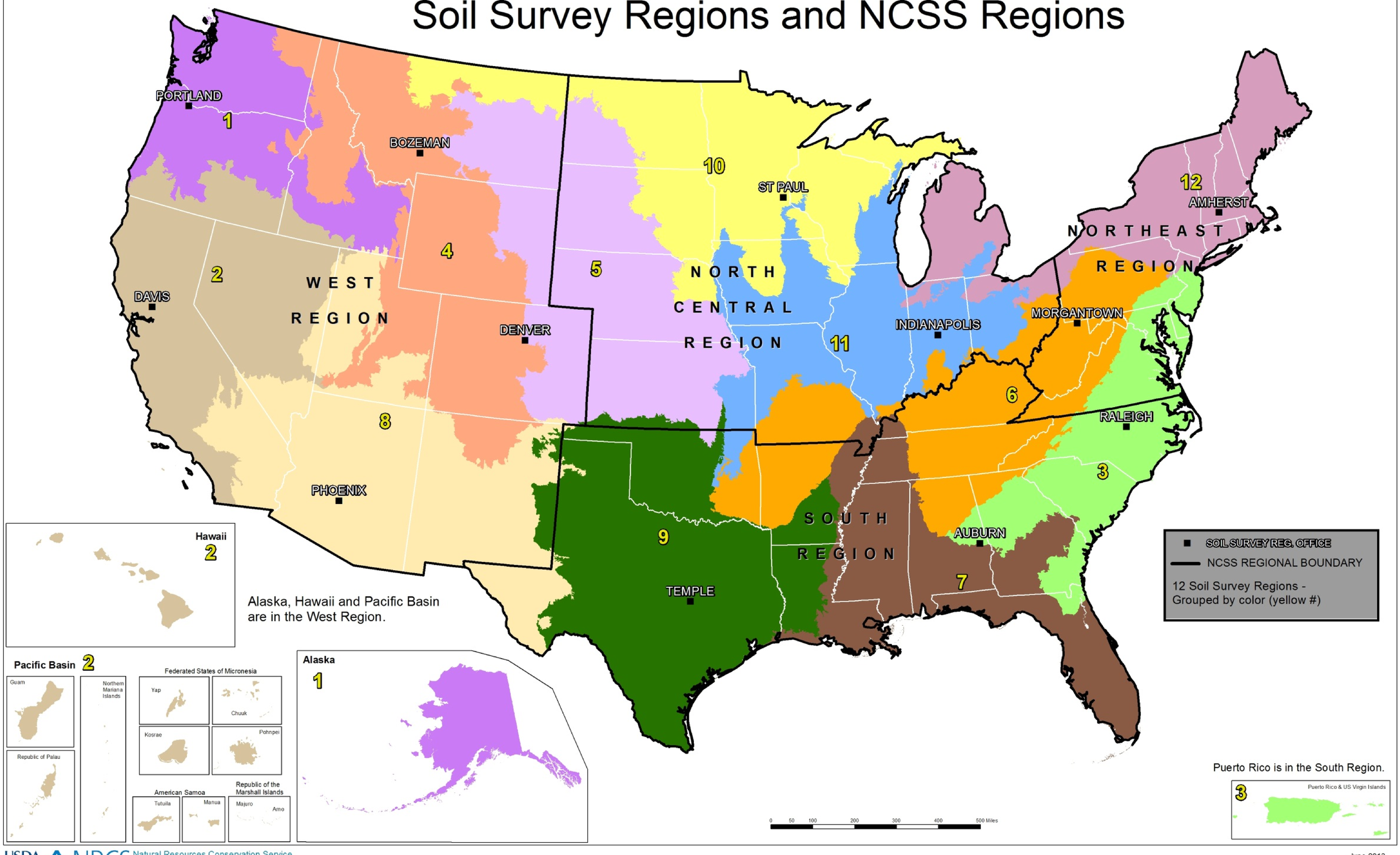
Soil Survey Regions and NCSS Regions

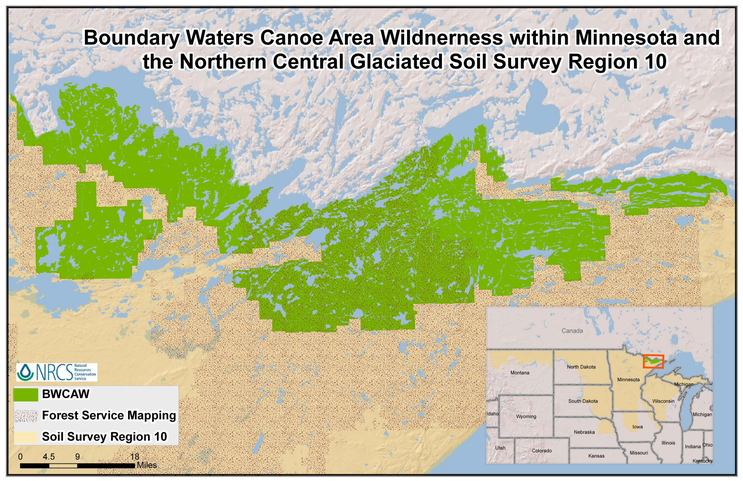


USDA NRCS Natural Resources Conservation Service
Soil Science Division
Washington, D.C.

