

# The Missouri Ecological Site Project: Correlating Soil Map Units to Pre-Settlement Vegetative Communities for Conservation Planning and Soil Health Monitoring

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## Ecological Sites for Conservation Planning

Ecological Sites (ES) comprise the Ecological Classification System, a hierarchical Natural Resources Conservation Service (NRCS) land classification model based on biotic and abiotic factors. Compiled together, these elements produce distinct ES's across a given landscape which respond similarly to disturbance and management (*National Ecological Site Handbook*, 2014).

The Ecological Site Project has been an ongoing collaboration between multiple state and federal agencies, with the Missouri Department of Conservation (MDC) and NRCS taking lead roles. Recently, the Missouri approach has served as a proven model and has been proposed for adoption by NRCS nationwide.

NRCS uses Major Land Resource Areas (MLRA) to divide the United States into regionally distinct eco-regions based upon geology, climate, topography, etc. (FIGURE 1). Each MLRA is further subdivided into ES's based upon the National Cooperative Soil Survey (FIGURE 2). Using a three-tiered approach, soils with similar properties have been grouped together into specific Ecological Sites when found to yield similar plant communities through field sampling (FIGURES 3 and 4).

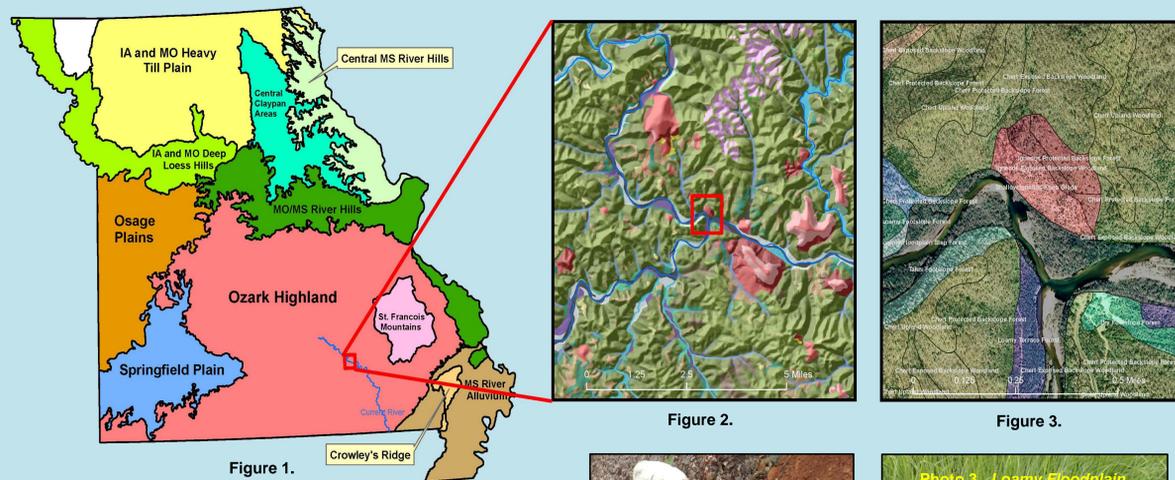


Figure 1.

Figure 2.

Figure 3.

Approval Stage	Research Stage
Tier I	Similar soils within MLRA are correlated with theoretical Ecological Sites
Tier II	Confirm and refine ES through field sampling, locate reference condition sites, create Ecological Site Description documents
Tier III	Reference condition sites are methodically documented, NRCS final approval and publication

Figure 4. Ecological sites are developed in three phases.

Photo 1. NRCS soil scientist Grant Butler describing a soil profile during field work.



Photo 2. Soil Scientist Dennis Meinert trains MDC staff on the ES program.



## Management Implications

NRCS, County and MDC private lands conservationists utilize ecological sites when determining if private land is eligible for cost-share (FIGURE 5), available online through the Web Soil Survey: <https://websoilsurvey.nrcs.usda.gov>

- The online Web Soil Survey provides the public with ES data about any area of interest selected, providing ES delineations, soil map units, management information, printable maps and much more (FIGURE 6).
- Also available are the Ecological Site Description documents, a comprehensive description of the ES (FIGURE 7).

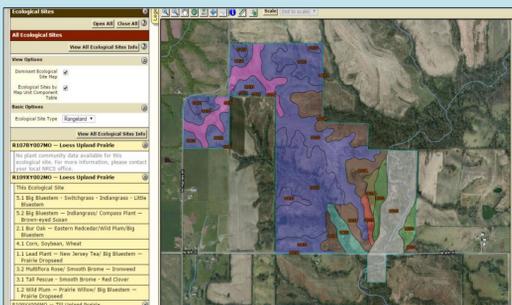


Figure 6. The Web Soil Survey is an online tool allowing both public and private users the ability to delineate an area of interest detailing ecological sites, soil data, acreage, management recommendations and more.

**Figure 5. Cost-share programs using Ecological Sites**

- Conservation Reserve Program
- Agricultural Conservation Easement Program
- Conservation Stewardship Program
- Environmental Quality Incentives Program
- Joint Chief's Landscape Restoration Partnership
- Regional Conservation Partnership Program

Missouri's pre-settlement landscape was a diverse matrix of prairie, woodland and forest (The Terrestrial Natural Communities of Missouri, 2010), making it difficult in today's world to distinguish where these communities occurred on the landscape. What sets ES apart from other restoration programs is the attention given to soil types and landforms specifically mapped in Missouri. Using ES, a specific acreage can be tailored to a restoration program which places the appropriate communities on soils which once supported them historically. Doing so can save stakeholders time, effort and money.

