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U.S. DEPARTMENT OF AGRICULTURE

Dynamic Soil Property Guide

Version 3

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How to Use This Guide

This guide and the associated supplements were developed to support the entire lifecycle of a Dynamic Soil Property (DSP) project from project planning through completion. All supplements are publicly available on the DSP Box.

Key Supplements in the Dynamic Soil Property Box

S1.1 Extensive DSP Measures

S2.1 Intermediate and Intensive Methods

S2.2 Plot Replication Diagram

S2.3 Sampling Depth Guide

S2.4 Waiver Request Form

S2.5 Special Circumstances

S2.6 Land Use and Management Questionnaire

S3.1 Project Plan Workbook

S4.1 Project Planning Resources

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Chapter 1: Program Overview

1.1 Definition: Dynamic Soil Properties

DSPs are soil properties that change in response to land use, management, and natural disturbances on the human timescale. Examples of DSPs are soil organic carbon, infiltration, and structure. DSPs are indicators of soil function and soil change. DSPs can indicate the effects of past management and help guide planning decisions regarding future management practices. Information about how soils change and how DSPs influence soil functions are crucial to sustainable soil management on a variety of lands.

1.2 Dynamic Soil Property Permanent Directive

In March of 2020, National Instruction Title 430 Part 308, "Soil Quality" (430 NI 308) established the DSP Program within the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soil and Plant Science Division (SPSD). NI430-308 also established the current DSP Guide as the standard for completing DSP projects. In addition, the bulletin established the requirements for three tiers of data collection. All major land resource area (MLRA) soil survey offices (SSOs) are required to collect DSP data. Please refer to NI 430-308 for more information.

1.3 Soil and Plant Science Division Dynamic Soil Property Program

Through detailed data collection, the DSP Program contributes to the National Cooperative Soil Survey to integrate DSPs into soil survey products.

The vision of the Dynamic Soil Property Program is

Increasing understanding of dynamic soil and ecological resources to benefit conservation.

The mission of the Dynamic Soil Property Program is

Observing and documenting repeatable patterns among DSPs and land use, management, and ecological state through rigorous data collection; analyzing new and existing data to summarize the changes occurring as soils, organisms, and disturbances interact; and integrating DSPs and soil function into an ecological context to inform support tools for conservation planning and land management—to help people help the land!

1.4 Training

Training is important to the successful completion of a project. The SPSD offers a variety of training to ensure soil and ecological staff understand the standards and methods of data collection. DSP course descriptions and schedules are now included in the annual SPSD Training Schedule and Catalog and AgLearn. Additional training tools are available in the DSP Focus Team shared resources.

1.5 Links to Dynamic Soil Property Guidance, Supplements, Resources, and Contacts

- This DSP Guide is available on the DSP Guide web page.
- This DSP Guide as well as supplemental resources and draft methods can also be found in the DSP Box. A Read Me First Document contains a list of supplements available in the DSP Box.
- The DSP Focus Team web page provides links to this DSP Guide, the DSP Box, additional resources, and contact information for the national and regional DSP points of contact (POCs).

1.6 Summary of Changes in Dynamic Soil Property Guide Version 3

Version 3 of the DSP Guide includes significant revisions to the 2022 DSP Guide. Below is a summary of the major changes made to the guidance:

- The DSP Guide was reorganized into chapters to better support project planning and training. In addition, the DSP Guide is now organized sequentially to support each phase of a project from planning through completion.
- The DSP Guide will no longer be published annually with the year identified in the document title. The DSP Guide will instead be updated by DSP Program staff as often as necessary to provide timely updates to guidance. The guide will be given a new version number with each revision.
- The DSP Guide provides the current procedures and standards for completing DSP projects. Since extensive measures are now a part of standard pedon description instructions, most of the discussion of these measures has been removed from the DSP Guide. See S1.1 Extensive DSP Measures and M1 Extensive DSP Form.
- Soil organic carbon has been added as a required Intermediate tier measure. See S2.1 Intermediate and Intensive Methods.
- Replication for intermediate tier bulk density and aggregate stability have been clarified. See S2.1 Intermediate and Intensive Methods.
- A waiver process provides an avenue to request approval for modifications to the protocols, study design, methods, or extent of plots, as needed, while meeting program goals. Details on how special circumstances effect the waiver process are included in S2.5 Special Circumstances.
- Guidance is provided on how to evaluate and incorporate existing data in S3.1 Project Plan Workbook.
- Quality control (QC) and quality assurance (QA) procedures have been provided.
- The previous request for assistance (RFA) screening process has been incorporated into regional project approval.
- DSP project type and subtype options were simplified to streamline the guide instructions and project planning.
  - References to project kind were completely removed.
  - Moving forward, all DSP projects will be considered space-for-time studies (see 1.2.3. Space-For-Time Studies in Soil Survey Investigations Report 51), comparing at least two conditions (the combination of a soil and ecological state). The project type in the National Soil

