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Introduction

The Echinacea Project has been identifying, quantifying, and mapping the purple coneflower (*Echinacea angustifolia*) since 1995. The study covers 27 plots and 6400 hectares or prairie preserves and roadside vegetation. Previous studies done by the Echinacea Project have predicted that the population of this species is in a slight decline. Many of the hypotheses have focused on pollinator decline, self-incompatibility, or inbreeding/outbreeding depression. It has also been observed that echinacea can grow in unusual places. Large numbers of this native prairie forb were found on a used field approach, roadside, or top edge of a ditch. Does this mean that echinacea angustifolia prefers the contents of dryer, gravel type soil? Prairie soils fall in the order of Mollisols and contain suborders depending on the moisture content of the soil (Anderson, Bell, Cooper, & Grigal, 2001). For most plants there are seventeen core nutrients that are key for plant growth and health (Cooper & Abi-Ghanem, 2015). Throughout Minnesota there are many different subsoil types each with different characteristics. Determining the type of soil that *Echinacea angustifolia* grows could be an important factor in determining the conditions optimal for this forbs growth.

Research Questions:
  1) *What is the soil type where Echinacea angustifolia grow?*
       a) *What is the difference in characteristics of that soil compared to other types?*

For this project my goal is to determine the soil type in the areas where the Purple Coneflower grows. The GPS points will be used from the remnant and prairie preserves taken and utilized by the Echinacea Project. Using Google Earth Pro and Rstudio, I will transfer the CSV files containing the phenology information for each site. Specifically looking at the GPS coordinates (Ax,Ly), I will convert these files to KML which will automatically plot the points for each plant on Google Earth. Soil Web, an application for Google Earth from UC Davis that shows soil types, is also visible as a layer on the same map. This allows you to see the soil type directly at the point where the Purple Coneflower is growing. For each site, I will determine the soil type

containing plants. This will also involve finding out the percent organic matter, water holding capacity, cation exchange capacity, pH, and major nutrients for each type.

Significance

Thousands of *Echinacea angustifolia* have been identified and charted since 1995. By observation, there are obvious differences in where the purple coneflower grows. This experiment may help determine the exact differences on the soil level between high and low *Echinacea* populations. The *Echinacea* population could be in decline due to environmental changes in soil or growing places. Overall, this analysis will provide this project with more information about the bottom half (roots/soil) of *Echinacea angustifolia* and other prairie plants.

Materials and Timeline

This project does not have a weather related timeline. It would be ideal to have it completed by the end of the Echinacea Project field work.

The materials for this project include:
- Google Earth Pro
- Soil Web download
- CSV files and maps from the Echinacea Project
- Rstudio

Environmental Impacts

To complete this study, none of the experimental plots or surrounding land will not be harmed. Most work, besides observation of the sites, will be done on the computer.

References

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