Assessment of soil composition and vegetation survey of Old Field, Forest 1, and Savanna 2 areas of the Asylum Lake Property, Kalamazoo, Michigan

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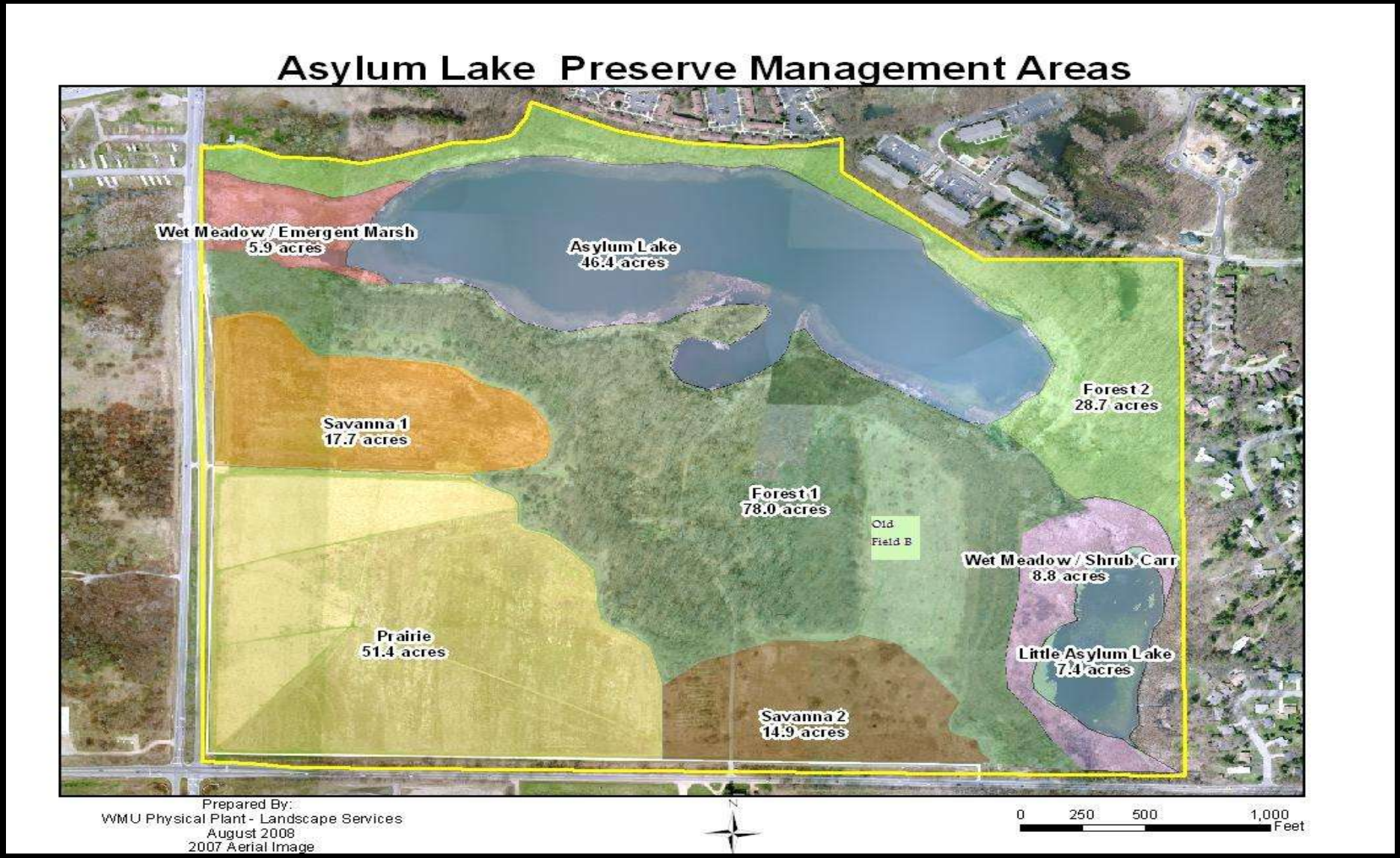
For
The Environmental Institute
Western Michigan University



- 274 acres total land space

Overview

- Site of Kalamazoo Asylum for the Insane later named Kalamazoo State Hospital
- Was in operation until 1969
- Structures demolished in 1977, tunnels in 1978
- Now used for passive recreation and research

http://www.wmich.edu/asylumlake/

Succession

- Secondary succession: A series of changes in a community which take place in a habitat which may have been previously disturbed, damaged, or colonized

- Rates?: Anywhere from days to hundreds of years

Management

- Owned by Western, managed by Physical Plant (WMU)
- Plans may include increasing forest, biodiversity, and prairie
- Reduction of invasive species