Information System (NASIS) is "Dynamic Soil Property Inventory," and the project subtype will be either "intermediate" or "intensive."
    - The inclusion of a reference state (or the most natural state in the state-and-transition model (STM)) is important as it is now used to define potential.
    - Dispersed, baseline, range of values, and repeated measures data collection efforts are no longer supported effort types or kinds and should not be conducted as DSP projects after the publication of DSP Guide Version 3.
    - If an opportunity for a repeated measure type effort is identified, it will need to be developed under the research or monitoring project types. The DSP Focus Team can advise on DSP protocols and data interoperability.
- The term "sponsor" is obsolete and is no longer used. However, as discussed in this guide, all DSP project leads are highly encouraged to pursue including a partner outside of the SPSD.
- Appendices were removed. The information is now provided as supplements in the DSP Box or has been incorporated in other parts of the DSP Guide or other national standards as appropriate.
- Along with the DSP Guide Version 3, the supplements and draft methods provided in the DSP Box are part of the DSP standards and are needed to complete a DSP project. A Supplement Index is provided in the supplements folder. A Draft Methods Index is provided in the draft methods folder.
- Updated information about vegetation methods were added to S2.1 Intermediate and Intensive Methods.
- NASIS data entry guidance for DSPs was removed because this information is now included in the corresponding official NASIS User Guide chapters: Chapter 14 Project Management, Chapter 23 Pedon Data Entry Guide, and Chapter 25 Populating Vegetation Plot Object.

Chapter 2: Project Requirements Overview

This chapter describes the requirements for all DSP projects. Once a DSP project lead is familiar with the requirements of the DSP program (430 NI 308), the lead may begin to evaluate workloads and build a detailed project plan (chapter 3). A DSP project lead can be a soil scientist or an ecologist.

2.1 Benchmark Soils and Ecological States

The combination of soils and ecological site descriptions (ESDs) are an important framework for communicating DSP data and interpretations. DSP projects support the refinement of STMs because DSPs typically correlate to underlying ecological processes due to the soil-plant feedback inherent in most terrestrial ecosystems. In addition, STMs are a tool to communicate the DSPs and the resulting interpretations associated with each ecological state and community. To reflect the importance of vegetation and soils, both soil scientists and ecologists should be involved from the initial stages of project planning through the completion of a project.

With over 23,000 established soil series and over 72,000 ecological states in about 12,000 ESDs in the United States, it will not be possible to complete DSP projects on each combination of soil and ecological states. Data from a DSP project will be extrapolated to similar soils and ESDs. As a result, DSP projects are prioritized on based on extensive ESDs that are used widely for conservation planning and benchmark soils. A 2.5 Waiver Request Form is available if needed. Considering input from the MLRA Technical Team, a DSP project may coalesce first around an ESD or around a soil. DSP projects must include a reference state or the most naturalized state available to establish the potential and baseline for optimal conditions. If there are difficulties locating a benchmark soil or reference states for the MLRA, please contact the regional DSP POC, the regional soil data quality specialist (SDQS), and partners. For detailed project planning steps, see S3.1 Project Plan Workbook.

2.2 Partnerships

Project leads are strongly encouraged to engage partners during all phases of DSP projects. Partnerships are important for building synergy between the SPSD and our customers, as well as promoting the value of our work.

A partner should be a person or organization that supports the project and provides review and input when developing a project. A partner helps ensure that a project will meet local needs for additional or updated data. Partners may also help with the implementation of the field work, provide outreach, or analyze samples and data. A partner can be NRCS state, area, or field office staff. Partners can also include local conservation groups, universities, K-12 institutions, and more. An SSO should make all partners aware of a project and provide opportunities for partners to assist in a project. This may be as simple as using the existing structure of the Technical Team (430 National Soil Survey Handbook (NSSH) § 608.1(G)) and Management Team (430 NSSH § 608.1(F)). Additional information about how to build partnerships is available in S3.1 Project Plan Workbook.

2.3 Project Objectives and Deliverables

A project should have clearly defined objectives and deliverables that are achievable within the time designated to complete a project. The S3.1 Project Plan Workbook contains a section to guide the development of objectives and deliverables.

2.4 Land Use and Management Questionnaire

Land use and management information provides context for DSP data. The S2.6 Land Use and Management Questionnaire is required for each plot. The questionnaire is not intended for the landowner or conservation partner to complete independently. The project lead should complete section 1 of the S2.6 Land Use and Management Questionnaire during the project planning phase. Section 2 should be completed in consultation with the local NRCS field office. Finally, section 3 should be completed during discussions with the land manager during reconnaissance and updated as needed during in-field sample and data collection days (chapter 4 and chapter 5).

2.5 Project Type and Subtype

All projects are entered in NASIS as the "Dynamic Soil Property Inventory" project type. The subtype choices in NASIS are "intermediate" or "intensive." The primary difference between intermediate and intensive projects is the level of laboratory analysis required for the project (table 1). Both intermediate and intensive projects require the collection and analysis of all the intermediate measures to be completed in the field and SSO laboratory. However, the intensive project requires additional measures to be completed by the Kellogg Soil Survey Laboratory (KSSL) at the National Soil Survey Center (NSSC) in Lincoln, Nebraska.

