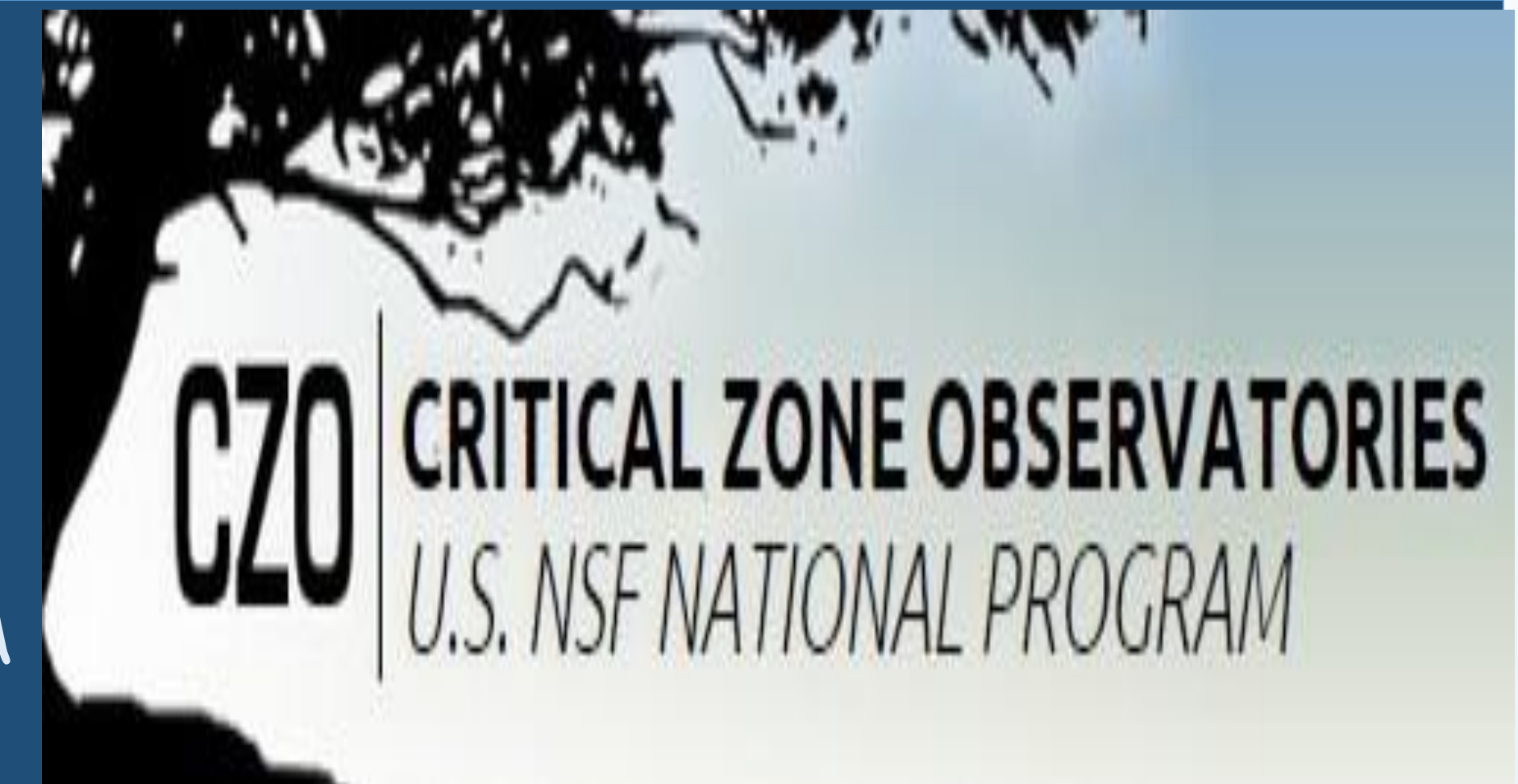


Sample Modeling for Soil Phosphorus at the Calhoun CZO via GIS Applications

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Introduction

- Phosphorus (P) is an essential element classified as a macronutrient because of the relatively large amounts of P required by plants (Brady et al, 1996);
- However, the amount of Phosphorus is often low in soil of tropical and subtropical regions (Liu et al, 2014) which are mostly cover with forest.
- Phosphorus is widely deficient throughout the southern pine region of the United States (Scott and Bliss, 2012).
- The availability of phosphorus in terrestrial ecosystems depends on soil age, climate, parent material, topographic position, and biota as well as land use history.