June 2013

Soil Survey of the Boundary Waters Canoe Area Wilderness (BWCAW)

A Collaborative Project between the USDA-Forest Service and USDA-Natural Resources Conservation Service



The one million-acre BWCAW established in 1978 lies within the boundaries of the Superior National Forest in Northeastern Minnesota which is within MLRA Soil Survey Region 10. This important wilderness area is managed by the USFS and is well known for recreational activities that include fishing, hunting, camping, canoeing, dog sledding, swimming, hiking, and skiing.

In August 2012 the USDA- Forest Service (USFS) and USDA-Natural Resources Conservation Service (NRCS) began a collaborative digital soil survey project of the approximately 595,000 remote acres of unmapped land in the BWCAW. This survey will be derived from a combination of digital soil mapping techniques using spectral and terrain data and will be supplemented by local expertise with the goal of a raster end product. Sufficient ground-truth data (soil samples and modeling correlation) will be collected so that the resultant survey has reliability and future products can be developed.

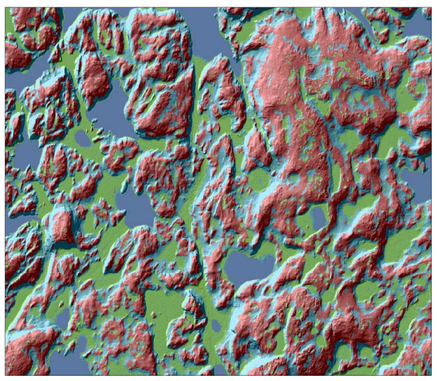
Various expert knowledge staff made up of FS and NRCS professionals were enlisted for this project and were divided into teams for data acquisition, data processing, modeling, field logistics, field data collection, ecological site development, quality assurance, standards, proof of concept, project management, and peer review. These teams will provide the utmost support during this collaborative project that is slated to be wrapped up by the end of 2014.

This is a very unique project in many aspects but a key distinction is the extreme remoteness of the area to be surveyed. The BWCA is a wilderness area managed by the Forest Service with no access by roads. While some lakes do allow motorized boats, in most cases, transportation is strictly via foot and paddle (canoe or kayak) only. There are portages throughout the area and primitive campsites but no cell phone service. A variety of charismatic wildlife inhabit the BWCAW include black bear, moose, and lynx.

Modeling workflow

- Perform unsupervised classification using selected variables based on Optimal Index Factor and variable importance from Random Forests (Figure W)
- Select sample points using conditioned Latin hypercube sampling for model building with some points held out for validation (Figure X, Y, Z)
- Refine classes using methods that may include: supervised, tree-based, or knowledge-based classification; or a combination of these
- Modeling will be concurrent with the data collection effort and continue through 2013 into early 2014
- An option to collect additional validation points during the 2014 field season is possible

Figure W. Preliminary results from unsupervised classification



Green- mostly Histosols
Red- shallow tills and rock outcrop
Light blue- deeper tills/lacustrine
Dark blue- water

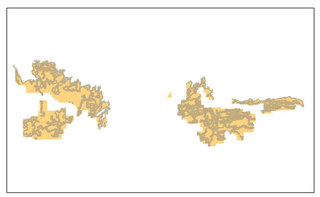


Figure X. Available areas for sampling include land within 0.2 miles of trails and shorelines contiguous to trails. These areas are representative of the BWCA based on the proportionate extent of landforms. Sample size is allocated according to the proportionate extent of these four areas. The total number of samples collected is dependent on the availability of staff and time.

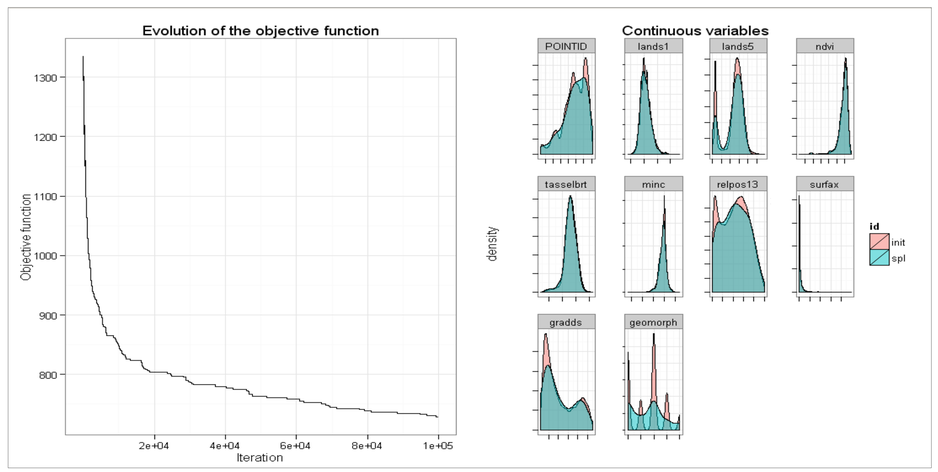


Figure Y. Objective function and density plots comparing frequency distribution of the population and sample based on 150 sample points and 100,000 iterations.