Table 1: Intermediate, Intensive, and Optional DSP Measures

The specifics for each measure can be found in S2.1 Intermediate and Intensive Methods.

Intermediate Measures Field and Laboratory Analysis (SSO or Partner Laboratory)	**Intensive Measures** Laboratory Analysis (KSSL or Partner Laboratory)	**Optional Measures** Field and Laboratory Analysis (KSSL or Partner Laboratory)
Land Use and Management Questionnaire; Land Use Dependent Measures (primarily vegetative); Site and Soil Profile Photos; Completed Soil Description (232 Form); Ecological Site, Ecological State, and Community; Earthworms; Infiltration; Saturated Hydraulic Conductivity (Ksat); Aggregate Stability; Bulk Density; and Soil Organic Carbon or Soil Organic Matter	KSSL Characterization; KSSL DSP Analysis Suite; and KSSL Bulk Density	Permanganate-Oxidizable Carbon; Biological Assays; and Additional Soil Health Indicators

Intermediate and intensive projects may include analyses from outside laboratories that a partner could find useful to support local conservation needs. While the collection of additional samples can be done during project sampling, the funding for shipping and analysis of these additional samples are approved and typically arranged by the conservation partner. All partner laboratories should use the KSSL methods for analysis to ensure data is comparable. Before agreeing to use a cooperator or private laboratory, please contact the appropriate regional KSSL liaison because some restraints and additional planning steps may be required.

2.6 Dynamic Soil Property Plot Design

The replication and distribution of DSP plots is essential to the usability of the data and increases the potential meaningfulness of results.

2.6.1 Plot Replication

All projects must include a minimum of two conditions (the combination of a benchmark soil and ecological state or community). Each condition must include a minimum of three DSP plots (a combination of one main or characterization site and pedon and its associated satellite sites and pedons and vegetation plot). A DSP plot must include a minimum of two satellite pedons, which results in each DSP plot having a minimum of three sites and pedons and each condition having nine sites and pedons. S2.2 Plot Replication Diagram provides an example of the minimum replicates needed per condition for a project. Note: Please see S2.4 Waiver Request Form if there is extensive existing data.

2.6.2 Plot Distribution

As much as possible, DSP plots should be distributed across the full spatial extent of the condition. Plots may be separated by many miles of distance, and overnight travel may be required to reach the extent necessary for the proper distribution of plots.

2.6.3 Dynamic Soil Property Plot Identification

Each DSP is assigned an alpha-numeric DSP plot identification (ID) code. The DSP plot ID should be entered into the NASIS site table and the S2.6 Land Use and Management Questionnaire during data entry. The DSP plot ID is used to query sites and pedons by DSP plot and organize data at the end of a project (chapter 6). The DSP plot ID is composed of two letters denoting the soil, two letters denoting the ecological state or community, and a sequence number (e.g., FA-HF-01). The letters used to identify the soil and the ecological state or community should be unique to eliminate confusion between plots in a project. The S3.1 Project Plan Workbook can be used to help to develop DSP plot IDs for each plot.

2.6.4 Layout and Design by Subtype

Each DSP plot includes one main site and pedon and a minimum of two satellite sites and pedons within the same range in characteristics. Additional satellite sites and pedons can be collected for soils with high variability. Intermediate and intensive projects require main pedons to be sampled to a minimum depth of 100 cm and satellite pedons to be sampled to a minimum depth of 50 cm or until lithic or paralithic contact. Intensive projects require at least one main pedon per condition to be selected for characterization data collection to a depth of 200 cm.

The coordinates and site characteristics of each site and pedon are recorded individually to account for variability in the range in characteristics within a plot. A satellite site and pedon will be a minimum of 10 m from the main site and pedon. However, the distance between the main site and pedon and satellite site and pedon may need to be increased in cases where the map unit is complex and the same soil and vegetation may be located further than 10 m away. Professional judgement should be used to ensure that the satellite site and pedon is not too far from the main pedon to be considered to lay outside a reasonable plot. The shape of the plot may also be impacted by the complexity of the site. While typically linear, the plot may be in the shape of a triangle or a cross depending on the site characteristics. The S3.1 Project Plan Workbook can be used to help determine the desired plot layout for each plot.

2.7 Soil Sample Replication and Subsampling

Consult S2.1 Intermediate and Intensive Methods to determine the number of soil sample replicates needed. During discussions with partners or from information gathered during the MLRA evaluation, a need may arise that suggests additional replication due to the variability of the soil and vegetative communities.

2.7.1 Sample Depth Subsampling

Sample depths should reflect genetic horizons. No samples should be collected crossing a genetic horizon boundary. If one or more O horizons are present, samples should be collected from each O horizon without crossing genetic boundaries and without subsampling.