Study Area

- Based on the research project, we selected Four watersheds within the Calhoun CZO area (Fig1)
- The Calhoun Experimental Forest is located in Union County, South Carolina, at about 34.5°N, 82°W.

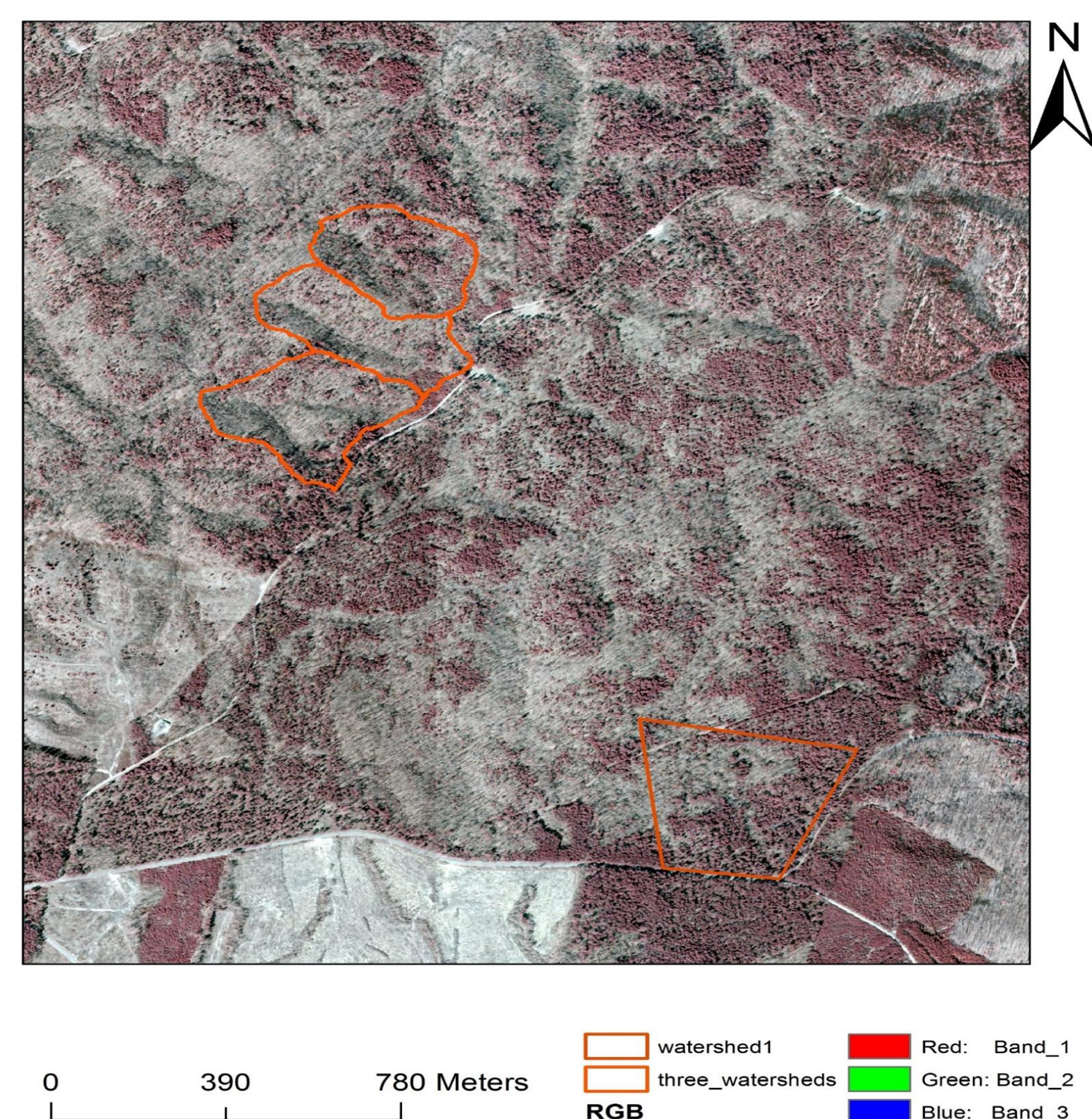


Fig 1. Study area: Four watershed areas in the Calhoun CZO

Objective

- Use GIS analysis to identify the best sampling locations for soil phosphorus fractionation measurements within four watersheds of the Calhoun CZO based on EMI, slope, and soil series data.