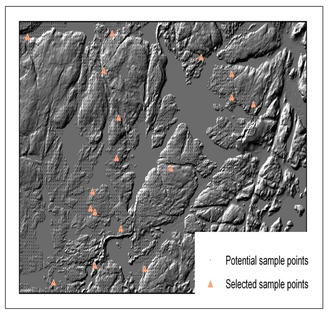


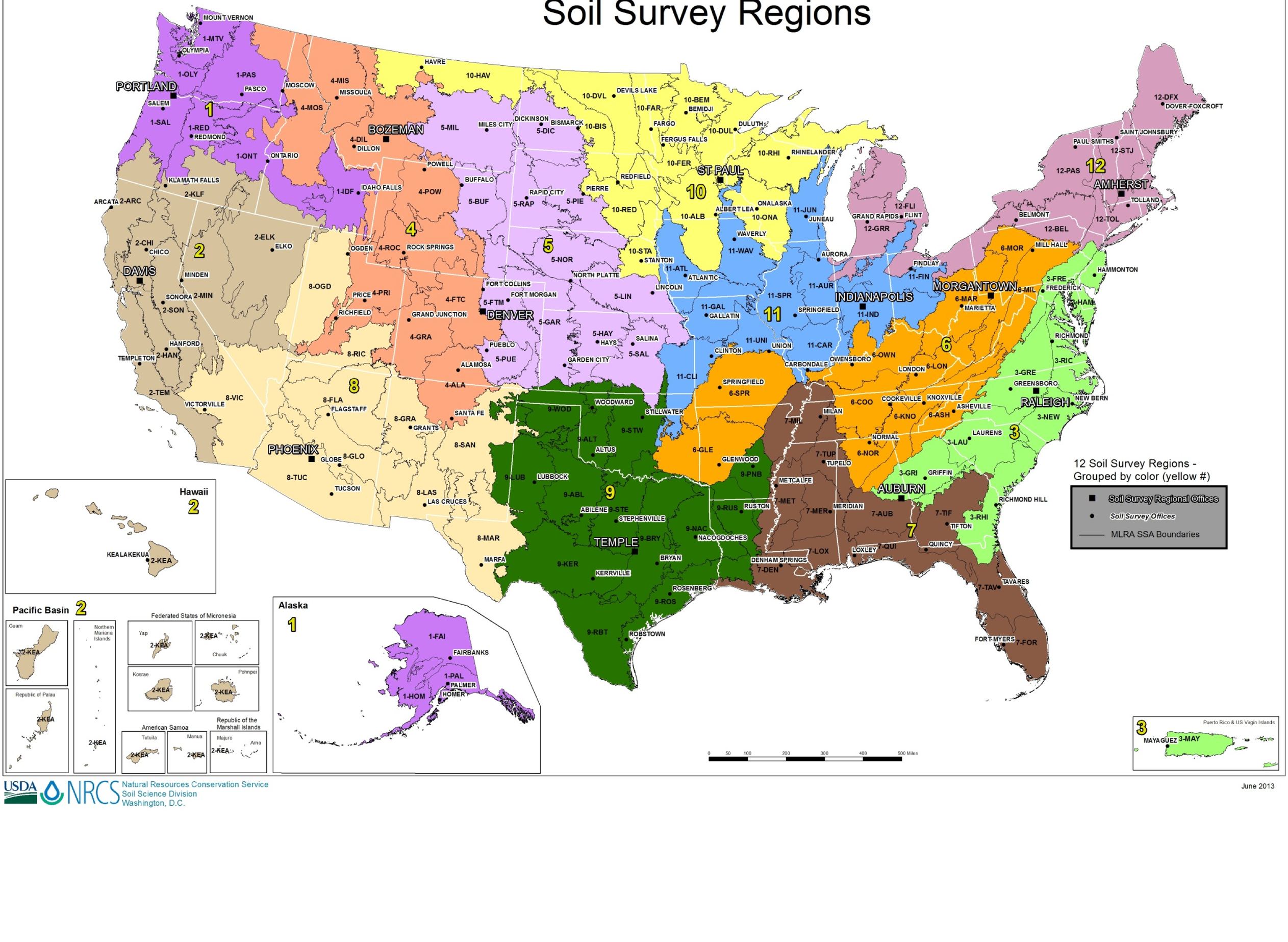
Figure Z. Sample sites selected from the conditioned Latin Hypercube sampling routine

As we move forward toward a world of raster soil surveys and disaggregated soil vector polygons, we will not only need procedures to define sampling, validation, investigations, documentation, etc., but also standards to define resolution, uncertainty limits, soil properties to measure/estimate, series versus properties, etc. This project will assist in providing both.

Poster created by Tom D'Avello, Soil Scientist/GIS Specialist, National Soil Survey Center and Danielle Evans, MLRA Soils GIS Specialist

For questions regarding the BWCAW soil survey project please contact Caryl Radatz, NRCS MO 10 Soil Survey Leader 651-602-7861 or caryl.radatz@mn.usda.gov

Soil Survey Regions



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