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# Mapping the variability of soil quality indicators in natural versus agricultural ecosystems

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# Mapping the Variability of Soil Quality Indicators in Natural Versus Agricultural Land Management

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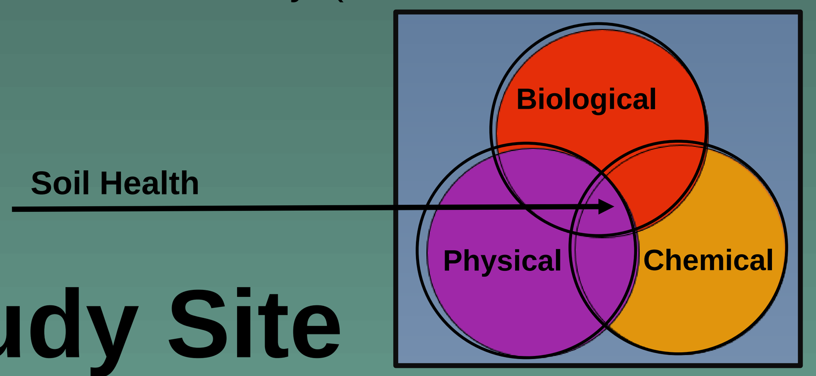
## Introduction

- Soil quality is defined as the capacity of a soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality and support human health and habitation (Karlen et al, 1997).
- The objective of this study was to evaluate the changes of physical soil quality indicators in natural versus agricultural land management (LM).
- Previous studies in western Kentucky indicate that decreases in soil organic matter content due to tillage have increased bulk density. (Arvidsson, & Håkansson,1996).