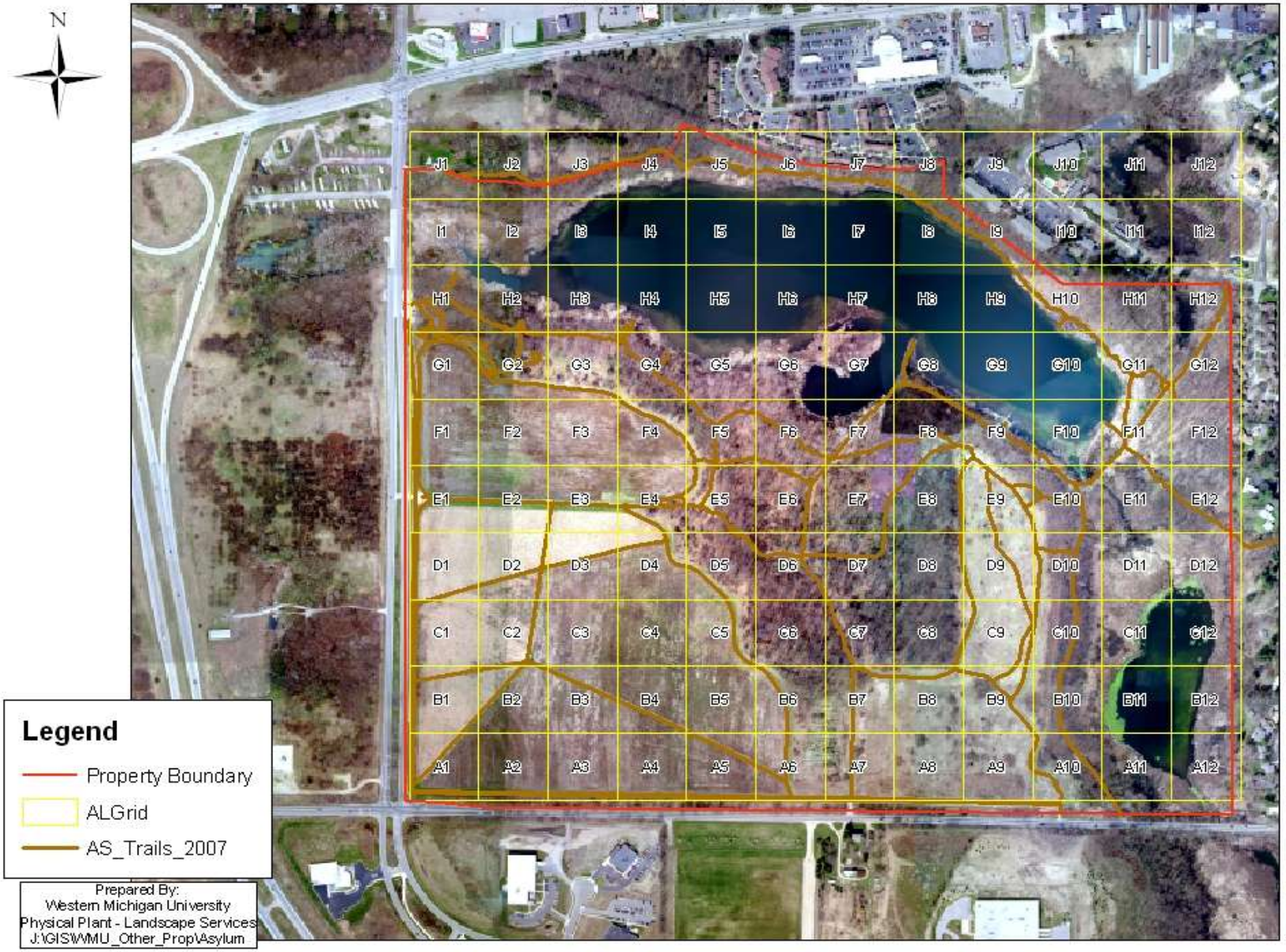
Objective

- To find out why vegetation differs in Old Field in comparison to the surrounding forest and The Savanna to the south

Methods

- 100×100 meter grid was created by Cari DeLong with an ESRI ArcGIS ground imaging system
- The Grid system image was then laid over a 2007 aerial image of the Asylum lake property

