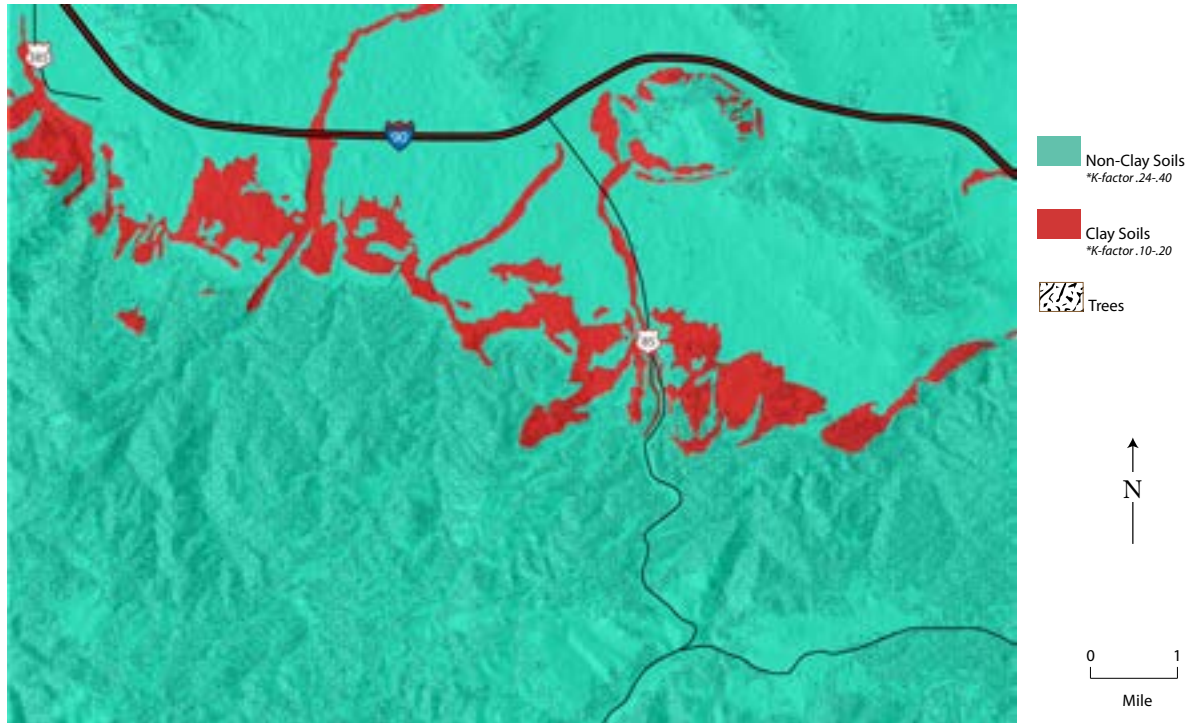
What was in common amongst all of the soils suitable was they were found on hilly or steep slopes. The remaining soils

were found on very slight slopes, as low as 0-2%. Another factor was many of these soils were silty-loams. These soils are permeable, able to drain. Unlike Shale which wasn't able to drain, these soils found on steep slopes are able to drain, preventing over irrigation to the pine trees.

This information follows the elevation data, stating they are more common at high elevations (above 1,250m).

SOIL K-FACTOR

K-Factors Suitable for Ponderosa Pines; Black Hills, SD



Source: EROS Data Center

Map produced by: Tyler Dardis

*Map of K-Factor in relation to Ponderosa Pines

The k-factor deals with erosion due to water runoff. A low k-factor means low erosion, while a high k-factor means just the opposite. Low k-factor soils have high clay content; much like shale. As we learned there, Ponderosa Pines do not grow well in those cases.