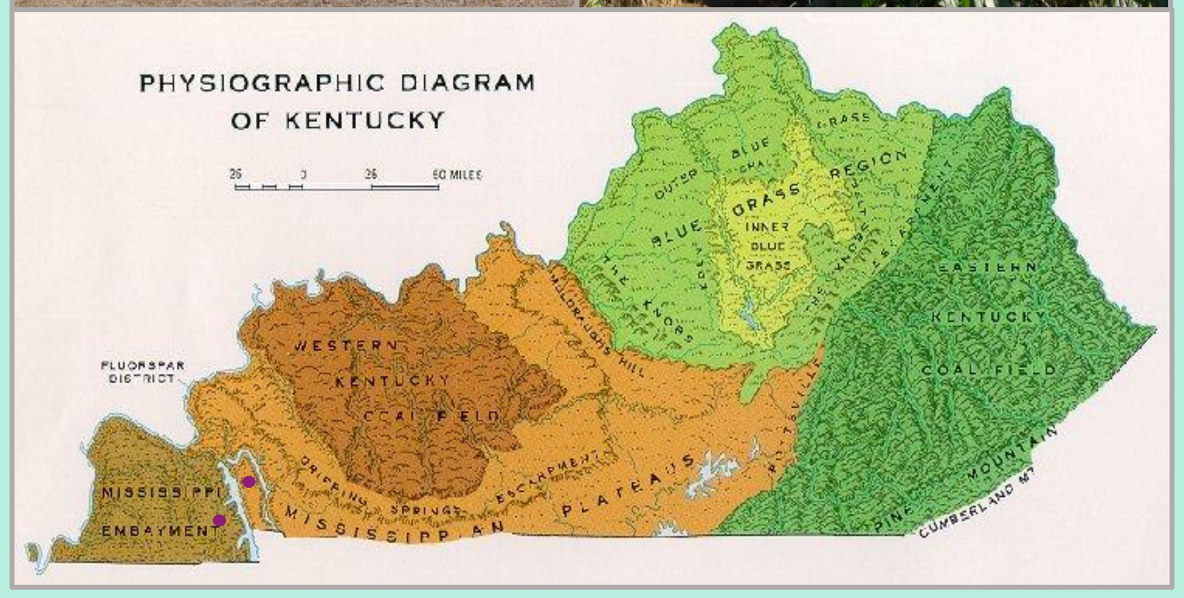



## Study Site

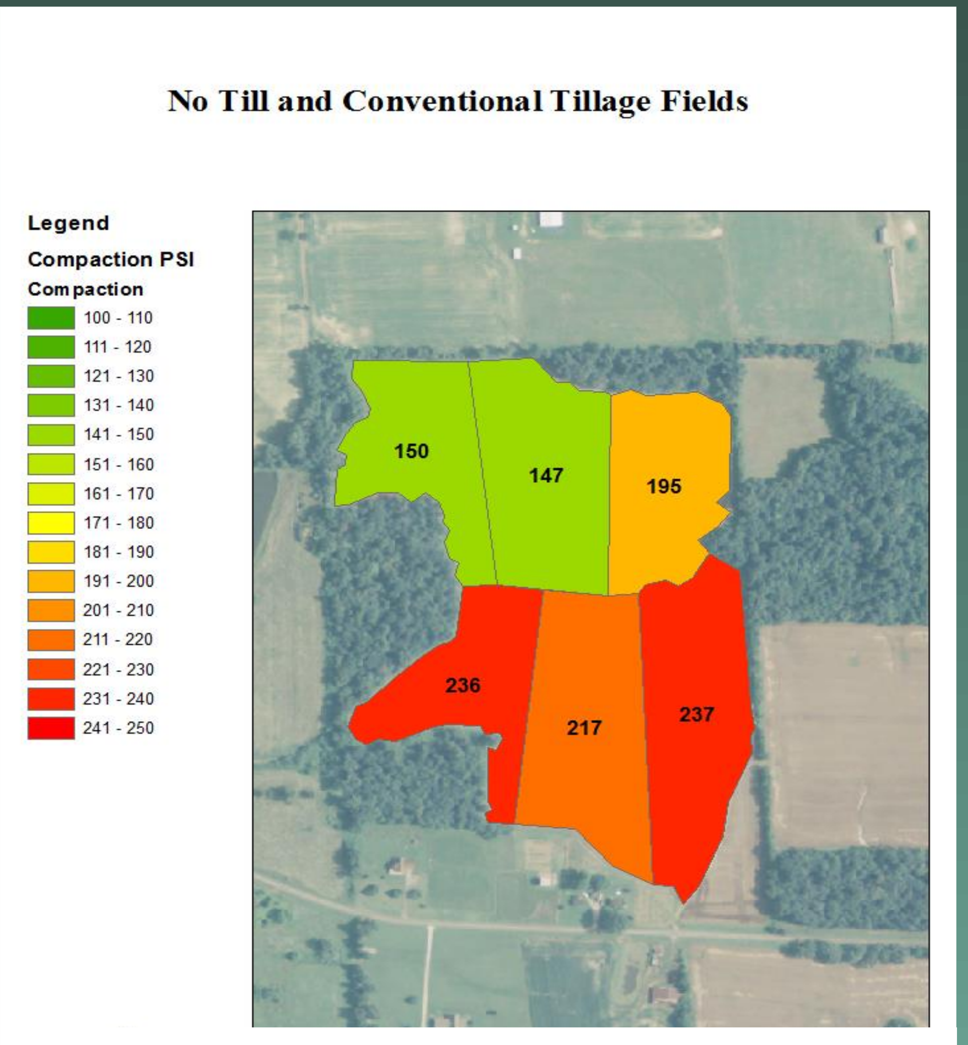
The natural grassland and woodland fields were located throughout Land between the Lakes in Kentucky (36°45'00.0"N, 88° 04'19.0"W. The agricultural no-till and conventional tillage sites were part of Kelly Farms in Calloway county Kentucky (36°41'3.33"N, 88°14'34.76"W). The minimum continued treatment timeline for all fields was 12 years. Major soil series for both ecosystems included Grenada silt loam and Brandon silt loam.