Data Method

- This project required three quads and DEM data for the CCZO area that were provided from South Carolina Geographic information System website (<http://www.gis.sc.gov>).
- Moreover, EMI data measured in three of the watersheds were incorporated in Arc GIS.
- Downloaded Soil data of selected area from soil survey (<http://websoilsurvey.sc.egov.usda.gov>).

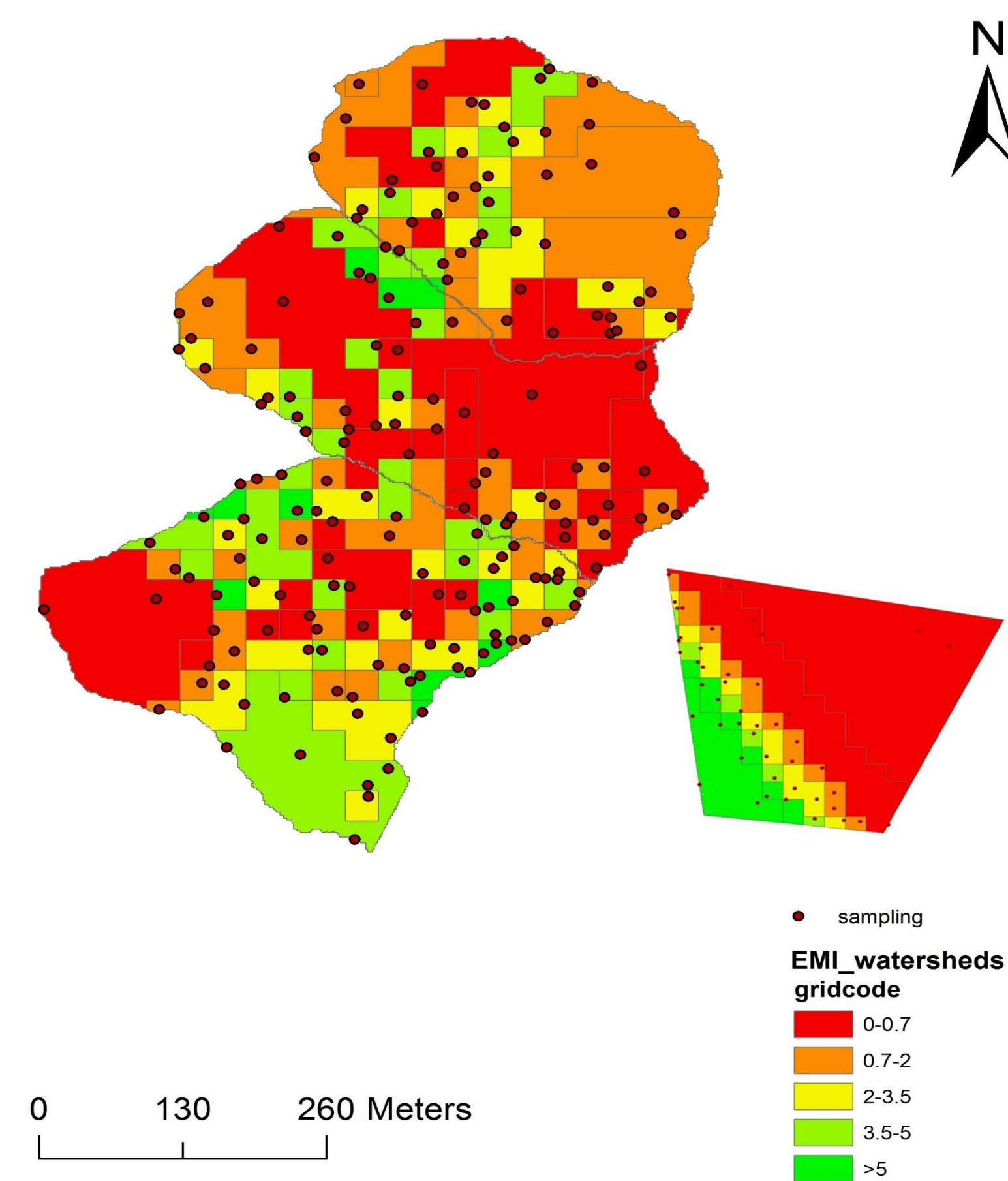


Fig 2. The electronic conductivity map of study area, which shows five classes.