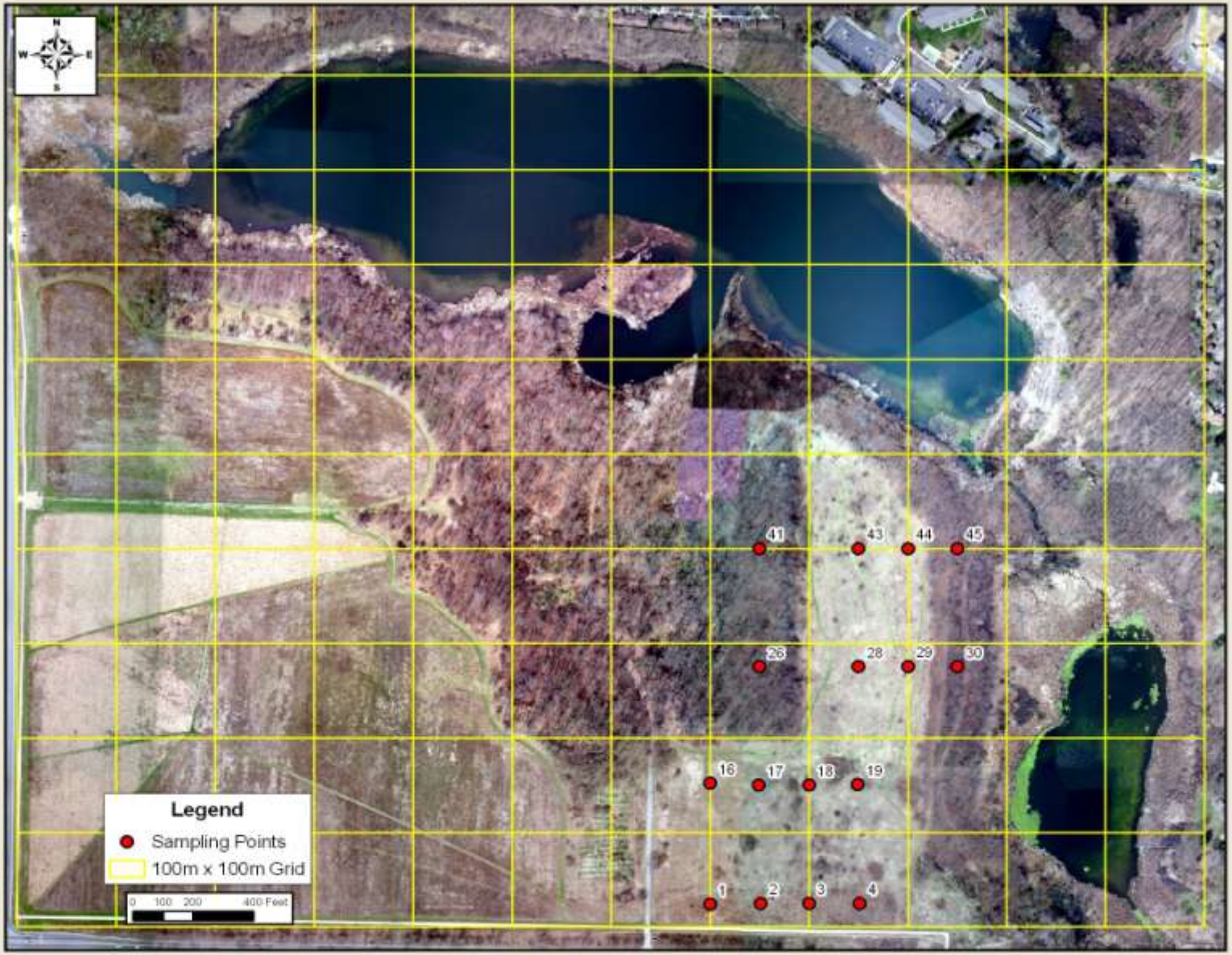
Asylum Lake Property
100m x 100m Grid



Methods

- A series of points were entered into the GIS which were located in Old Field, Savanna, and Forest 1 and uploaded into a Trimble GeoXH 2005 series GPS system by Cari DeLong
- Twenty points were chosen for sampling and located via GPS
- Edges were removed from data for true area results and 16 points were quantified

Jay's Sampling Points



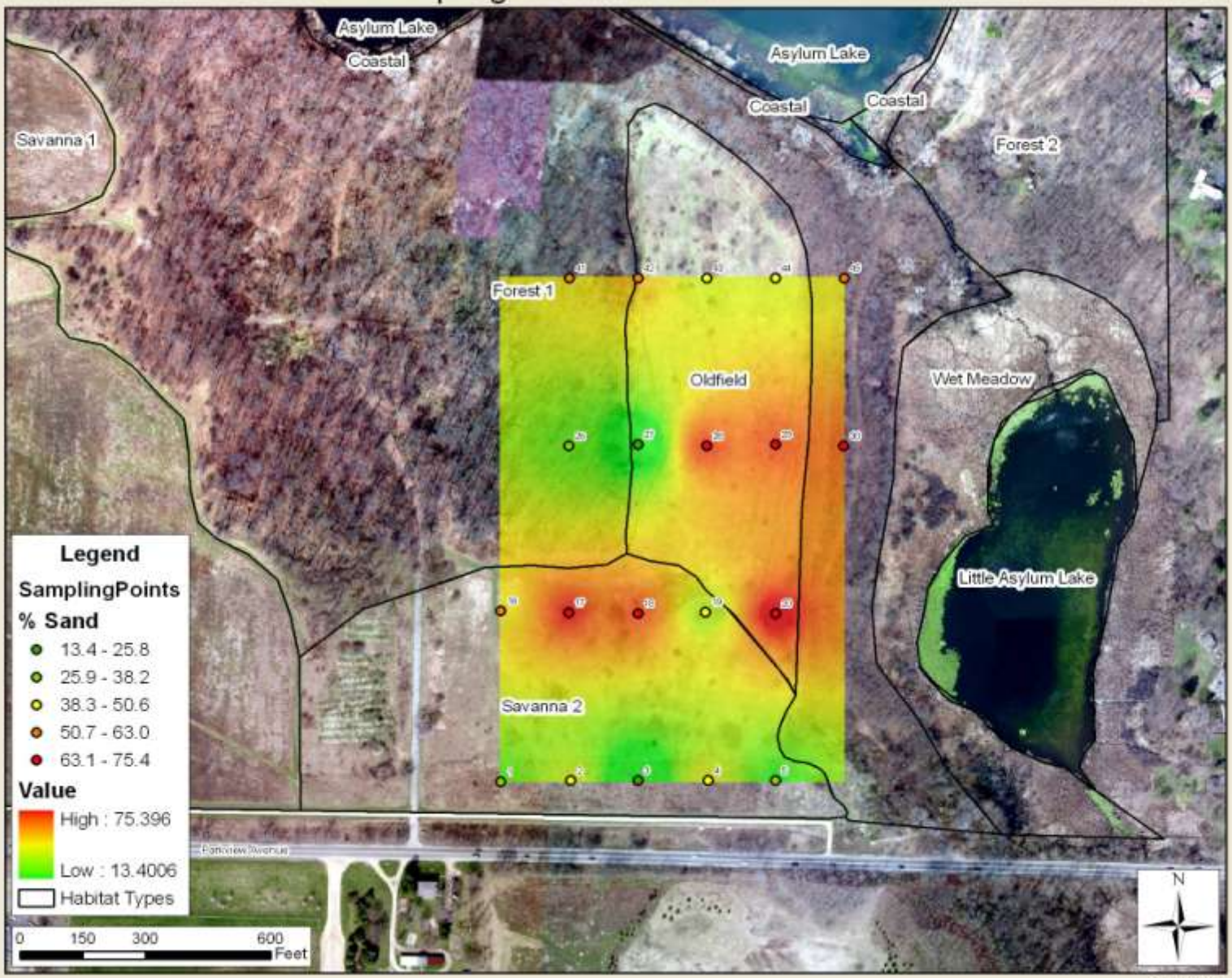
Sampling and Analysis

- 18” Oakfield Apparatus Company Soil probe used at chosen points 1’ deep
- 3 cups of soil from each point bagged, marked, and stored in cooler (no ice or heat)
- Samples crushed, and dried on paper for 24 hours in Gibbs’ House barn
- Re bagged, marked, and transported to MSU extension for analysis (nutrient content and sand silt and clay composition)

Soil analysis Mapping Methods

- Maps were created using ESRI ArcMap software by Cari DeLong
- The sampling points were imported into ArcMap and the Arc Toolbox application was used to interpolate the sampling points with Inverse Distance Weighting

