Internship on Mapping Sustainable Farm Systems: An Experiential Introduction to Sustainable Agriculture

Spencer A. Shanholtz – Intern, Dr. Steven Hodges – Faculty Mentor,
K. Tanaka, L. Brislen, K. Niewolny, L. Macauley, K. Jacobsen, M. Velandia, and A. Wszelaki

Introduction

The success and good stewardship of sustainable farms are associated with multiple biophysical and social factors. This topic is being explored by an existing SARE project "Mapping Sustainable Farm Systems" which is an interdisciplinary collaboration involving Kentucky, Tennessee and Virginia, and includes multiple aspects of the social and biophysical sciences. As an intern, my assistance with this study included researching the "sense of place "for a study area by compiling and organizing geospatial data, transcribing farmer focus groups discussions, participating in a farm observation walk, and putting together a preliminary system dynamics of a sustainable agriculture operation

Collecting Geospatial Data

The first step in determining what makes a sustainable and successful farm included finding and collecting as much data as possible about the "place" and documenting a set protocol for this collection in future more in depth case studies. A GIS geospatial database in ArcMap was created including data about:

- Soils: from USDA SSURGO data including map units, soil type, crop indexes, erosion factors, drainage classes, and water holding capacity
- Aerial images
- Elevation maps : from USGS NED data and used to generate slope and aspect
- Climate: from NOAA National Climatic Data Center including precipitation and temperature
- Road networks, surface water, and political boundaries: from US Census TIGER Data

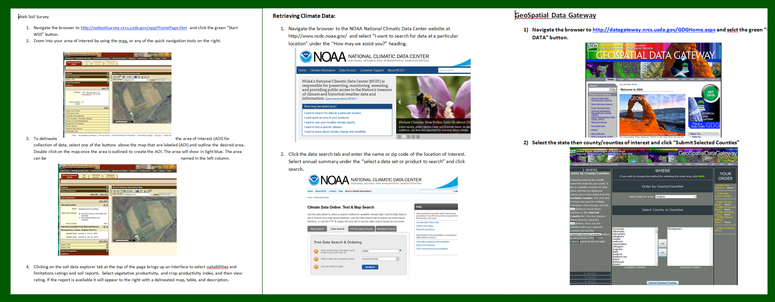
Guides were created to assist with future access of this information from online databases.

Field visit at Virginia Tech Kentland farms with farm manager Johanna Crecenti

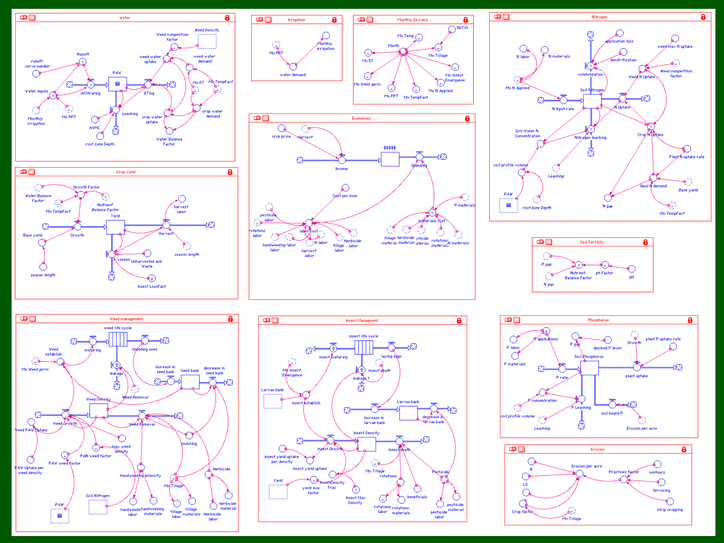
Field Experiences

Spatial information is not sufficient in characterizing the "place" of a farm and thus a trip to the site is necessary to gather additional information. Information on crops, rotations, conservation practices, farm animals, beneficial and pest insects and plants, and other site specific information was collected. These various factors are often highly variable and hard to characterize but play an important role in determining the success of a farm operation. A trip was taken to Kentland Farms which is the Virginia Tech owned research and education Farm. The objective of this trip was to gain a sense of place for this location that could not be obtained through geospatial data alone. With knowledge from geospatial and GIS data we were seeking information based on ground level, on site observations. We plan to make a trip to visit to the University of Kentucky to discuss the project with collaborators and tour local farm operations.

GIS model displaying soil map units of Kentland Farms, Virginia Tech's farm facility operation



Examples of guides that were created to assist in collecting spatial data for future access



An overview of the STELLA model created to simulate farm systems and their interactions based on "place" data.

Focus Groups

An portion of this SARE project focuses on social factors that affect the success of a sustainable farm. Six farmer focus group sessions took place in southwest Virginia and I had the opportunity to gain insight into the social aspect of this project by transcribing some of these sessions. The information obtained from these sessions was about the perception of resource that a beginning farm requires and where to obtain these resources. These included knowledge, skills, materials, and allowed an insight into where and how current farmers obtain the things they need and what barriers are in place. This information will be used to create resource maps that can be used by future beginning farmers.

Modeling and Systems Thinking

Systems thinking is a holistic approach to analysis that focuses on how constituent parts or factors interrelate within a system. This ideology is based on cyclical rather than linear cause and effect. STELLA modeling software was used to develop a preliminary model of a sustainable farm system based on the data collected about a "place". Components incorporated into the model include :

- Crop growth by season
- Water uptake by crops and weeds
- Nitrogen uptake by crops and weeds
- Pest Management
- Economics: Income and Costs from above practices
- Environmental Outcomes

The model will look at a farming operation on a monthly time step, and serve as the starting point to begin analyzing different farmer decisions based on their personalized operation. The model will allow "place" based information to be input and simulations run to determine the "Success" of the farm. This level of success could be determined by economic factors such as profit or environmental impacts as well.

Reflection

My experiences throughout this internship have taught me to approach interactions and problems with a broader of view and to realize the interdependencies of factors, rather than just their linear relationships. This change in thought pattern has allowed me to approach sustainable agriculture in more comprehensive method.

In order to determine what makes a sustainable farm successful, we must combine accurate information about the geospatial location, field level data, and economic and social factors in a systems thinking approach. There are a large number of factors in play when it comes to the "success" of a farm operation. Using the model developed through this internship we can apply these factors into a system that can predict relative outcomes of scenarios and assist farmers in making sound decisions.

This project was supported in entirety through a Southern SARE Young Scholar Enhancement Grant.