Analysis steps

- Merge EMI data of watersheds 2, 3, and 4.
- Reclassify EMI and Slope separately and convert to polygon (vector).
- Union EMI, Slope, and Soil Series layers.
- Intersect Union layer with watershed layers.
- Select stratified samples in GME software

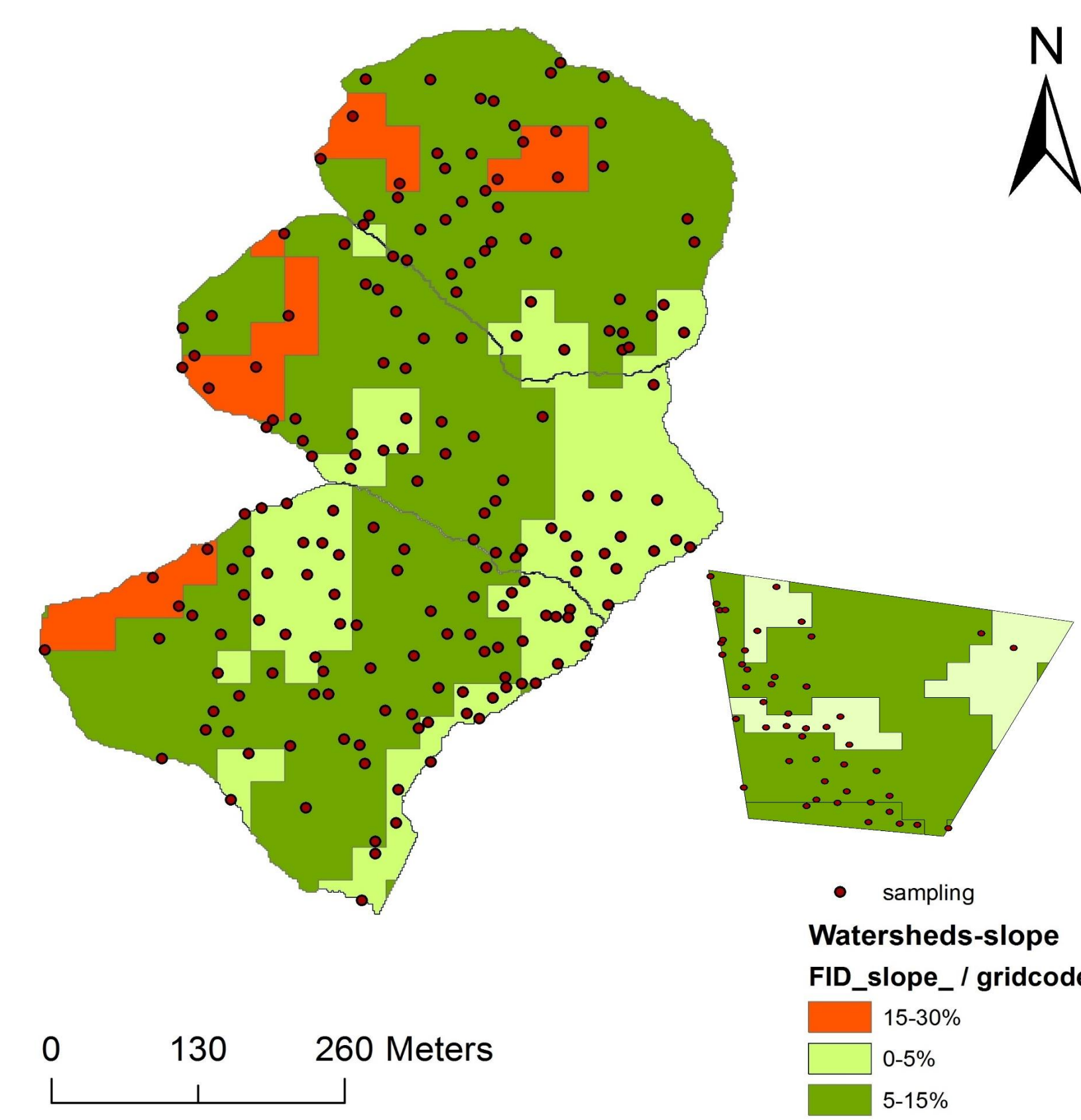


Fig 3. Slope map of Calhoun CZO shows four slope classes in four watersheds.