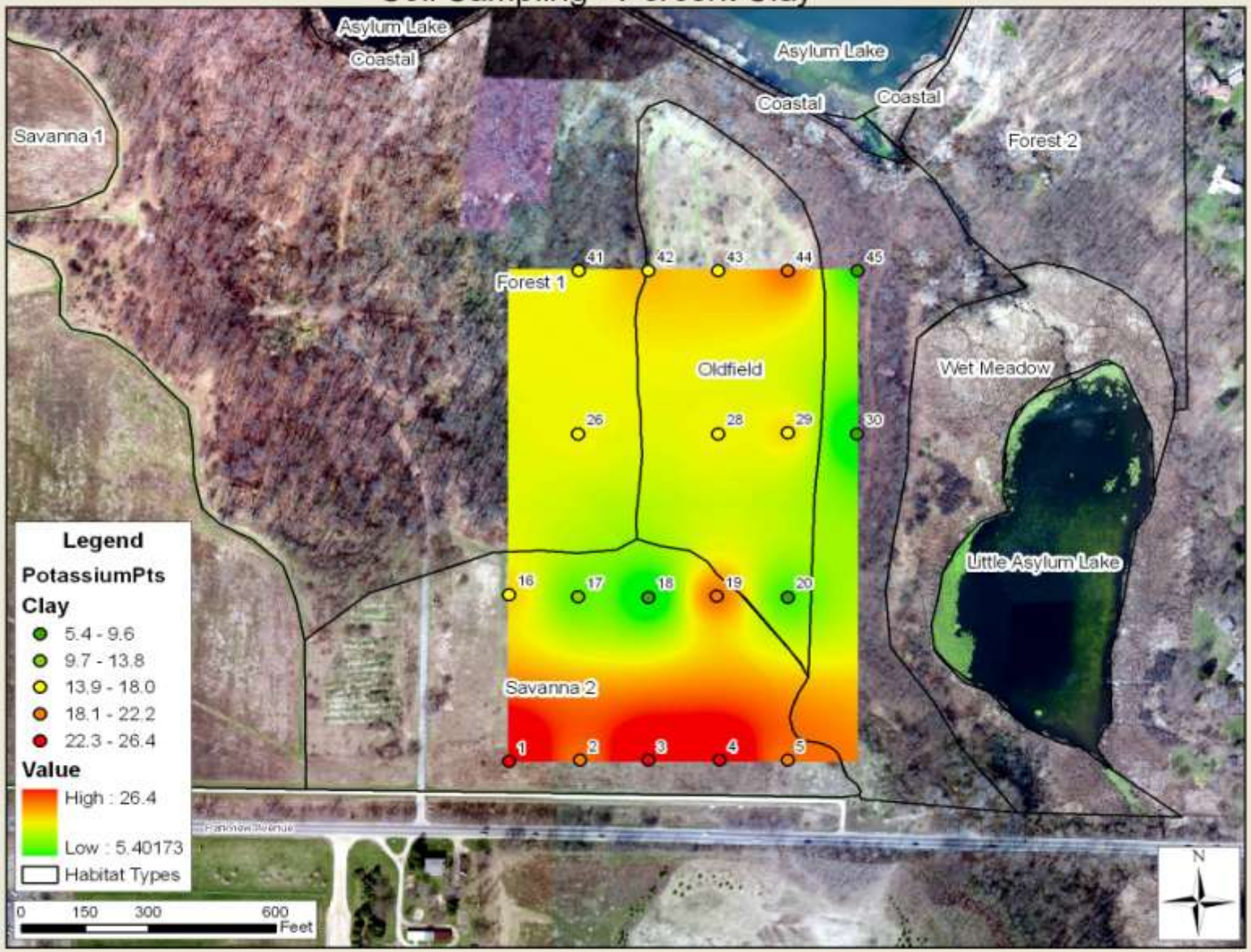
Asylum Lake Preserve
Soil Sampling - Percent of Sand Content



Sand Results

- Old Field had a significantly higher sand content than Savanna South (P>.0385)
- Savanna North also showed a significantly higher sand content than (P>.0340) Savanna South