Subsampling begins at the mineral soil surface (at 0 cm or directly below an O horizon). An A horizon greater than 15 cm thick should be subsampled in layers that are approximately 5 cm thick without crossing a genetic horizon boundary, for example, in layers from 0–5 cm, 5–10 cm, and 10 cm to the bottom of genetic horizon. Genetic horizons below 15 cm of the mineral surface should only be subsampled if they are greater than 50 cm thick (see Soil Sampling in the Field Book for Describing and Sampling Soils). S2.3 Sampling Depth Guide provides a subsampling decision tree and real-world examples of how to subsample horizons.

2.8 Waiver for Departure from Requirements

There are some exceptions to the requirements for intermediate and intensive projects (see S2.5 Special Circumstances). For situations where the requirements cannot be met during a project, there is a waiver process (see S2.4 Waiver Request Form). When a waiver approval letter is received from the national resource soil scientist – DSP, it should be saved in the project files, and the date on the letter should be entered into a project text note in NASIS and S7.1 QC QA Checklist.

2.9 Quality Control and Quality Assurance

QC and QA of projects are continuous processes from the planning phase all the way through the completion of the project. Projects require a significant amount of work to build a reliable and robust dataset. The S7.1 QC QA Checklist outlines the QC and QA tasks required for each phase of a project. All QC and QA tasks must be completed before milestones and project completion can be marked in NASIS.

2.10 National Soil Survey Center and Kellogg Soil Survey Laboratory Assistance

2.10.1 Annual National Soil Survey Center Request for Assistance

Assistance from the NSSC, including the KSSL, is requested in the annual NSSC RFA process. The RFA is announced through a national bulletin and open for approximately one month, and requests must include all work planned for the fiscal year. This process informs the NSSC of upcoming projects where assistance is needed, so the NSSC can plan its supply purchasing, shipping, and workload needs.

If supplies are needed for sampling a project in the first quarter of a fiscal year, the project needs to be submitted on the previous year's RFA, so the KSSL can purchase and ship supplies in the previous fiscal year. This means that a project may need to be planned up to 1 year in advance to account for supply procurement and shipping needs. The KSSL uses information about the number of main and satellite pedons, horizons, and samples to purchase and ship supplies to the SSOs for both intermediate and intensive projects. The KSSL also uses this information to manage the annual workload and prioritize sample analysis for the intensive project samples shipped to the KSSL. Proper accounting in the RFA ensures adequate supplies and timely delivery for project success.

An intermediate project must be included on the RFA only if the SSO is requesting supplies from the KSSL or is requesting some other type of assistance from the NSSC. An intensive project where samples will be analyzed by the KSSL must be included on the RFA for supplies and for workload assessment. An intensive project that will be analyzed by a partner laboratory should only be included on the RFA if supplies are needed. As part of the QA and project approval, the SDQS reviews and confirms that the DSP project meets the DSP protocols or has an approved waiver for deviations from standards. Once a project has been submitted for the RFA, the "Laboratory Investigation Plan" milestone may be marked complete in NASIS.

Shipping must be arranged directly with the KSSL liaison following the procedures outlined in the KSSL Sample Submission guide for all samples shipped to the KSSL (S2.1 Intermediate and Intensive Methods). This protocol includes additional Animal and Plant Health Inspection Service shipping requirements. The KSSL will provide shipping labels once all electronic documentation is received. Samples shipped without KSSL approval will be refused and returned or destroyed. For assistance with the KSSL sample submission protocols, please refer to the appropriate soil survey region KSSL liaison.

2.11 National Soil Information System Data Entry

The minimum NASIS data entry standards to meet both SPSD and DSP project requirements are available in the NASIS User Guide. The chapters most useful for projects are Chapter 14 Project Management, Chapter 23 Pedon Data Entry Guide, and Chapter 25 Populating Vegetation Plot Object.

Chapter 3: Project Planning and Approval

This chapter, along with the S7.1 QC QA Checklist and S3.1 Project Plan Workbook, provides the instruction needed to complete the "Project Proposed" and "Project Approval" milestones in NASIS. The S3.1 Project Plan Workbook provides a template and additional information to guide an MLRA soil survey leader or DSP project lead through the project planning, decision making, and approval process. The final "Project Plan" will be populated in the NASIS "Project Text Note" table.

3.1 Evaluate Major Land Resource Area Data Needs

An SSO should evaluate and identify benchmark and extensive soils and ecological states with an MLRA. Section 1 of the S3.1 Project Plan Workbook can help guide the MLRA evaluation process.

3.2 Project Plan

Section 3 of the S3.1 Project Plan Workbook provides a template of the text that should be entered into the NASIS "Project Description" field. Section 4 of the S3.1 Project Plan Workbook provides a template that should be completed and then pasted into the NASIS "Project Text" child table as a "Project Plan" kind text note. See NASIS User Guide Chapter 14 Project Management for more information. Once the project plan is entered in NASIS, it should go through QC as outlined in S7.1 QC QA Checklist.