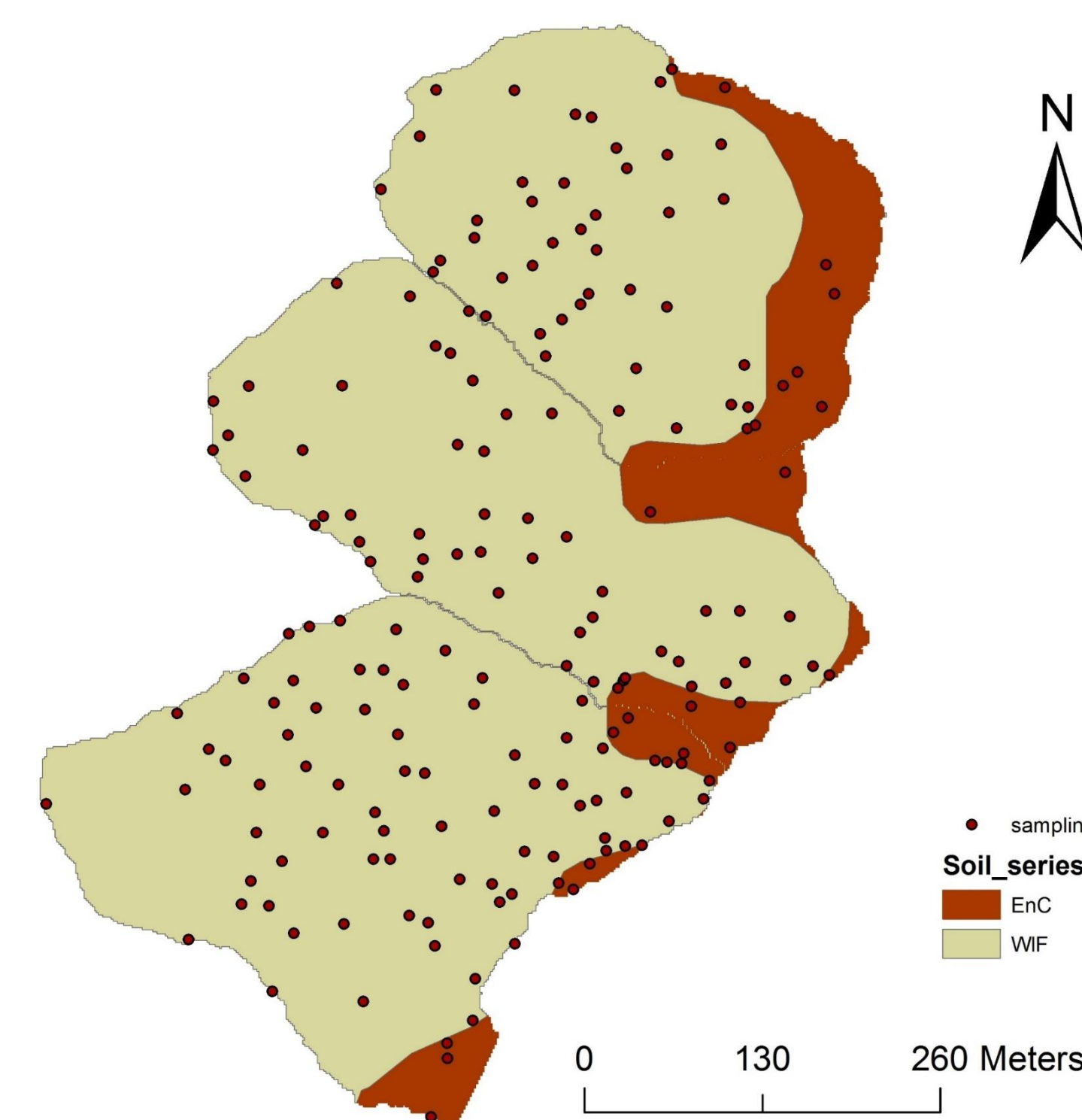


Fig 4. Soil series map of watersheds shows two different soils in three watersheds.