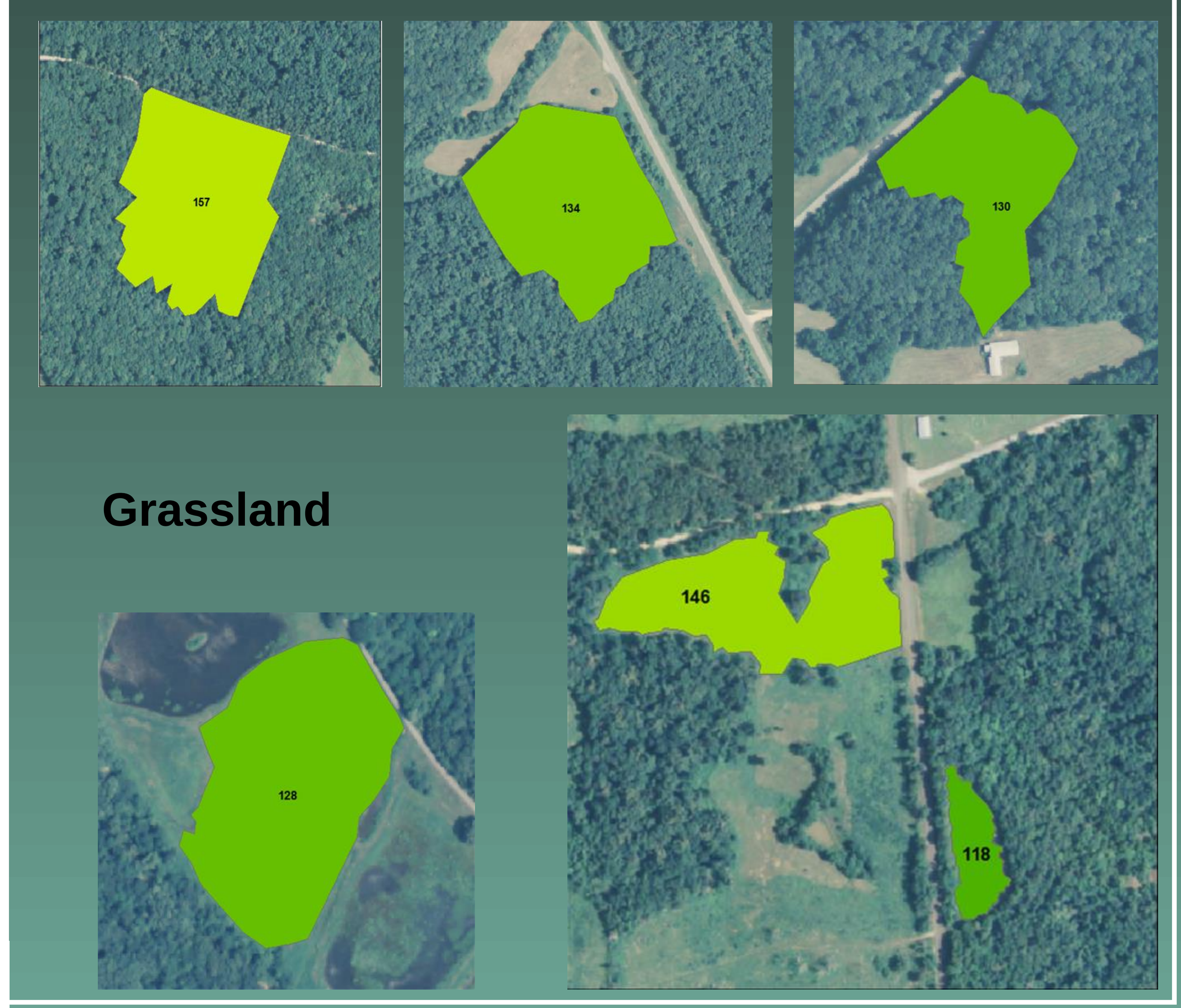
## Methods

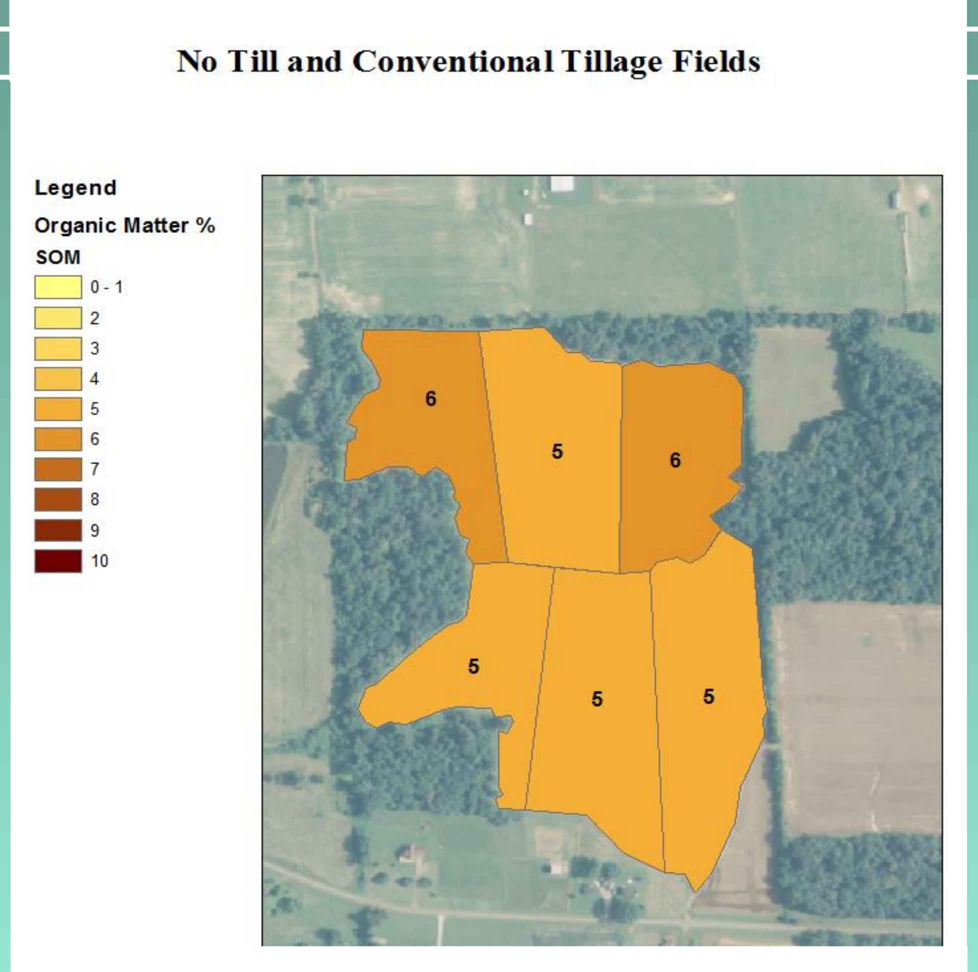
Natural LM consisted of grassland and forest, Agricultural LM consisted of conventional tillage and no-tillage. Three fields were sampled from each LM type. Fields were between 0.5 and 1 hectare in size. Ten random compaction measurements were taken per field at the depth of 21 cm. Five disturbed samples were randomly taken and mixed from each field at the depths of 0-7.5 cm. These mixed samples were used to measure soil organic matter content (SOM) and soil macro-aggregate and micro-aggregate amounts. SOM was determined using the method of loss of ignition (LOI). Macro-aggregate (2.0 mm – 0.25mm) and micro-aggregate (0.25 mm - ≤) were measured using the wet sieving method (Handayani et al., (2011). All data was statistically measured using ANOVA single factor with an α of 0.05.