3.3 Quality Control of Project Plan

The MLRA soil survey leader should complete the "Project Planning QC" tab of the S7.1 QC QA Checklist. Once all errors found using the reports in the checklist have been addressed, the project should be submitted for discussion to the Technical Team (430 NSSH § 608.1(G)) and the Management Team (430 NSSH § 608.1(F)).

3.4 Quality Assurance and Project Approval

When QC is complete, the MLRA soil survey leader informs the regional SDQS that a project is ready for review and approval. The MLRA soil survey leader should provide the SDQS with the S7.1 QC QA Checklist with the "Project Planning QC" tab completed. The SDQS will review the project using the "Project Approval QA" tab of the S7.1 QC QA Checklist. The "Project Approval QA" tab is completed when errors and comments have been addressed by the SSO. After the soil survey regional (SSR) director approves the project, the project is marked approved in NASIS, the "Project Approval" milestone is marked complete, then the SSO may start the project and submit a RFA to the KSSL.

Chapter 4: Project Preparation

This chapter provides the instruction needed to complete the "Laboratory Investigation Plan" and "Logistical Planning" project milestones in NASIS. The MLRA soil survey leader should use the "Preparation QC" tab of S7.1 QC QA Checklist as a guide.

4.1 Laboratory Investigation Plan

Once an intermediate or intensive project is submitted to the NSSC RFA (chapter 2), the MLRA soil survey leader should enter the completion date for the "Laboratory Investigation Plan" milestone in NASIS. If an intermediate project does not need supplies from the KSSL, it does not need to be submitted to the NSSC RFA. In this case, a project text note should be entered in NASIS stating that an NSSC RFA is not needed, and then, the MLRA soil survey leader should enter the completion date for the "Laboratory Investigation Plan" milestone in NASIS.

4.2 Landowner Permission

Maps can be shared with partners to determine who the landowners are within the area of interest for a project using Web Soil Survey or ArcGIS Pro using existing geographic information system layers such as Soil Survey Geographic Soils, common land unit, Public Land Survey System, and public land layers. Local conservation partners, such as NRCS field office, area office, state office, and soil and water conservation district staff, may be able to view the maps and provide the contact information of the landowners who would be most willing to grant permission for sampling. Often, the local conservation partner can serve as an initial landowner contact to provide a personal introduction and help guide conversations related to the project. Land trusts and university partners can also be a resource in locating sites and obtaining landowner permission.

4.3 Reconnaissance

Conservation partners and landowners should be included when preparing for and during reconnaissance visits whenever possible. The landowner should be interviewed using questions in section 3 of the S2.6 Land Use and Management Questionnaire to determine if the targeted condition is present at the DSP plot (chapter 2) before digging begins. Landowners can also identify the most obvious locations of any existing gas, water, power lines, or private utilities to help determine the areas that need to be submitted for the utility locate request that needs to be filed with the proper local regulatory authority prior to excavation. The landowner may help with understanding the location of all nearby junction boxes and the direction the lines run. Utility companies do not always document small local service lines in many residential or commercial settings, so extra care should be taken in these areas. Refer to regional safety guidance to ensure all safety requirements are met before digging.

Reconnaissance visits in advance of sampling are necessary to ensure each site and pedon within a potential plot will meet the needs of a project. The DSP plot should have enough space to include at least one main site and pedon and two satellite sites and pedons as well as space to conduct vegetation, infiltration, and Ksat procedures. Site and pedon descriptions should be collected to document the main and satellite sites and pedons and confirm that the entire DSP plot includes the correct range in characteristics for the targeted condition referenced in the completed S3.1 Project Plan Workbook. Once confirmed, all pedons within a DSP plot should be flagged, if possible, and geolocated for future

sampling. For intensive projects, reconnaissance can help determine which main sites and pedons will be sampled for characterization (chapter 2).

If a potential DSP plot does not represent the range in characteristics of the condition described in the project plan, a new plot should be found elsewhere. Each sample represents a large investment of time and resources. If the targeted condition is not found throughout the selected plot and samples and data are collected anyway instead of locating a new plot, the minimum replication for the required range in characteristics of the condition will not be met. The resulting analysis will not represent the range in characteristics of the project, and the quality of the results is reduced. The time spent confirming the conditions is time well spent even if the DSP plot does not meet the current project's needs. Records, such as the S2.6 Land Use and Management Questionnaire and completed 232 forms collected during reconnaissance, should be retained and entered into NASIS, so they may be used for the planning of future projects because the DSP plot may be suitable for future projects.

4.4 Equipment, Supplies Procurement, Testing, and Preparation

The S7.1 QC QA Checklist lists equipment and supplies to be obtained, tested, and prepared prior to the sampling day. The SSO laboratory should be stocked with the necessary equipment and supplies to perform the required sample collection and analysis in S2.1 Intermediate and Intensive Methods. Refer to specific analysis methods for the supplies needed to perform both the sampling and analysis for each required measurement.