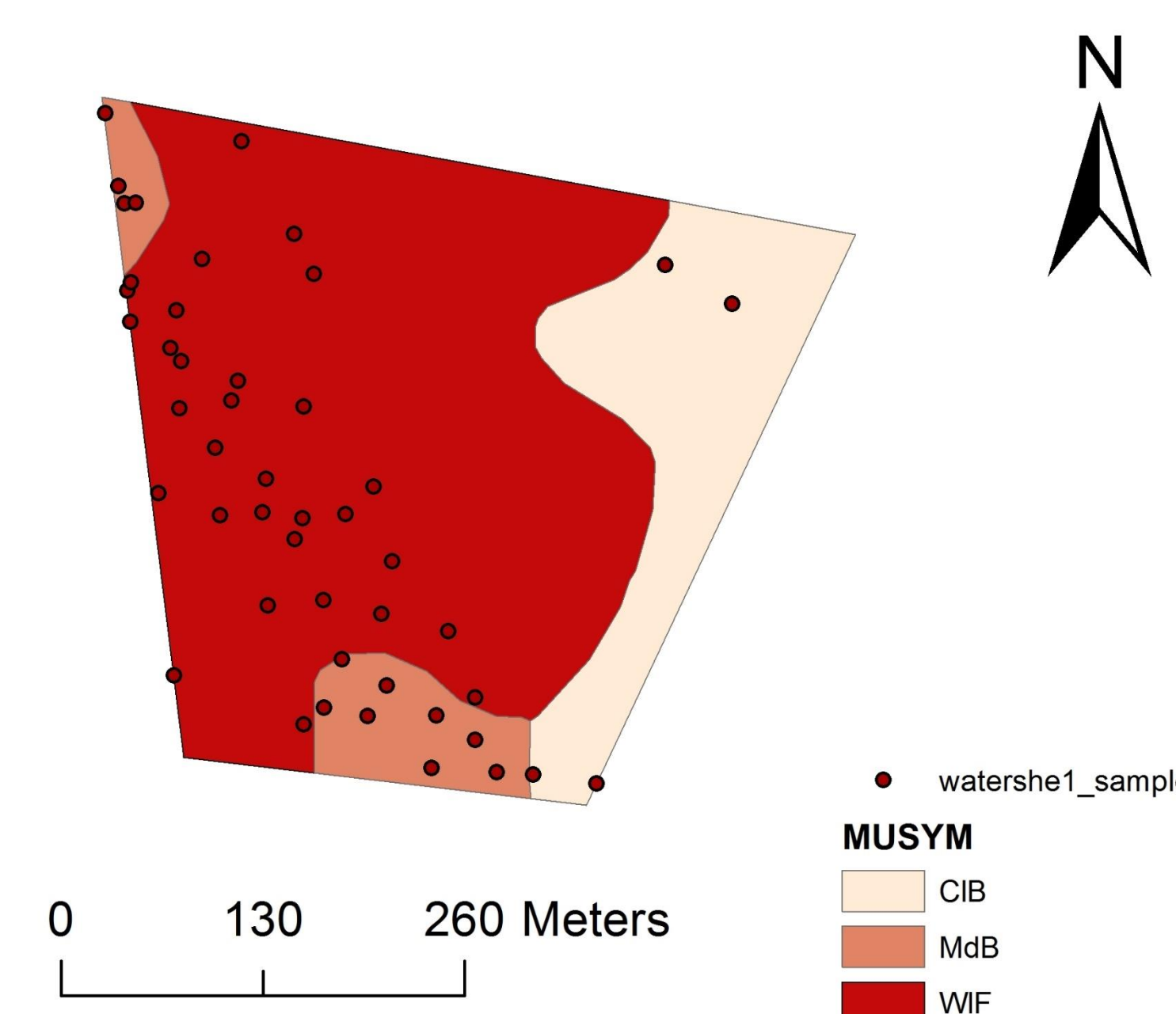


Fig 5. Soil series map shows three different soils in watershed 1.

Result and Discussion

- According to Fig 2, conductivity of soil based on EMI measurement reclassifies to five classes (0-0.7, 0.7-2, 2-3.5, 3.5-5, and >5).
- Percent soil slope primarily influences the effective soil mass and ranged from 0-30%. An increase in percent soil slope can both increase P release to run off water and decrease soil phosphorus in proportion to slope (R.LAHUJA et al., 1982).
- DEM data from the watersheds reclassifies to Three slope classes (0-5, 5-15, and 15-30) with much of the watersheds having 5-15% slope (Fig 3).
- Based on the Fig 4 and 5, four different soil series are identified under the Calhoun watersheds:
 - Enc (Enon fine sandy loam) covers 6-10% slope
 - WIF (Wilkes soils) covers 15-40% slope
 - CIB (Cecil sandy loam) covers 2-6% slopes
 - MdD (Madison sandy loam) covers 10-15% slopes

Conclusion

- Previous knowledge suggests that phosphorus fractions will vary by slope, soil series, and measured conductivity.
- This sampling model, using Arc-GIS, helps identify areas where soil series, EMI, and slope change in across the research area.
- By selecting 189 stratified samples from Three watersheds and 47 samples for watershed-1 in the Calhoun CZO we can investigate the effect of slope, soil series and conductivity on Phosphorus fractions.

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