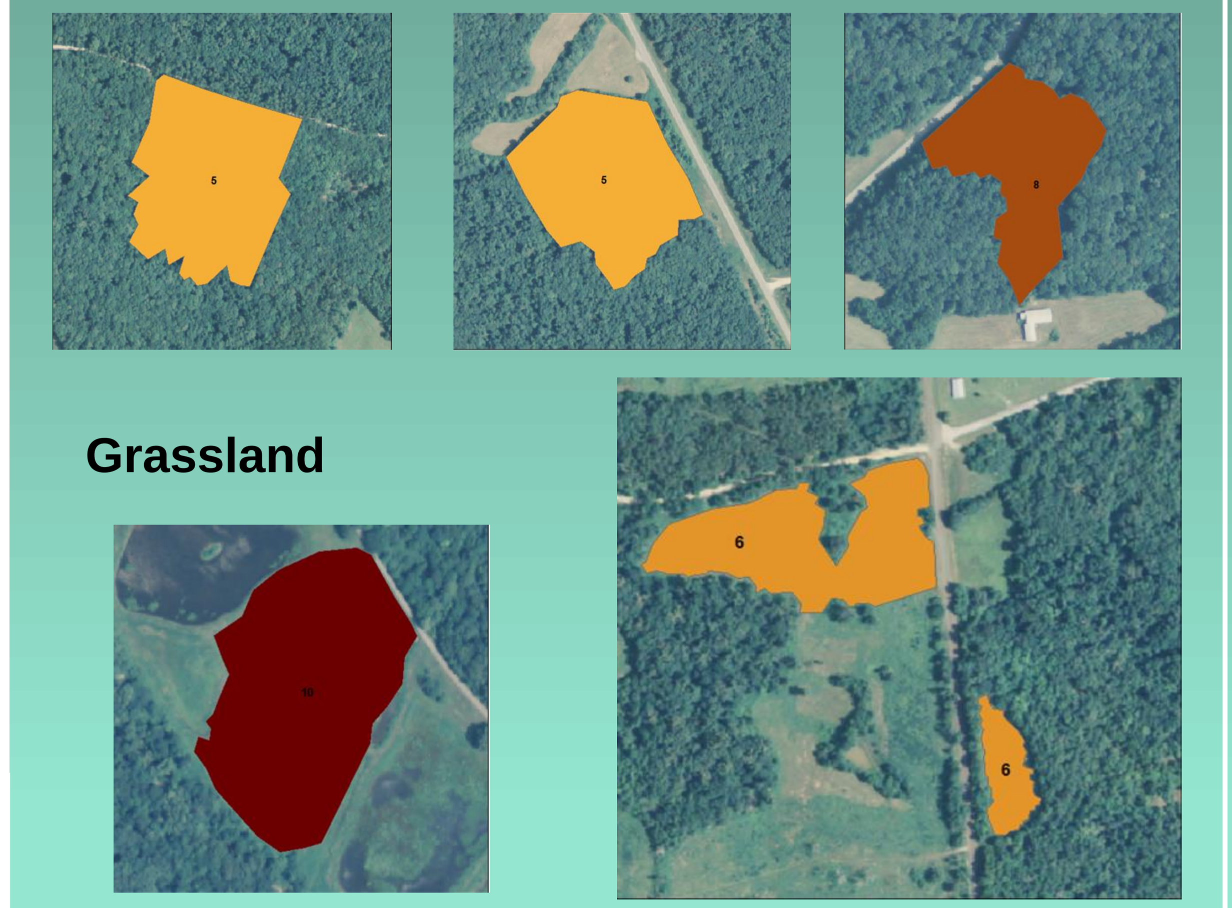


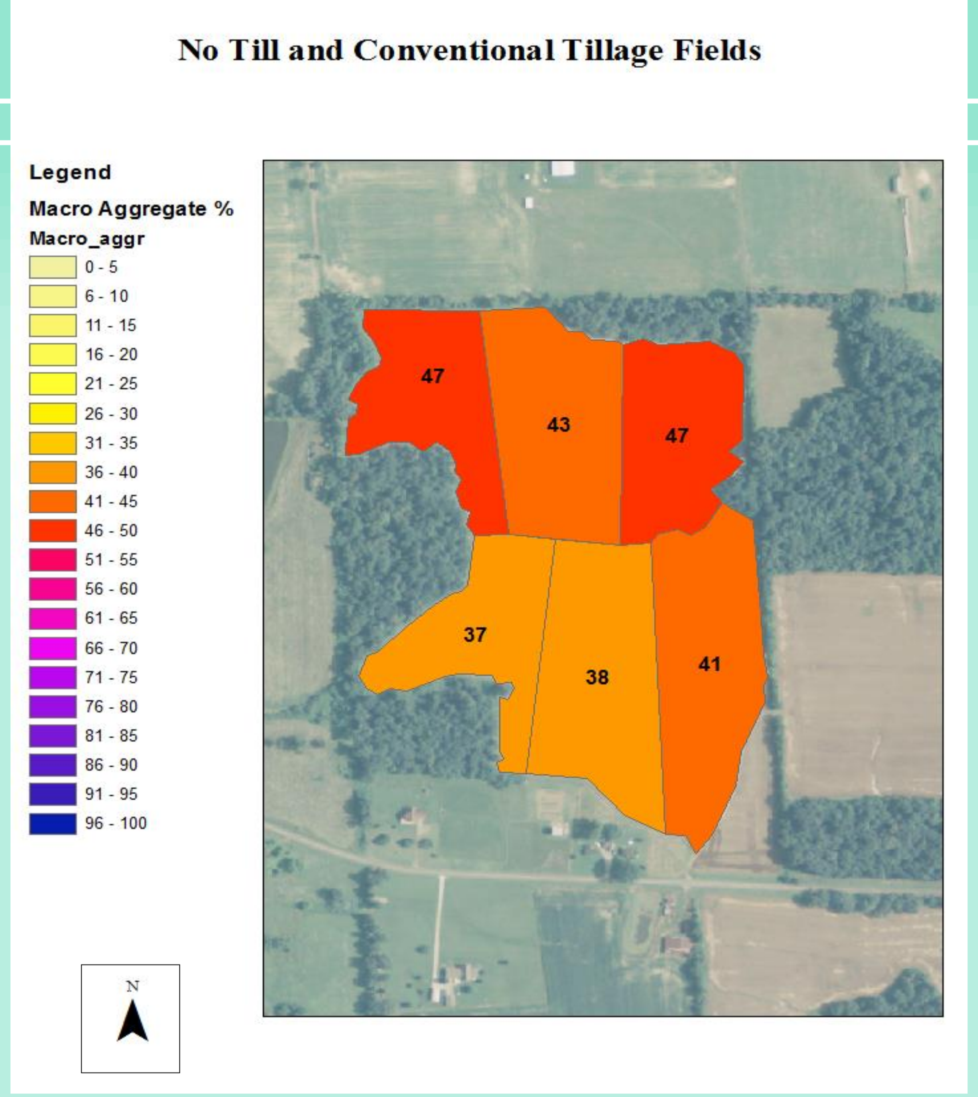

## Results

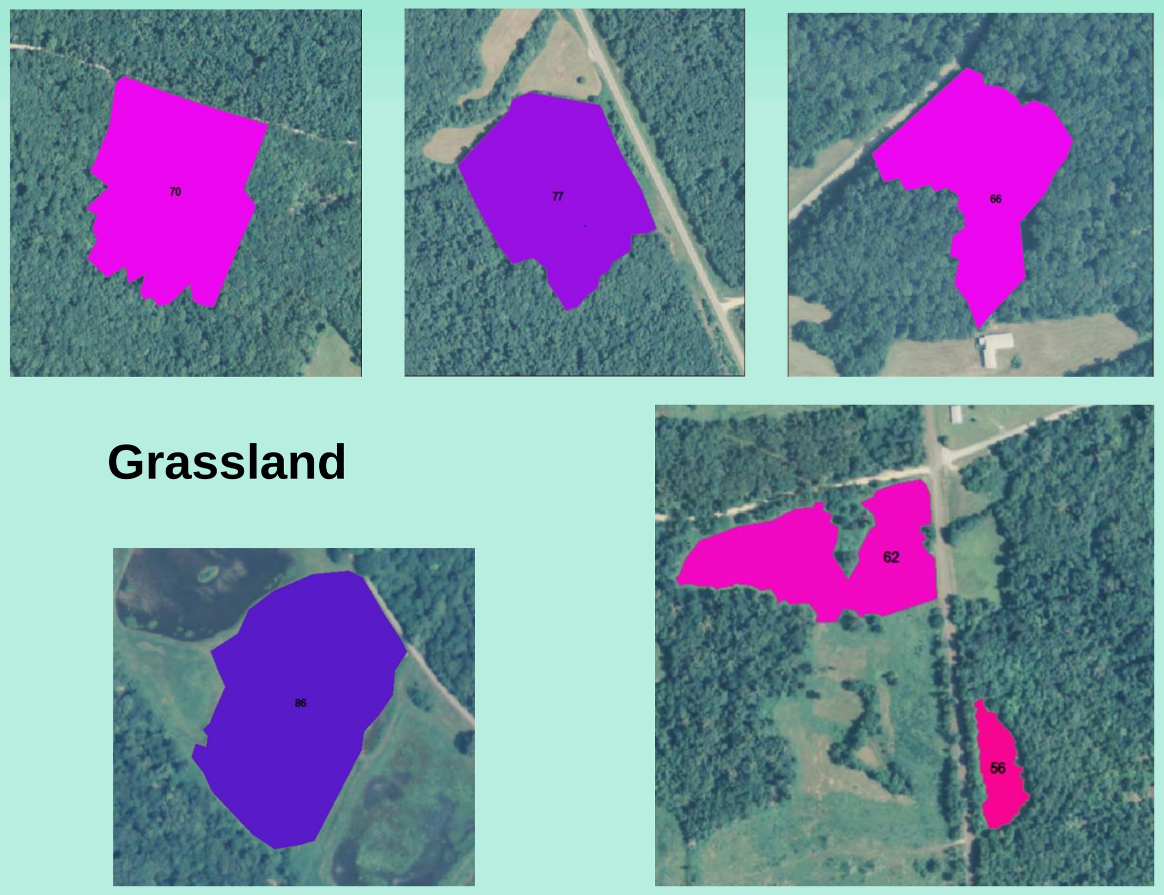



## Conclusions

- Conventionally tilled soil was significantly more compacted at 230 PSI compared to grassland, woodland, and no-till at 130, 140, and 164 PSI respectively. Conventionally tilled soils suffer from high soil compaction at the depth of 21 cm. Such high compaction has been shown to affect crop yield.
- Macro-aggregate amounts are about 45-50% lower in agricultural fields than in natural fields at the topsoil, indicating less resistance to water erosion.
- No-Till fields had a 16% increase in macro aggregate amounts over a 12 – 15 year period.
- Soil organic matter (SOM) content was 25% higher in natural LMs at the soil surface (0-7.5 cm) than in agricultural LMs. This shows that SOM is very sensitive to LM type.
- The findings revealed that soil organic matter content, macro-aggregates, soil compaction are significantly sensitive to soil health changes over 12 to 15 year periods of consistent Land Management.

## Acknowledgements

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