S4.1 Project Planning Resources is meant to facilitate sharing of equipment between offices. For a list of equipment and consumables available to be ordered from the KSSL through the NSSC RFA process, refer to the KSSL Equipment and Materials Request for Assistance. If the SSO needs additional supplies (i.e., acetone, acid, etc.) or equipment to complete a method, the items should be purchased through the SSR office. Equipment and supplies should be procured early.

4.5 Storage and Laboratory Work Location Preparation

The S7.1 QC QA Checklist includes a step to identify the locations for sampling, data storage, and local laboratory analysis. Digital data storage locations are identified in S2.1 Intermediate and Intensive Methods. Storage locations for physical samples should follow the guidelines provided in the specific methods for collecting samples and in the KSSL Soil Sample Submission Protocol.

If sufficient space is not available in the SSO to complete the required DSP procedures (S2.1 Intermediate and Intensive Methods), alternate laboratory spaces can be provided by a project partner. Some offices have used laboratory spaces in adjacent SSOs, universities, or agriculture research stations to complete the required SSO analyses (S2.1 Intermediate and Intensive Methods). All laboratories must follow Occupational Safety and Health Administration and regional safety requirements. Please contact the regional safety officer for additional information, if needed.

4.6 Printable Guidance and Checklists to Use in the Field

Refer to the "Preparation QC" tab of S7.1 QC QA Checklist for checklists and forms that should be printed and taken to the field to ensure all data required for a project (S2.1 Intermediate and Intensive Methods) is collected.

Chapter 5: Data Collection and Entry

This chapter provides the instructions necessary to complete the "Data Collection" and "Data Entry" milestones in NASIS and to meet the requirements outlined in S2.1 Intermediate and Intensive Methods.

5.1 Field and Laboratory Methods

The methods for the field and laboratory data requirements are listed in S2.1 Intermediate and Intensive Methods. S5.1 Guided Field Sampling Checklist and S7.1 QC QA Checklist should be used to ensure that all samples are collected in the field to meet the minimum replication requirements outlined in chapter 2.

5.2 Data Entry

All field- and SSO-generated laboratory data must be entered into the appropriate NASIS tables following the guidance in the NASIS User Guide Chapter 23 and Chapter 25. However, some data cannot yet be entered into NASIS because the current NASIS data model does not contain the necessary tables to store the information. Please refer to S2.1 Intermediate and Intensive Methods for the details on where to store the data in the interim.

5.3 Intensive Projects Only: Package and Ship Samples to the Kellogg Soil Survey Laboratory

For intensive projects, packaging and shipping using the KSSL Soil Sample Submission Protocol and the KSSL Sample Submission Workbook for DSP Projects is required. Only the intensive samples may be submitted to KSSL for analysis. SSO-generated laboratory data, such as bulk density and aggregate stability, do not need to be entered into NASIS before shipping samples to the KSSL. The KSSL Sample Submission Protocol provides instructions for data entry and editing after pedons and their ownership are transferred to the KSSL. Samples submitted to the KSSL without following the KSSL Soil Sample Submission Protocol and KSSL Sample Submission Workbook for DSP Projects may be destroyed or rejected.

5.4 Quality Control

The MLRA soil survey leader should document the completion of all steps in the "Data Collection and Entry QC" tab of the S7.1 QC QA Checklist. Once all items in this tab are marked as completed, the MLRA soil survey leader may enter the completed date for the "Data Collection" milestone in the NASIS milestone table.

5.5 Project Field Review

During the data collection phase, the SSR office conducts at least one project review to ensure that site and pedons selected in plots are in the correct range in characteristics for the targeted soil series and that field data was collected following regional and national standards. Following completion of the project review, the SDQS should record the completion date in the "Project Review" milestone in NASIS and in the S7.1 QC QA Checklist.

Chapter 6: Analysis and Reporting

This chapter provides the instructions necessary to complete the "Data Analysis" and "Quality Control" project milestones. It outlines the process of data entry, storage, and analysis necessary to create the deliverables required for projects. Data entry and deliverables must be completed before a project is submitted to the SDQS for the final QA and to determine project completion (chapter 7).

6.1 Analyze Results

For intermediate projects, data analysis can begin when all data is entered and has gone through QC. If necessary, the project lead may work directly with SSR staff, DSP POCs, or the national resource soil scientist – DSP to make analysis decisions and summarize the data. For intensive projects, the KSSL data can be downloaded from the NCSS Lab Data Mart when available. Instructions for downloading data are provided on the Lab Data Mart website. Commonly downloaded data from Lab Data Mart include—

- bulk density and moisture;
- carbon and extractions; and
- any other data that may have requested or that relate to the objectives or goals of the conservation partners.

In the future, a DSP-specific download option may be available.

6.2 Complete Deliverables

All required deliverables and links to resources are outlined in S6.1 DSP Deliverables. All other deliverables in S3.1 Project Plan Workbook should be completed at this stage and marked as completed in the S7.1 QC QA Checklist.

