# Use of Spatial Interpolation in predicting Nutrient Availability in Agricultural Fields

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## What is Spatial Interpolation?

Spatial Interpolation is the process of using points with known values to estimate values at other/surrounding points. In GIS, Spatial Interpolation is used on raster files. Cell values are estimated based on the known values of Control points. For these maps, Radial Basis Functions were used to demonstrate the surface between control points. This is especially useful in situations such as, determining state-wide how much water the entire area receives annually.

## Background

- Ammonia and Nitrates were chosen due to their importance for photosynthesis. So availability of it in the soil is crucial for plant productivity.
- Phosphorus is needed for storage of energy produced by photosynthesis.
- pH of the soil is necessary to know how readily available nutrients are to be transferred by water to roots.
- Aggregate sizes show how high or low quality the soil is. Larger aggregates have more surface area that water can be held in, not only that but there's more pore space between aggregates.
- Three maps were chosen from the variety made to demonstrate nutrient availability and pH.

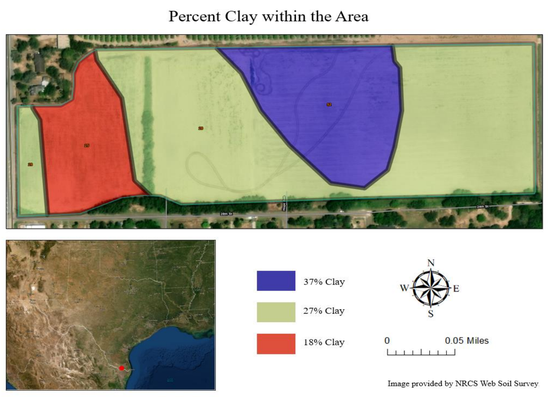


Figure 1: Demonstrates the percentage of clay of the area. Image provided by NRCS Web Soil Survey.

## Results

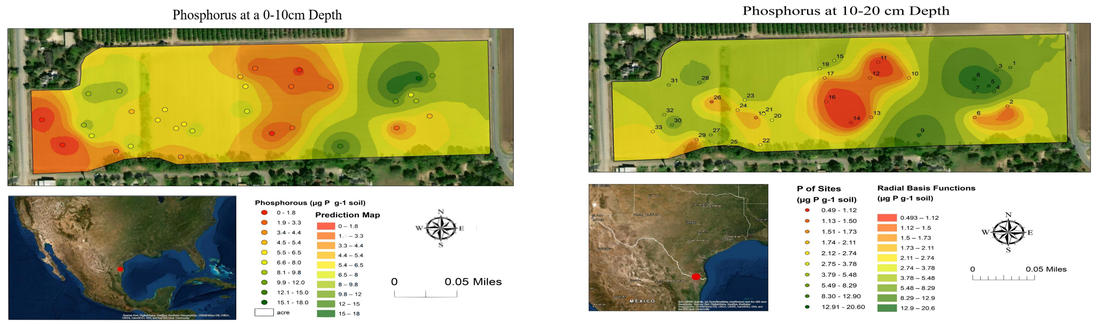


Figure 2: Fig. 2A demonstrates the amount of P available and potentially available within a 0-10cm depth within the AOI. Fig. 2B demonstrates the amount of P available and potentially available within a 10-20cm depth within the AOI.

