

Digital Soil Mapping Focus Team Long Range Plan

9/16/20

Vision: Operationalize digital soil mapping methods in production soil mapping.

Objective: Continue to build the digital soil mapping framework of standards, training, support, and delivery of raster-based soil information products in the National Cooperative Soil Survey, as outlined in the team's charges.

Charges

1. Coordinate DSM activities across the Soil and Plant Science Division
2. Identify training needs
3. Identify needs to update standards and propose solutions
4. Initiate annual field weeks to investigate soil-landscape relationships in selected DSM project areas
5. Assemble existing data
6. Identify gaps
7. Produce raster-based soil data and information

Goals and Strategies:

10-Year Goals

1. **Digital soil mapping is standard operating procedure for SPSD Soil Survey Offices and the NCSS.** Digital soil mapping is soil mapping. There is no longer an artificial distinction between 'digital soil mapping' and 'conventional soil mapping'. Soil Survey Offices are in full production mode and contributing to production of Raster Soil Surveys and nationwide continuous soil property maps.
 - a. This goal is achieved through continued capacity building with current and future SPSD staff and NCSS partners. Capacity building will be met through training courses, field weeks, project mentoring, and an active practitioner's group.
2. **Create a support system of staff with expertise in digital soil mapping at both the regional and national levels of the SPSD.** Technical support for digital soil mapping activities needs to come from both the Soil Survey Regional Offices and the National Soil Survey Center, just as technical support for all soil survey activities has always been structured. Digital soil mapping is relatively new within SPSD and there are very few staff in these key positions with expertise to support field activities.
 - a. As key positions at Regional Offices (Senior Regional Soil Scientist, Soil Data Quality Specialist, and Regional GIS Specialist) and at the National Soil Survey Center (Soil Business Systems-Geospatial Research Unit, Standards, Research, etc.) are advertised, include digital soil mapping language in hiring questionnaire and position announcement (and official position description). Include National GIS Specialist, or other key Soil Business Systems staff, on selection panel for key positions. DSM Focus Team members will propose questions for hiring questionnaires.

3. **National ecological site map built from continuous soil property maps.** Ecological sites are a deliverable of the SPSD and can be predicted using the digital soil mapping framework and soil properties.
 - a. The DSM Focus Team will implement an Ecological Site Sub-team involving key expertise within the SPSD and NCSS to focus on methodology for predicting ecological sites using continuous soil properties (and other data as identified) as covariates. As the nationwide continuous soil property maps are published annually, the ecological site maps will be too.
4. **Digital soil mapping methods and products applied to dynamic soil property inventory and assessment within the framework of Dynamic Soil Survey.** Digital soil mapping integrated with dynamic soil properties will provide soil knowledge to end-users that is both timely and functional.
 - a. A coordinated group of NCSS cooperators could be assembled under a new initiative (e.g., the National Institute of Soil Modeling and Forecasting) to lead the fusion of Dynamic Soil Survey using digital soil mapping and dynamic soil property expertise.

5-Year Goals

1. **Online delivery mechanism of all raster-based soil information products through one streamlined portal.** Raster datasets could include gNATSGO, Raster Soil Surveys, and nationwide continuous soil property maps. Minimum capabilities would mimic current Web Soil Survey (define area of interest, generate map, interpretations, reports, and data download).
 - a. This goal requires programming and development resources to be focused on new delivery systems for raster-based data. Progress toward this goal may be made through the NASIS redesign process. Ongoing support, including personnel and infrastructure, will be essential to maintain customer access to the most up to date raster datasets.
2. **Computing solution for handling development, storage, analysis, modeling, and sharing of nationwide datasets.** This computing solution needs to be accessible to both NRCS staff as well as NCSS partners to support essential collaboration.
 - a. Allocation of resources to support such a computing solution is needed. The agreement for Google Cloud services in FY21 will be the first opportunity to test a potential solution through the USDA framework. If this solution is found to be inadequate, solutions with university partners will be explored in the short-term. The first opportunity to test both the Google and university partner options will be via the nationwide continuous properties project with NMSU and WVU. Long-term computing options could include continued contracts with providers such as Google, university partners, or an in-house NRCS solution if infrastructure can be supported.
3. **Annual refresh of nationwide continuous property maps.** The first set of CONUS continuous property maps is anticipated in 2020. Annual publication of updated maps is expected to include additional properties, expanded geographic extent (eventually nationwide), updated methodology in line with current research findings, increased accuracy and decreased uncertainty.
 - a. This goal will be met by current and continued activities of the Properties Sub-team, including research into methodology for model development and calculation of uncertainty. Keeping this team active and engaged in generation of property maps

into the future would greatly benefit the NCSS and is deemed necessary for keeping these products innovative and relevant.