Asylum Lake Preserve
Soil Sampling - Percent Clay

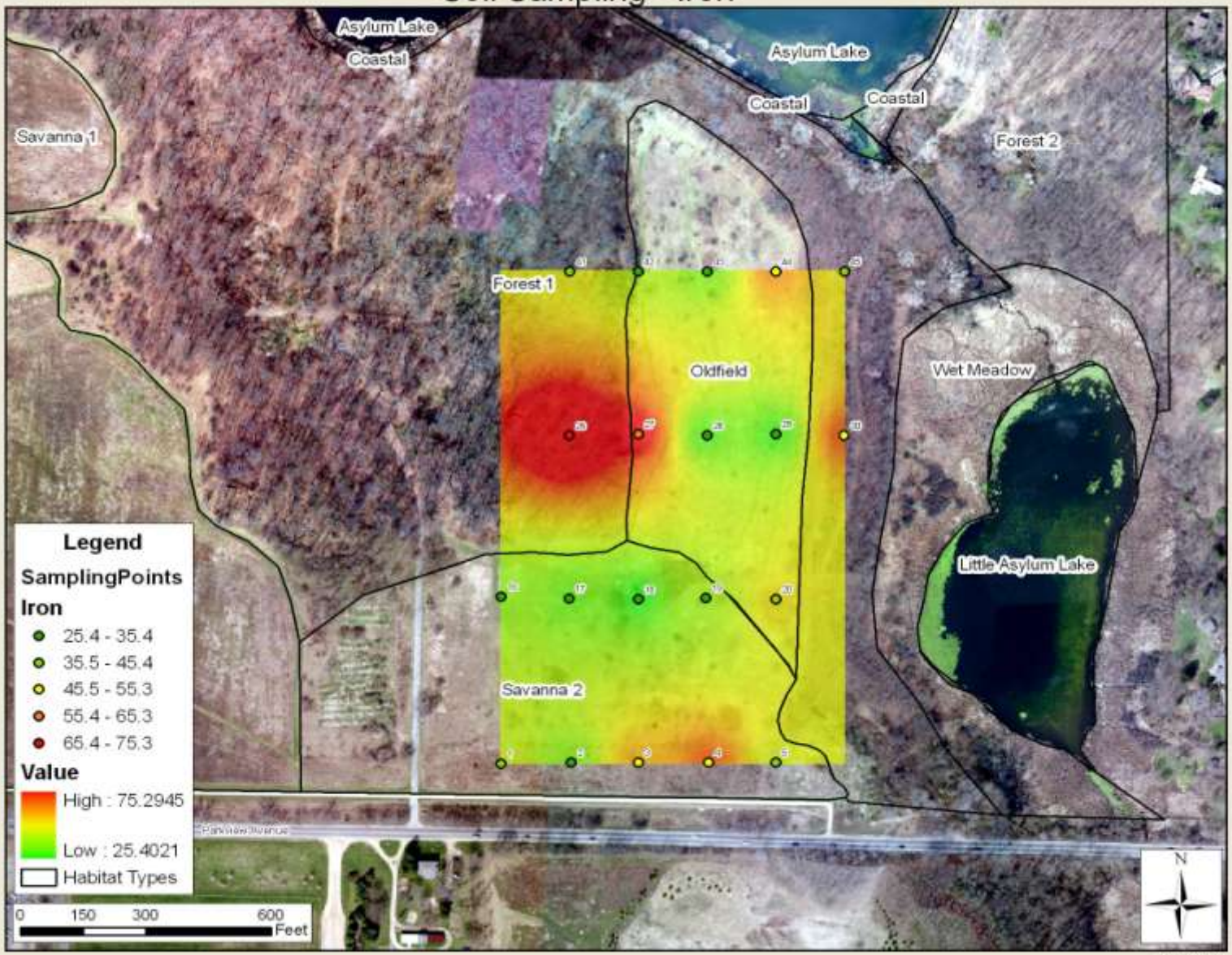


28 July 2009

Clay Results

- Clay content in Savanna South was significantly higher than Forest 1 (P>.0012)
- Savanna South showed significantly higher clay values than Old Field (P>.0291)
- Savanna South also proved to have significantly higher clay content than Savanna North (P>.0027)

Asylum Lake Preserve
Soil Sampling - Iron

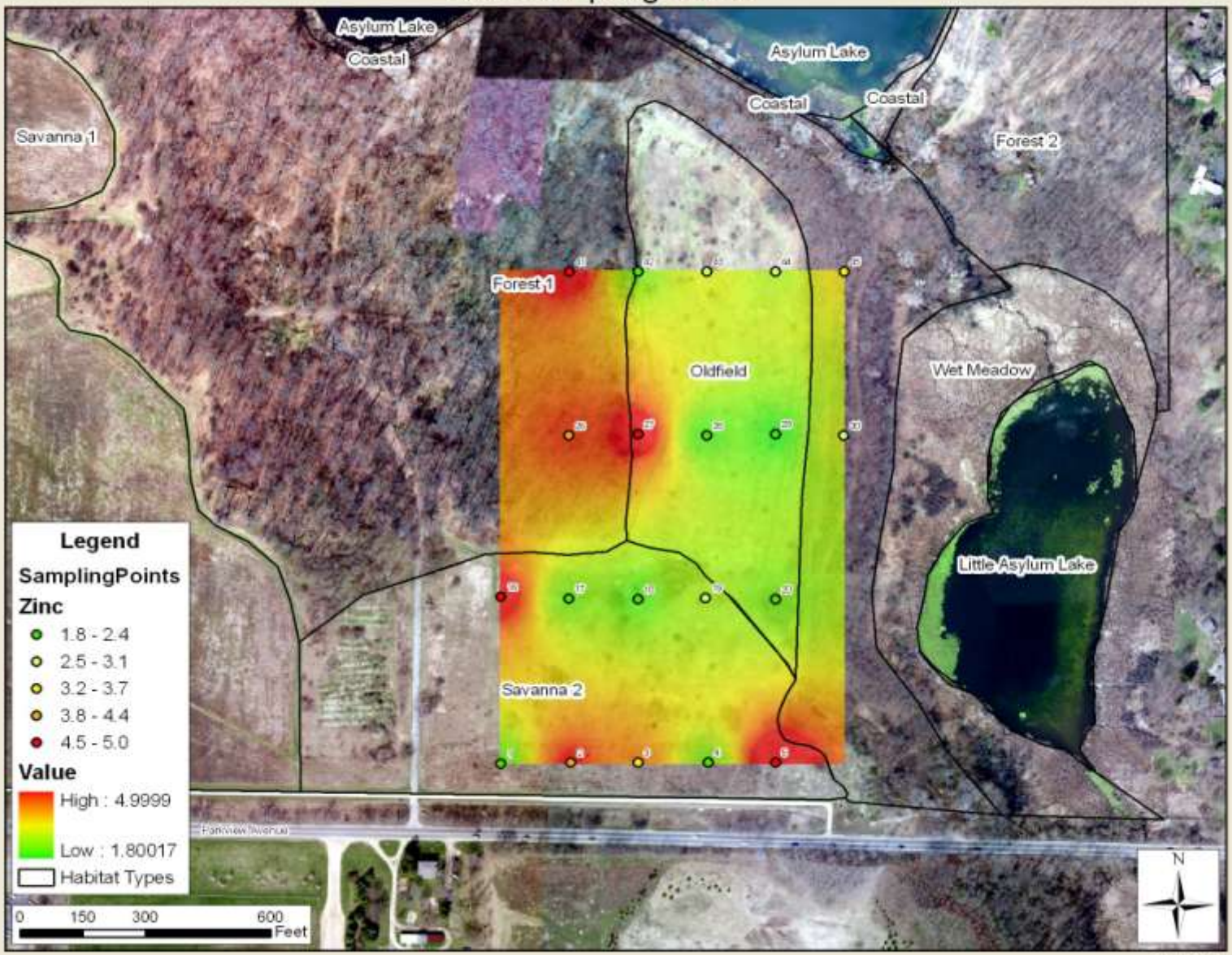


Iron results

- Forest 1 showed significantly higher Fe values Old Field ($P > .0398$)

- Forest 1 also showed significantly higher values of Fe than Savanna North ($P > .0278$)