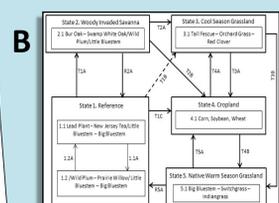


Figure 7. The Ecological Site Description (A) is a comprehensive document detailing the finer points of each ES, including the State and Transition Model (B).

## Soil Health Monitoring

Ecological site data is being utilized for statewide soil health studies by NRCS and the University of Missouri-Columbia's Soil Health Assessment Center (SHAC) to classify a given soil type's biological profile. In the past, this aspect of soil science has not been investigated to the same degree as the physical and chemical parameters.

### A Soil's Reference State Condition

Through field work with the ES Project, sites are located which have little disturbance history. These locations can be described as having both the soil and vegetative community existing in a *reference state*, resembling pre-European settlement conditions.

NRCS soil scientists conduct full soil characterization down to two meters, collect Basic Soil Health Package data plus the Phospholipid Fatty Acid test at these reference state locations (PHOTOS 4-6). Doing so captures the full physical, chemical and biological properties for each horizon within the soil profile. This is determined to be baseline data for the respective soil series in its reference or "healthiest" state.

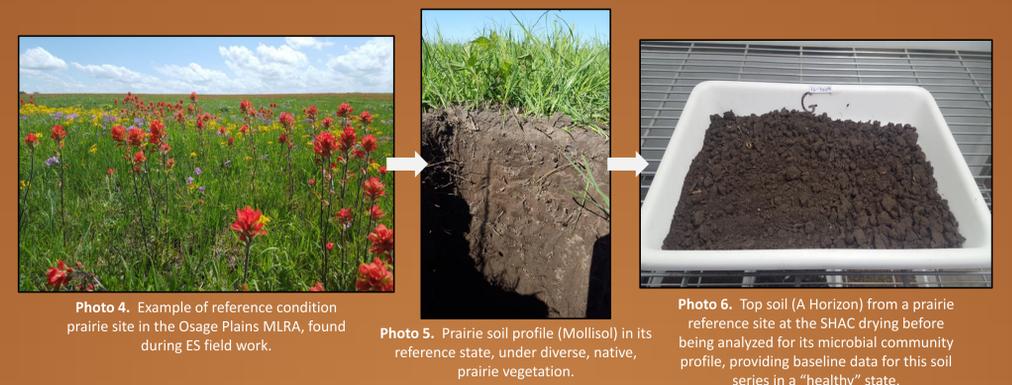


Photo 4. Example of reference condition prairie site in the Osage Plains MLRA, found during ES field work.

Photo 5. Prairie soil profile (Mollisol) in its reference state, under diverse, native, prairie vegetation.

Photo 6. Top soil (A Horizon) from a prairie reference site at the SHAC drying before being analyzed for its microbial community profile, providing baseline data for this soil series in a "healthy" state.

### Alternate States

In contrast to reference state conditions, a crop field, a cattle pasture or a clear cut forest would be classified as an *alternate state* for the soil series existing at that location (PHOTOS 7-8).

NRCS scientists are visiting these alternate state locations to perform similar data collection, revealing the difference between reference state vs. alternate state conditions. Labeled as Dynamic Soil Property Research Projects, these investigations can provide valuable insight as to how soil properties and microbial biological activity changes under various management regimes (FIGURE 7). This undertaking has enormous potential to guide management of our state's soils to much "healthier" conditions.



Photo 7. Example of near reference state condition Till Protected Backslope Forest ES.

Photo 8. Example of alternate state condition Till Protected Backslope Forest ES under cool season grass pasture.

Example of Dynamic Soil Properties Research for <i>Mexico Silt-Loam</i>	
State During Data Collection	Disturbance or Management
Reference State	Prescribed Burning
Native Warm Season Grass Restoration	Grazing Only
Native Warm Season Grass Restoration	Haying Only
No-Till Crop Production	Crop Production
No-Till Crop Production with Cover Crops	Crop Production
Conventional Crop Production	Conventional Tillage

FIGURE 7. Table detailing an example of a Dynamic Soil Property research project.

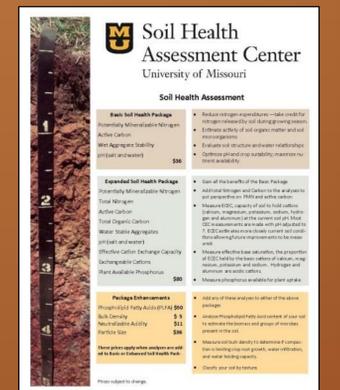


FIGURE 8. Listing of the various analyses available at the SHAC.

## The SHAC

The SHAC at MU's South Farm Research Center is conducting lab analysis for these and many other studies. Recent interest in the biological components of soil has led to the addition of new biological analyses at the SHAC, enabling this research to be conducted here in Missouri. Answering soil health questions is the next step in soil science, and the SHAC is Missouri's best resource for the job. The SHAC is open to the public (FIGURE 8).

## Acknowledgements

Many people have helped on this project over the years. Thank you to all, including those not listed, as this project would not exist without their knowledge and hard work:

- |                      |                    |                             |                               |
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