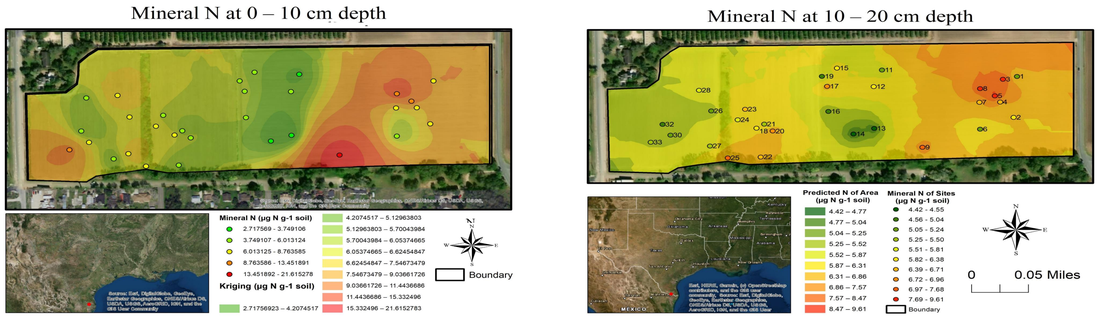


Figure 3: Fig. 3A demonstrates the amount of mineral N available and potentially available within a 0-10cm depth within the AOI. Fig. 3B demonstrates the amount of mineral N available and potentially available within a 10-20cm depth within the AOI.

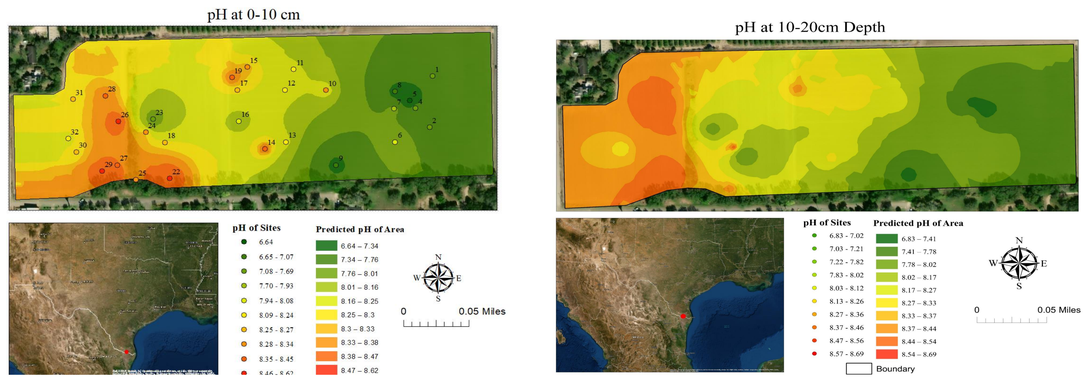


Figure 4: Fig. 4A demonstrates the pH of the soil and potential pH within a 0-10cm depth within the AOI. Fig. 4B demonstrates the pH of the soil and potential pH within a 10-20cm depth within the AOI.

## Acknowledgements

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## Methodology

There were 68 samples collected, split between two different depths (0-10cm and 10-20cm). The samples taken from the sites were transferred to Dr. Pereira's Soil Ecology Lab where extractions on nutrients were done on the soil. Phosphorus, Nitrates, and Ammonia were extracted from the soil to record its availability for plant uptake. Tests were also run for pH, and soil was sieved for variously sized aggregates. Once data was collected for the 34 sites, two tabs were created on Excel with the same coordinate information. This was done to differentiate the depths from which data was collected. The excel sheet was imported into ArcMap and XY data pinpointed the location to all sample sites.

The Geostatistical Analyst tool bar was brought up and a histogram was done in order to see how well distributed the data was.

As a result, whether there was a present trend or not determines what form of spatial interpolation to move forward with. If there is no trend present, trial and error would suffice.

## Discussion

As depth increased the varying concentrations of mineral N, Phosphorus, and pH can be seen fluctuating throughout the maps. Figure 1 demonstrates the percent clay within the site. From here conclusions can be drawn regarding the correlation between the clay content and the interpolation methods. Further studies can be done to determine whether there truly is a trend between the two by adding more sites with a similar clay content as the area of interest.

## Conclusion

The changes in concentration of N, P, and changes in pH over depth potentially coincides with the amount of clay present in the plot. A larger percentage of clay potentially inhibits nutrient leeching due to the clays porosity.

## Citations

Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey.https://websoilsurvey.sc.egov.usda.gov/.