**Methods**

The method I used to demonstrate soil quality change involved a combination of external calculations and the use of ArcMap functions. I started by compiling the results of 25 composite samples from 8 fields at Philo Ridge, collected and processed by Alvez and his UVM team. These fields were located on one square mile of land, which amounted to 640 acres divided into 8 plots. Alvez tested these samples for chemical compounds using the Modified Morgan Soil Testing system at the UVM soil lab and generated (show table) results for the macronutrients Phosphorus, Potassium, Calcium, Magnesium and Sulfur, and the micronutrients Iron, Manganese, Boron, Copper, Zinc, Sodi-

In two short years, Integrated Livestock Management (ILM) has made a significant difference on the nutrient content of Philo Ridge Farm soils. A diverse range of change can be observed throughout the farm, the majority of which is positive. The corner field 8, middle field 3 and largest field 5 experienced an overall decrease in macronutrients. The data shows that this is due to large, isolated decreases in Potassium, Calcium and Magnesium, which can likely be traced to factors outside of livestock introduction.

Alvez and his team stress that these changes are the consequence of easy, inexpensive changes to livestock grazing patterns, and reduced the farm’s need for overall fertilizer inputs. It is clear that ILM, a soil building strategy, is also one that promises to improve the bottom lines of farming operations. One of the huge benefits of mapping this data, rendering it comprehensible and visually engaging, is that the positive changes generated by ILM can be communicated to neighboring farms in Vermont, and state legislators currently debating whether or not to develop and support effective farm Bills. Advocacy groups like Soil 4 Climate and the Northeast Organic Farming Association have developed regenerative soil legislation for Vermont, which would establish knowledge hubs and other capacities farmers could consult to help reform their practices to restore their soil health. Displays of successful case study results like Philo Ridge Farm can be used to persuade legislators to enact these policies and lead to sustainable farm reform.

**Limitations**

The main limitation I had for accurately depicting soil quality change across these fields was the generalization of the soil test results. I was given data of element change that was averaged around the centroid point of each field. I therefore am making a generalization across multiple acres of land when I assign an element change attribute to each polygon. With more detailed data, I would have generated raster layers from tables of soil quality across every square meter of each field and displayed change across a raster gradient. Additional challenges I faced included an inability to edit attribute tables in Editor after performing joins, which required that I input details needed for each nutrient map before performing any joins.

**Recommendations for Future Projects**

As they stand, these maps could be greatly enhanced by using knowledge of soil erosion patterns to map other factors in the area that could be contributing to soil organic matter change over time. The Universal Soil Loss Equation could be used to determine which factors should be mapped and spatially analyzed. For instance, if rainfall and watershed patterns, proximity to roads and discharge areas, surrounding soil characteristics, farming practices and landscape features could all be factored in to gain a more holistic picture why soil quality changed in the way it did.

**Sources**

1. Vermont Geodata open portal: Charlotte Zoning, Soil Quality data: [http://maps.veg.vt.edu/geospatial/Soils/3DGis.html](http://maps.veg.vt.edu/geospatial/Soils/3DGis.html)


3. ArcGIS portal: Vermont imagery basemap