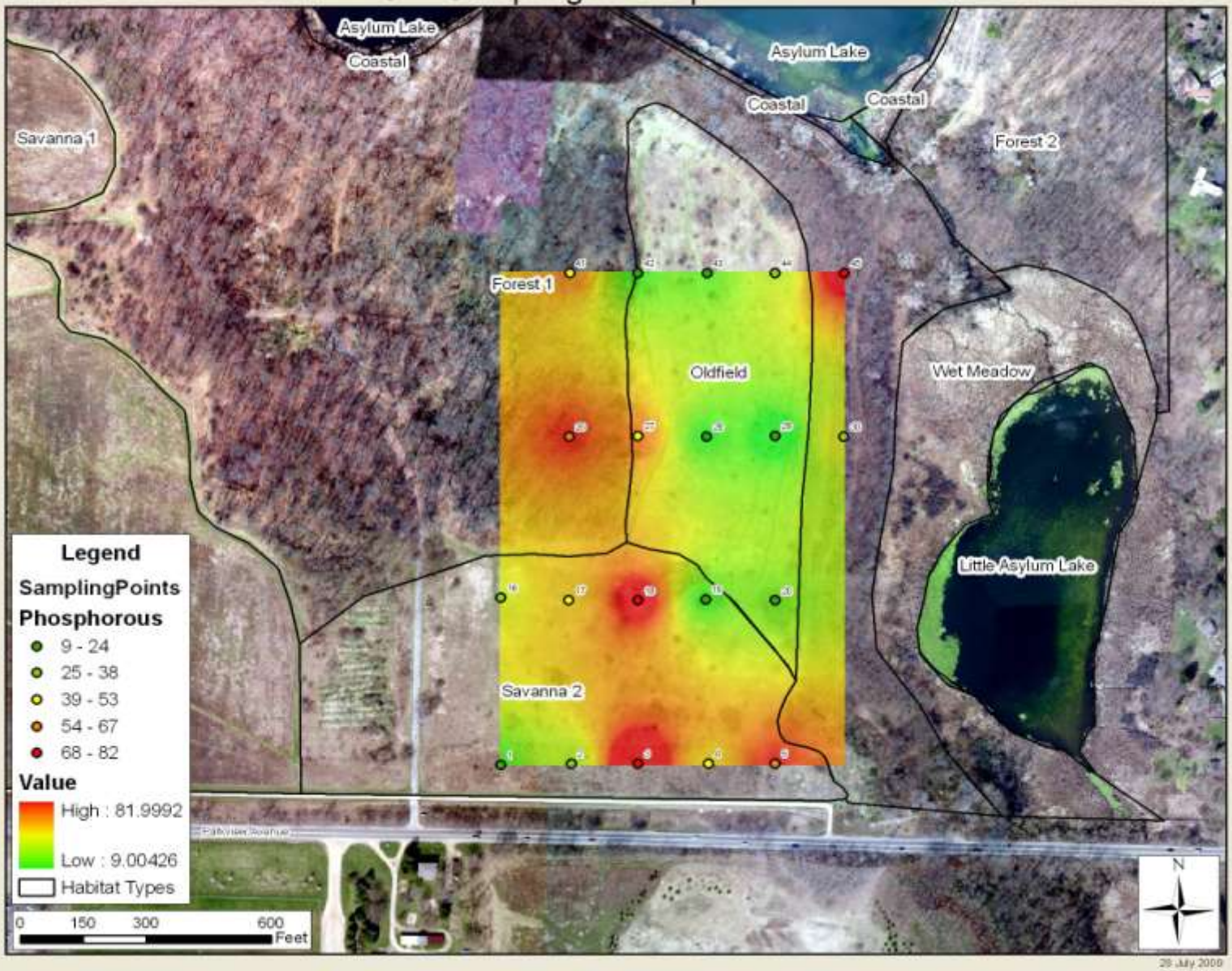
Asylum Lake Preserve
Soil Sampling - Zinc



Zinc results

- Zn values proved significantly higher for Forest 1 than Savanna North (P>.0317)
- Forest 1 showed significantly higher Zn values than Old Field as well (P>.0387)

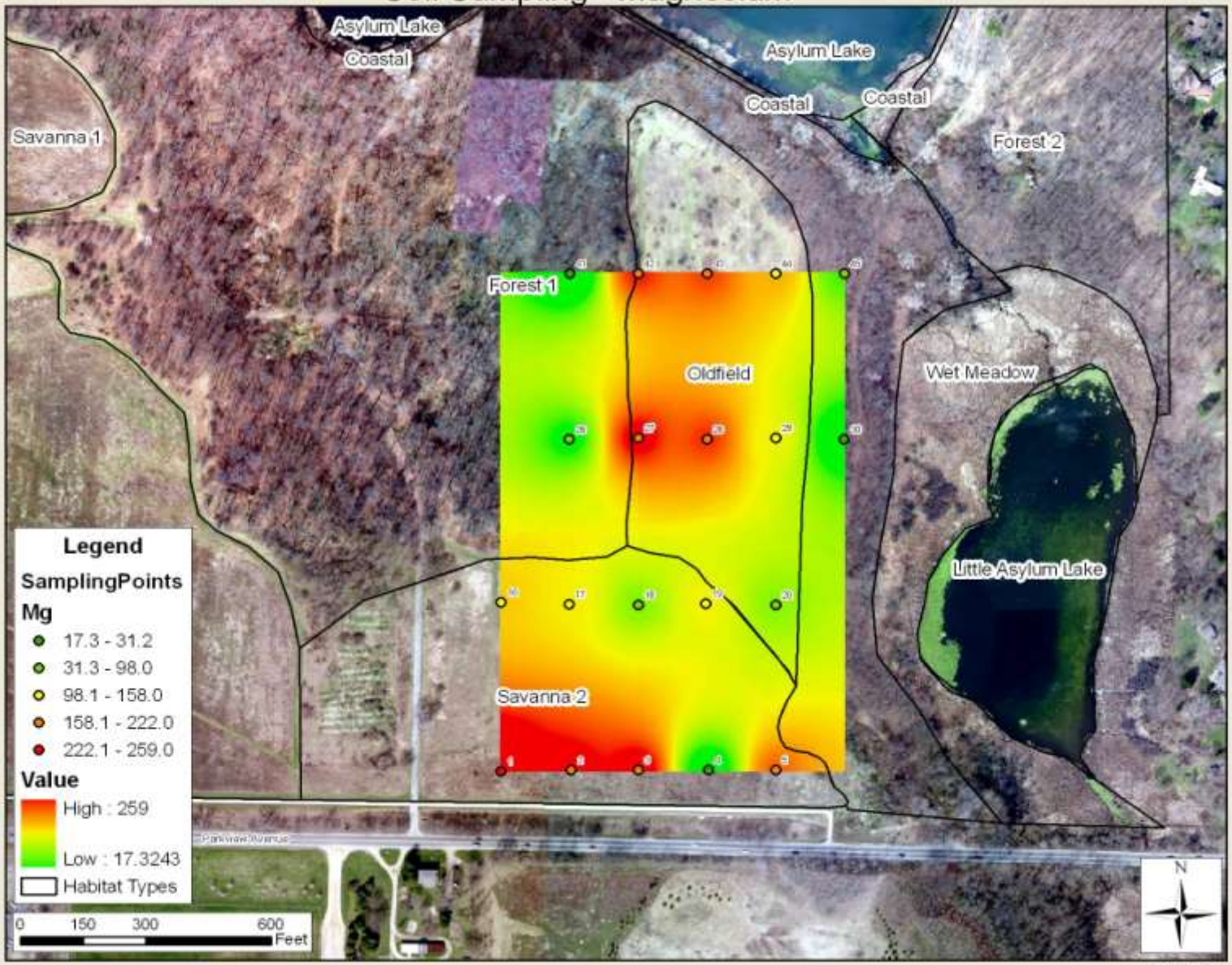
Asylum Lake Preserve
Soil Sampling - Phosphorous