6.3 Communicate Results

Communicating the results is a project requirement. Project results that have been summarized in various deliverables may be communicated to the landowners, public, and other non-NRCS partners via printouts, emailed reports, presentations, and other media. All media shared outside of the SPSD must pass through the SPSD Internal Review process prior to dissemination. The SPSD Internal Review process is initiated by the MLRA soil survey leader.

6.4 Final Quality Control

After determining that a project is complete, the MLRA soil survey leader should complete the final QC steps in the S7.1 QC QA Checklist. The MLRA soil survey leader should submit the S7.1 QC QA Checklist and all deliverables to the SDQS for QA. When final QC is complete, the MLRA soil survey leader should update the milestone date for the "Quality Control" milestone in NASIS.

Chapter 7: Final Quality Assurance and Project Completion

This chapter provides the instructions necessary to complete the "Quality Assurance" and the "Project Complete" milestones required for SSR staff to mark a project complete in NASIS.

7.1 Final Quality Assurance

The SDQS will complete a final QA of the project and deliverables using the "Final QA and Project Completion" tab of the S7.1 QC QA Checklist and the NASIS reports listed in the tab. When final QA is complete, the SDQS should update the milestone date for the "Quality Assurance" milestone in NASIS.

7.2 Project Completion

The project may be marked "Completed" by the appropriate SSR staff in NASIS when all objectives and deliverables described in the project have been completed, the data has passed QC and QA reviews, and all project milestone completion dates have been entered into NASIS. The "Project Complete" milestone date will be entered by the appropriate SSR staff when the project is checked as completed in the NASIS project table.

Glossary of Terms

The following is a list of terms and their definitions for the purposes of this DSP Guide.

characterization pedon – a main pedon sampled to 200 cm (or lithic or paralithic contact) for characterization and DSP analysis

community – unique assemblages of plants and associated abiotic properties that can develop over time on an ecological site (190 National Ecological Site Handbook (NESH) § 631.4(C)(3)(ii))

condition – the combination of a soil and ecological state or community

dynamic soil property plot – a combination of one characterization or main site and pedon and its associated satellite site and pedons and vegetation plots

ecological state – a recognizable plant community (or set of communities) that differs in ecological structures and related functions from other plant communities that may exist on the same site (190 NESH § 631.4(C)(1)(i))

horizon – a soil layer, approximately parallel to the surface of the soil, that is distinguishable from adjacent layers by a distinctive set of properties produced by the soil-forming processes (i.e., pedogenesis)

intensive – data collection designed to evaluate specific conditions with soil properties that are measured in the field, in the MLRA SSO laboratory, and by the KSSL

intermediate – data collection designed to evaluate specific conditions with soil properties that are measured in the field and MLRA SSO laboratory

layer – when applied to DSP projects, a soil depth interval that is subsampled from the full horizon to provide higher resolution data

main pedon – a pedon sampled to 100-plus cm (or lithic or paralithic contact) for DSP analysis

representative soil – a soil (benchmark or other soil) that represents similar soils within the same ESD and with similar use and management interpretations; data for a representative soil will be extrapolated to similar soils

satellite pedon – a pedon sampled to the bottom of the horizon that crosses the 50 cm mark for DSP analysis; at least two satellite pedons are required per DSP plot

similar soils – soils with similar properties and interpretations

site – a description of the location of a single pedon and vegetation plot in NASIS

space-for-time studies – studies that are used to evaluate trends by examining field sites of different ages (Soil Survey Investigations Report 51)

state-and-transition model (STM) – a box and arrow diagram that describes the observed ecological states, communities within states, and the types of disturbances and management actions that drive transitions between states and communities within an ecological site

References

The following is a list of references used in the creation of the DSP Guide. A printable and updated version is available in the supplements.