4. **Full suite of raster-based interpretations and ratings to mimic current options in Web Soil Survey.** In order to maximize the utility of raster soils information (both class-based Raster Soil Survey and continuous property maps), the data must be able to be used to generate interpretations and ratings for use and management. We recognize that most users are seeking soils information through these means.
 - a. Progress will be achieved through the interpretations engine project currently underway with NMSU with support from the interpretations working group, which includes members of the DSM Focus Team and pertinent NRCS staff. At the conclusion of the interpretations engine project, it will be critical to keep the working group involved and identify the necessary steps to keep moving forward toward achieving this goal.
5. **Raster products integrated into conservation planning tools.** Application to conservation planning and integration into planning tools like Conservation Assessment Ranking Tool (CART) and Conservation Desktop will connect the digital soil mapping effort in the SPSSD and provide relevant soils information to the main mission of the NRCS.
 - a. DSM Focus Team members will continue to demonstrate the benefit of raster-based data in conservation planning through projects like the Dynamic Soil Survey, raster-based interpretations, and attendance to conservation-focused conferences or other events. Effort will be made to stay connected to those working on development of CART and CD, and a soil conservationist and a state soil scientist will be asked to join the focus team to help facilitate this connection.
6. **Increase the number of quality pedon observations available electronically to support digital soil mapping activities.** Pedon observations of both soil type (class) and properties are critical to the success of digital soil mapping activities at both the local and national scale. Pedon observations exist in NASIS at varying levels of completeness and quality. There are also pedon observations that have not been entered into NASIS or any electronically useable form, and there are areas of the country that are lacking pedon observations completely.
 - a. Additional 20,000 pedons digitized annually. With approximately 300 field staff in SPSSD, this is roughly 66 pedons per staff person each year. The pedon source could include cleanup of existing NASIS pedon data and entry of previously or newly collected pedon observations into NASIS. The DSM Focus Team will work with the Database Focus Team-Pedon Sub-team to develop a proposal to implement this strategy that will be presented to SPSSD leadership for review and coordination.
 - b. Nationwide analysis of pedon data gaps based on covariates. Members of the DSM Focus Team will complete an analysis of existing pedon data and key covariates to identify gaps in data representation and target specific geographic areas for field data collection. Identified areas will be the focus of SPSSD field staff data collection, adding to the overall knowledge of soil-landscape relationships in these areas and supporting digital soil mapping activities. Newly collected data will be entered into NASIS for development of both Raster Soil Surveys and continuous property maps.
 - c. Develop DSM-specific sample analysis protocol for KSSL and submit a portion of newly collected samples for lab analysis. DSM Focus Team members will identify minimum dataset needed to support development of Raster Soil Surveys and continuous property maps and work with KSSL staff to implement protocol. DSM

Focus Team members will also outline criteria to determine what portion of newly acquired pedon observations should be submitted to KSSL for analysis.

- d. Develop DSM-specific NASIS queries/reports. DSM Focus Team members will work with members of the Database Focus Team to develop tools to ensure that field soil scientists can easily and consistently access quality pedon data for their digital soil mapping projects.
7. **Publish first coastal zone and urban area Raster Soil Surveys.** Raster Soil Surveys have been published for both update and initial soil survey projects. Coastal zone and urban area soil surveys are unique project areas for the SPSD and recognized as prime candidates for applying digital soil mapping.
 - a. The DSM Focus Team, specifically the project mentoring group, will work with the Coastal Zone Soil Survey and Urban Soil Survey Focus Teams to identify candidate projects for implementing digital soil mapping. Projects will be assigned a DSM mentor and work through the mentoring process to support completion of project goals.
8. **Integrate digital soil mapping concepts into all appropriate technical soil scientist and ecological site specialist training courses.** In order to make digital soil mapping standard operating procedure in all Soil Survey Offices and the NCSS, these concepts must be woven into SPSD technical training courses from early career moving forward.
 - a. Digital soil mapping will be built into the core training for all soil scientists, starting with the Basic Soil Survey course.
 - b. DSM Focus Team members and instructor cadres from DSM training courses outlined a number of action items related to training during the February 2020 focus team meeting. We will work with the Training Focus Team as needed to complete action items. Once action items are complete, we will reassess training courses and identify further action if necessary.
9. **Develop an advanced digital soil mapping training course.** There are concepts introduced in the current DSM training curriculum that require more in-depth presentation and exploration in order to build capacity for independent application among SPSD staff and the NCSS. Example topics include quantitative covariate selection techniques, prediction of continuous soil properties, and quantification and evaluation of advanced accuracy and uncertainty measures.
 - a. DSM Focus Team members and instructor cadres from the DSM training courses will work with the Training Focus Team to propose the advanced digital soil mapping training course. Cadres members will work with the SPSD Training Coordinator to develop course structure, materials, and delivery. This activity will take place following completion of the integration of digital soil mapping concepts in current technical training courses as outlined in (8) above.
10. **Review and update National Soil Survey Handbook and Soil Survey Manual standards on a minimum five-year cycle.** Advancements in digital soil mapping methodology and continued application in routine soil mapping activities will result in the frequent need to review and update existing standards to provide the best possible guidance to SPSD staff and the NCSS.
 - a. DSM Focus Team members will work with NCS Standards staff and through the proper NCSS process to review, propose, develop, and implement updated standards for the application of digital soil mapping in soil survey activities. This will occur as needed, but at a minimum of every five years. In addition, DSM Focus Team members will work on less formal guidance including job aids, technical notes, and other supplemental material to support digital soil mapping activities.

11. **Deliver online, self-paced versions of digital soil mapping training courses from the existing digital soil mapping curriculum.** The NRCS digital soil mapping curriculum is the only comprehensive training on digital soil mapping principles and practices in the United States. However, these courses are only open to federal employees and are mainly delivered to NRCS staff. University cooperators and students (undergraduate and graduate) have expressed interest in participating in the NRCS training. Creating online, self-paced versions of these courses will allow university cooperators to deliver NRCS-quality training to undergraduate and graduate students. As these students are potential NRCS employees, this will help create a more prepared candidate pool and ensure that new soil scientists, ecological site specialists, and GIS specialists join the NRCS with greater qualifications. These online, self-paced course materials would also be available to NRCS staff to review important concepts and techniques previously learned when they were initially enrolled in the training courses.
 - a. DSM Focus Team members will begin by developing a self-paced version of the Introduction to DSM course. This will be initiated at the NSSC-GRU through current and future agreements with WVU with support from the DSM Focus Team members, instructor cadres from the DSM training courses, and the Training Focus Team.