Phosphorus results

- P results proved significantly higher for Forest 1 than Old Field (P>.0338)

Asylum Lake Preserve
Soil Sampling - Magnesium



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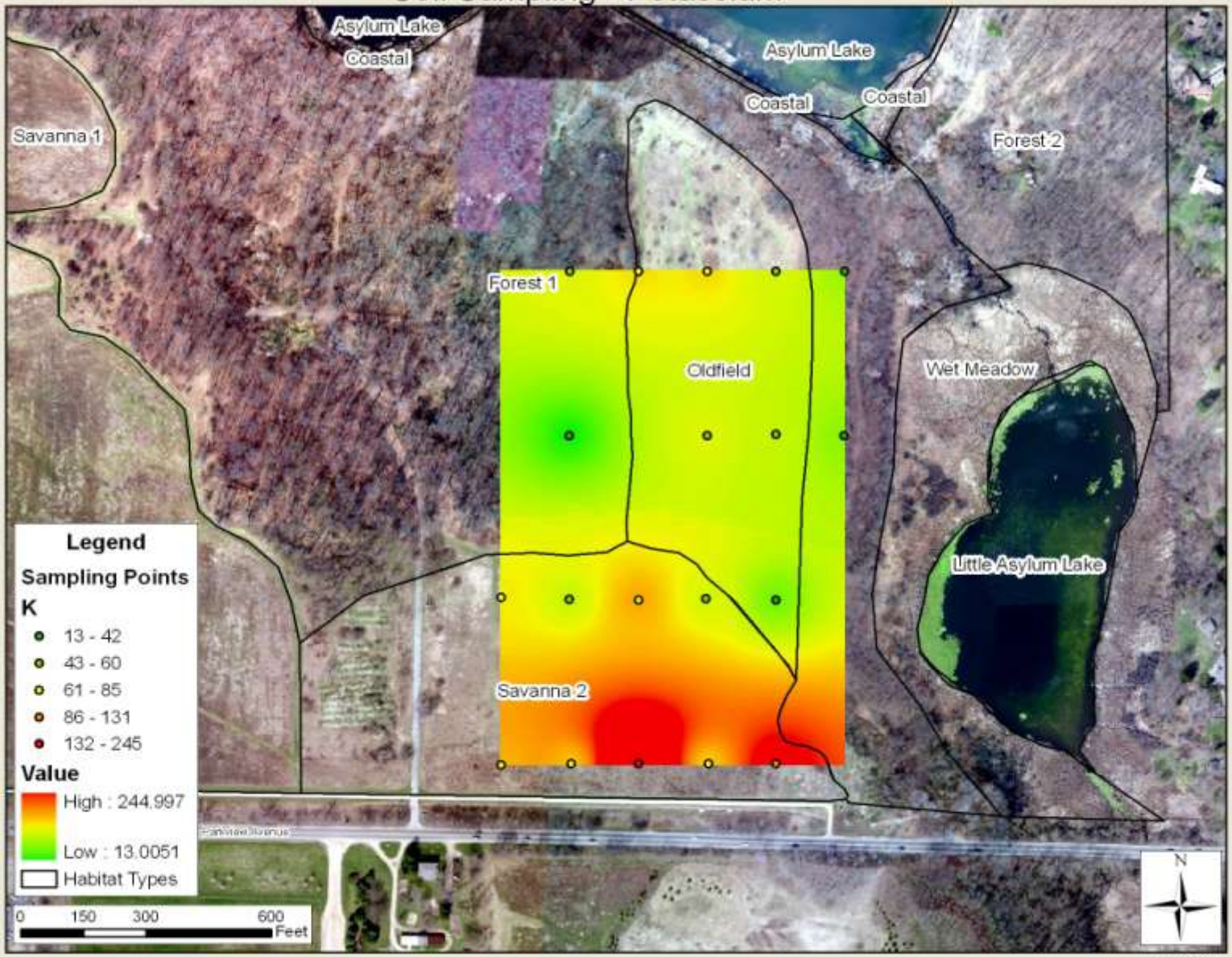
Magnesium Results