- AgLearn: https://aglearn.usda.gov/totara/dashboard/
- Agricultural Research Service – Contact Us: https://www.ars.usda.gov/contact-us/
- Crop Residue and Stubble, National Agronomy Manual: https://www.nrcs.usda.gov/sites/default/files/2022-10/National-Agronomy-Manual.pdf
- DSP Box: https://nrcs.app.box.com/v/DynamicSoilProperties/folder/195679646745
- DSP Shared Resources SharePoint Page: https://usdagcc.sharepoint.com/sites/FPAC-NRCS-SPSD-NSSC-Resarch-DSPFocusTeam/dsp_ext
- DSP Supplement Index: https://nrcs.box.com/s/8fhsnwdsykk0r3zr4fl69usm27pmtfce
- Dynamic Soil Properties Team: https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/soil/dynamic-soil-properties-team
- Ecosystem Dynamics Interpretive Tool (EDIT): https://edit.jornada.nmsu.edu/
- Field Book for Describing and Sampling Soils: https://www.nrcs.usda.gov/resources/guides-and-instructions/field-book-for-describing-and-sampling-soils
- Kellogg Soil Survey Laboratory Equipment and Materials Request for Assistance: https://www.nrcs.usda.gov/sites/default/files/2022-10/KSSL-Sampling-Equipment-and-Supplies.pdf
- Kellogg Soil Survey Laboratory Methods Manual (Soil Survey Investigations Report 42): https://www.nrcs.usda.gov/sites/default/files/2023-01/SSIR42.pdf
- Handbook for Collecting Vegetation Plot Data in Minnesota: The Relevé Manual: https://files.dnr.state.mn.us/eco/mcbs/releve/releve_singlepage.pdf
- Interpreting Indicators of Rangeland Health: https://www.blm.gov/sites/default/files/documents/files/Interpreting%20Indicators%20of%20Rangeland%20Health%20Technical%20Reference%201734-6%20version%205_0.pdf
- NASIS Documents and User Guides: https://www.nrcs.usda.gov/resources/education-and-teaching-materials/nasis-documents-and-user-guides
- National Cooperative Soil Survey: https://www.nrcs.usda.gov/about/partner-with-us/national-cooperative-soil-survey
- National Cooperative Soil Survey Soil Characterization Data (Lab Data): https://ncsslabdatamart.sc.egov.usda.gov/
- National Ecological Site Handbook: https://directives.nrcs.usda.gov//sites/default/files2/1712930318/Part%20630-633%20-%20National%20Ecological%20Site%20Handbook.pdf
- National Forestry Handbook: https://directives.nrcs.usda.gov/sites/default/files2/1712930231/22605.pdf

- National Instruction Title 430 Part 308, "Soil Quality": https://directives.nrcs.usda.gov/sites/default/files2/1712939733/35607.pdf
- National Planning Procedures Handbook (NPPH), Amendment 9: https://directives.nrcs.usda.gov/sites/default/files2/1712930121/33148.pdf
- National Range and Pasture Handbook: https://directives.nrcs.usda.gov//sites/default/files2/1712930400/Part%20645%20-%20National%20Range%20and%20Pasture%20Handbook.pdf
- National Soil Survey Handbook: https://directives.sc.egov.usda.gov/directive/39
- NSSC – KSSL Regional Liaison Contact List: https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/soil/national-soil-survey-center#liaisons
- Official Soil Series Description (OSD) View by Query: https://soilseries.sc.egov.usda.gov/osdquery.aspx
- Riparian Area Management: Proper Functioning Condition Assessment for Lentic Areas: https://www.blm.gov/sites/default/files/docs/2020-12/TR%201737-16%20Layout%20121020.pdf
- Riparian Area Management: Proper Functioning Condition Assessment for Lotic Areas: https://www.blm.gov/sites/default/files/documents/files/TR_1737-15.pdf
- Sampling Vegetation Attributes: https://www.nrcs.usda.gov/sites/default/files/2022-09/stelprdb1044175.pdf
- Soil Data Access: https://sdmdataaccess.nrcs.usda.gov/
- Soil Sample Submission Protocol for the Kellogg Soil Survey Laboratory (KSSL): https://www.nrcs.usda.gov/sites/default/files/2023-05/KSSL-Sample-Submission-Protocol.pdf
- Soil Surveys by State: https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/soil/soil-surveys-by-state
- Soil Survey Field and Laboratory Methods Manual (Soil Survey Investigations Report 51): https://www.nrcs.usda.gov/sites/default/files/2023-01/SSIR51.pdf
- SPSD DSP reports: https://nasis.sc.egov.usda.gov/NasisReportsWebSite/limsreport.aspx?report_name=DSP-Reports
- Soil Survey Manual: https://www.nrcs.usda.gov/resources/guides-and-instructions/soil-survey-manual
- SPSD Internal Review Files: https://usdagcc.sharepoint.com/:f:/r/sites/FPAC-NRCS-SPSDInternalReview/Shared%20Documents/General?csf=1&web=1&e=62pdsR
- SPSD On the Job Training Module Library: https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/soil/on-the-job-training-modules
- SPSD Training – NCSS Materials – FY24 Schedule and Catalog: https://nrcs.app.box.com/v/FY2024-SPSD-Training
- SPSD Training Team: https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/soil/training-team

- Technical Soil Services Handbook: https://www.nrcs.usda.gov/resources/guides-and-instructions/technical-soil-services-handbook
- USDA NRCS Soil and Plant Science YouTube Channel, @nrcssoilandplantscience: https://www.youtube.com/@nrcssoilandplantscience University of California, Davis, SoilWeb Apps: https://casoilresource.lawr.ucdavis.edu/soilweb-apps/
- Volume I: Core Methods, Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems: https://jornada.nmsu.edu/files/Core_Methods.pdf
- Volume II: Design, Supplementary Methods and Interpretation, Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems: https://archive.jornada.nmsu.edu/files/Volume_II.pdf
- Web Soil Survey: https://websoilsurvey.nrcs.usda.gov/app/