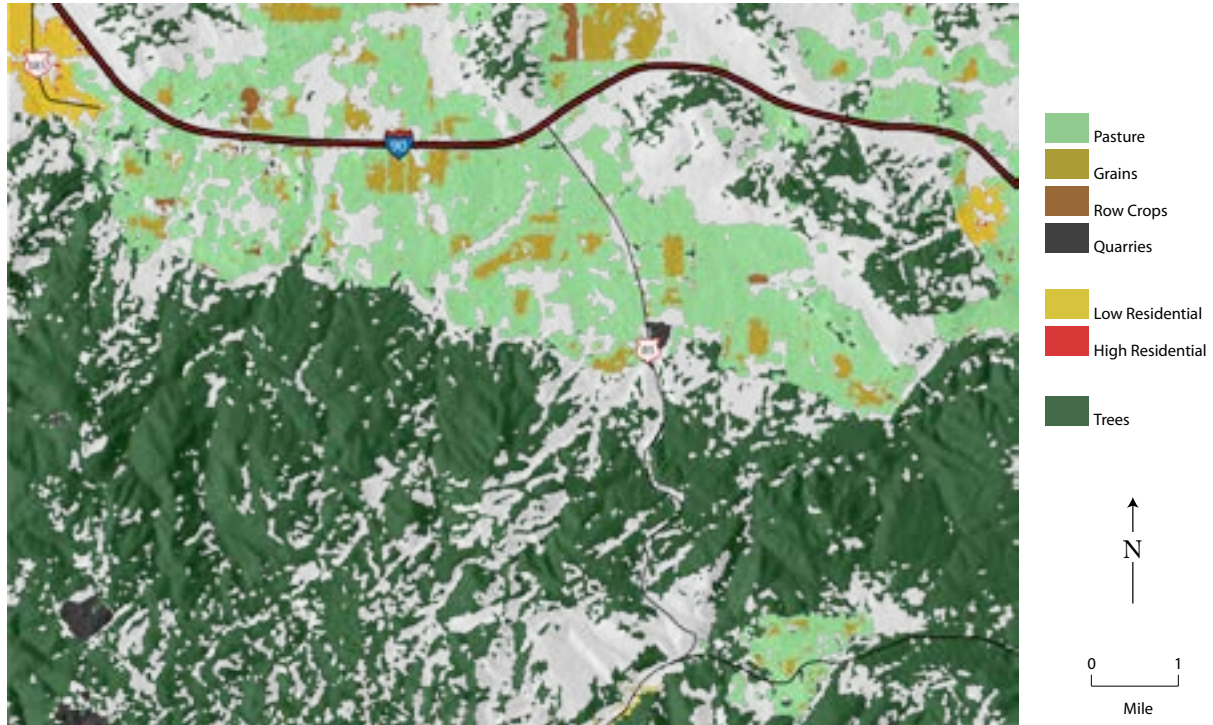
After examining the map of where the trees crop in relation to the k-factor, it was clear that k-factors below .20 were soils with clay content (like shale), while the factors above were silty/sandy soils.

This data goes in line with the soil

data, and Geology analysis done earlier. The map follows a familiar pattern of what the shale showed, acting as a stopping point for the pines. Just like the previous examples, there is marginal growth, but does have a large impact on the border between pines and no pines.

DEVELOPMENT

Developmental Impacts on Ponderosa Pines; Black Hills, SD



Source: EROS Data Center

Map produced by: Tyler Dardis

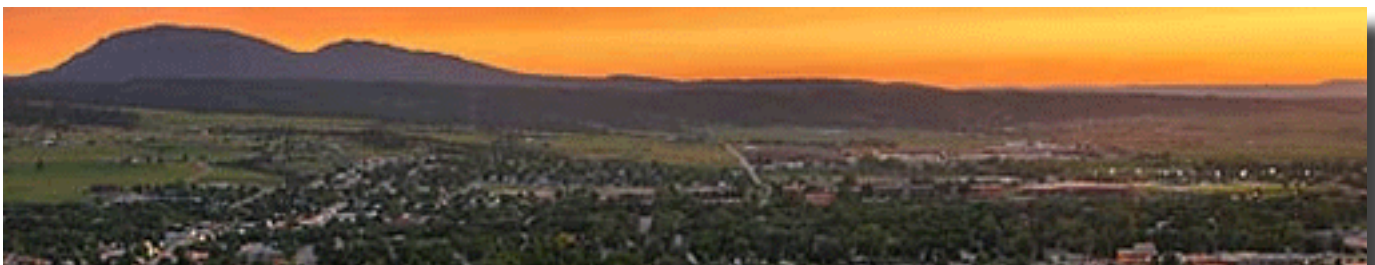
**Map of development in relation to Ponderosa Pines*

Finally, there seems to be a connection between human development and the growth of the Ponderosa Pines. One of the areas that seem to have a large impact is quarries. They seem to be focused in suitable areas for the pines, and are wiping out in the process of mining.

Another interesting thing is the af-

fect of pasture land. Though much of it is in lowlands, some of these lands seem to have quite an impact on the pines.

Though much of the developed land is on lowlands, it will be curious to see how human development and intervention (20th century first suppression) will affect the pines in the future.



**Panoramic image of Spearfish, South Dakota*

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