- Mg values for Old Field Proved higher than Forest 1 (P>.0106)
- Mg values also proved higher for savanna South than Old Field (P>.0067)

Asylum Lake Preserve
Soil Sampling - Potassium

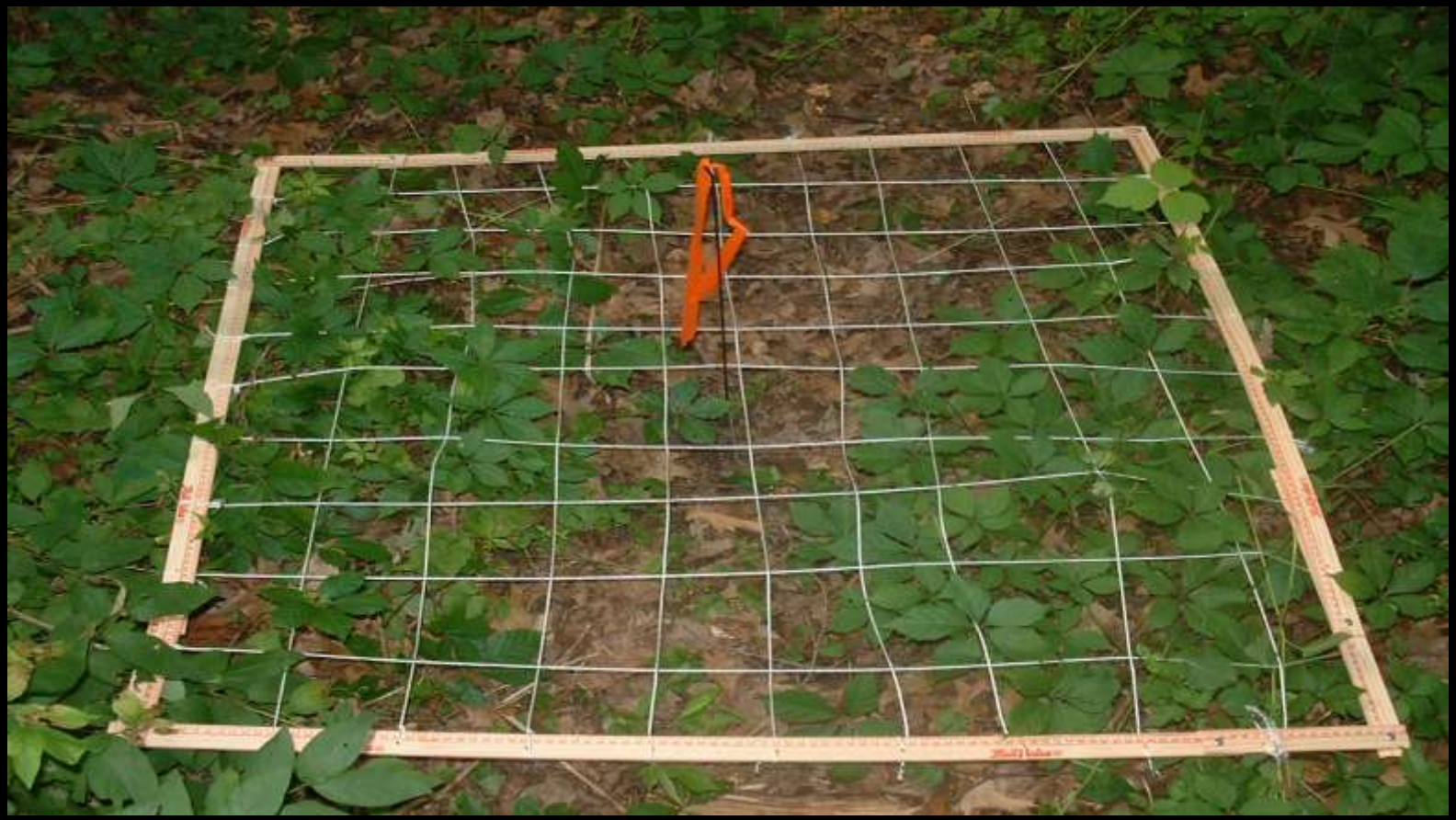


Potassium

- Savanna South proved to have significantly higher values than forest 1(P>.0254)

Vegetation Survey

- All points where soil samples taken were flagged to make return possible
- 1 meter by 1 meter quadrat was constructed and line was used to make grid within of 100, 100cm² squares
- The quadrat placed at flagged areas to make quantitative vegetation analysis possible



- Vegetation was recorded in a small surrounding area of the points sampled
- Only small trees(seedlings) were recorded

Old Field

- Bromus inermus (Smooth Brome)(grass)

  -greater amounts than Forest 1 (P.>0267) and Savanna North (P.>0374)
- Solidago canadensis (Canada Goldenrod)(forb)

  -greater amounts than Forest 1 (P.>.0373)

Savanna North

- Agropyron repens (Quack Grass)(grass)
  -greater amounts than Old Field(P>.0192)
- Dactylis Glomerata (Orchard Grass)(grass)
  -greater amounts than Old Field(P>.0192)
- Rumex acetosella (Sheep Sorrell)(tree)
  -greater amounts than Old Field(P>.0047)
- Achillea millefolium (Yarrow)(forb)
  -greater amounts than Old Field(P>.0363)

Savanna south

- Solidago canadensis (Canada Goldenrod)(forb)

  -greater amounts than Old Field (P>.0373)

Forest 1

- Parthenocissus quinquefolia (Virginia Creeper)(vine)

  -greater amount than Old Field(P>.0402)

Conclusion 1-Discussion

- There was a difference between Old Field soil and soil from surrounding areas
- Seems that plants (tree litter) influence soil in surveyed areas
- Deeper silt and/or clay layers allow for higher P cycling rates and greater Fe & Zn cation exchange
- As succession happens, more litter may enrich soil in Old Field allowing for better tree germination

Conclusion 2- Further Research

- Larger transects should be used in later research for vegetation survey to be more representative
- Future research should focus on plant, soil composition relationships

Acknowledgements

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