

## Part 306 – Ecological Site Inventory and Ecological Site Description

Amended December 2023

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### 306.0 Purpose

- A. This national instruction supplements guidance in the National Ecological Site Handbook<sup>1</sup> (NESH), the National Soil Survey Handbook<sup>2</sup> (NSSH), and the National Soil Information Systems (NASIS) user guides<sup>3</sup>, and replaces existing guidance.
- B. This instruction outlines common procedures for the systematic development of ecological site descriptions (ESDs) by the Soil Science and Resource Assessment (SSRA) and Science and Technology (S&T) deputy areas beginning in fiscal year (FY) 2024. Additionally, this instruction clarifies roles, specifies objectives, and standardizes processes associated with ecological site (ES) project planning, new documentation standards, new database population standards, progress reporting, and the development of guidance for creating meaningful interpretations.
- C. Effective implementation of this instruction will:
  - 1. Build upon earlier work (e.g., Provisional Ecological Site (PES) Initiative, Moving Beyond Provisionals Workshop).
  - 2. Account for variability in quality and quantity of available knowledge and earlier ES work among regions and states throughout the country.
  - 3. Recognize that ES development priorities vary by region and state.
  - 4. Consider internal and external partner priorities for developing ESDs that support conservation planning and resource management needs.
  - 5. Improve nationwide coverage of reliable, accessible ecosystem knowledge.

### 306.1 Background

- A. The purpose of ES work is to provide easy access to reliable ecosystem knowledge in support of natural resource conservation. The ES framework captures, organizes, and delivers ecosystem knowledge in an intuitive manner for

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<sup>1</sup> NRCS, [National Ecological Site Handbook](#) (2017).

<sup>2</sup> NRCS, [National Soil Survey Handbook](#) (2023).

<sup>3</sup> NRCS, [NASIS User Guides](#).

a variety of end users, particularly conservation planners, landowners, managers, and resource management agencies.

## 306.2 Procedures

### A. Stages of ES Development and Status of Products

1. ESD and State-and-Transition Model (STM) product development is a process with three general stages (Figure 306A-1).
  - a. In all stages, ES and STM concepts are subject to change as new information becomes available following an abductive reasoning approach<sup>4</sup>.
  - b. Literature review and existing data must be integrated with expert knowledge at all stages to ensure ESD products use the best available information.
  - c. ES keys are developed and updated throughout the process to reflect the most up-to-date concepts.
  - d. Technical teams must be involved in all stages of ES development. ESD and STM products must be continually tested by users and improved as new information emerges.
2. The status of products are Draft, Provisional ES (PES), and ESD.
  - a. A draft ESD does not meet basic standards of completion and has not been approved for publication.
  - b. A PES is publicly available but is not verified with sufficient field data in NASIS to meet the national minimum data standard (see section 306.6(C)(2)).
  - c. An ESD is a PES that meets the national minimum data standard.
  - d. ESD products will be updated according to priority to meet user needs and refined as needed to reflect new knowledge of ES and STM concepts and subsequent STM interpretations.

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<sup>4</sup> Karl, J. W., & Talbot, C. J. (2016). The role of data and inference in the development and application of ecological site concepts and state-and-transition models. *Rangelands*, 38(6), 322-328.

**Figure 306A-1: Comparison of ES Development Stages, Project Types, and Data Standards.**

Stage	Field Verified	Project Type	Standards by Stage	Status Before→After	Product Description
1	No	ES Provisional, ES MLRA, Soil Inventory	April 2021 PES checklist, Basic STM, ES key, and MLRA-wide soil-site correlation	Draft → PES	Provisional use product needing refinement
2	Ongoing	ES Verification	National Minimum Data Standards for NASIS and EDIT	PES → ESD	Reliable product verified with field data
3	Yes	ES Characterization	STM Characterization Standard, DSP Standards, and Interpretations Standards (by S&T)	ESD → ESD	Full characterization of site features, STMs, DSPs, and interpretations

#### B. Stage 1 – Concept Formulation

1. Soil and Plant Science Division (SPSD) staff work with technical teams and ES local working groups (see 190 NI 316 and NESH § 630.3(J)(1)(v)) to identify recurring patterns in soil, site, and vegetation features across the landscape by evaluating existing information and collecting low-intensity reconnaissance data, such as photos, ocular estimates of dominant vegetation production and cover, auger holes, physiographic description, and apparent disturbance (see NESH § 631.11(E)).
2. Field observations and existing information are combined with technical team knowledge to form ES concepts and draft ESDs for an entire Major Land Resource Area (MLRA).
3. Once all major soil components in an MLRA are correlated to an ES in NASIS and the draft ESDs pass quality control (QC), quality assurance (QA), and SPSP internal review, it is made available for public use as a PES.
4. Stage 1 will reoccur periodically as new ES concepts are formulated during other projects (e.g., initial soil surveys, ES verification projects).

#### C. Stage 2 – ES Verification

1. Stage 2 begins with a prioritization project that ranks ESD and STM development needs for an entire MLRA.
  - a. Development needs are prioritized strategically, ensuring the first ESD and STM products to be verified address the most important and immediate needs of NRCS conservation planners and partners.
  - b. Some stage 1 ES will be low priority for end users and may remain in PES status indefinitely.

- c. Technical teams should refer to NESH § 630.14 and section 306.4 of this national instruction to determine which ESDs in an MLRA will proceed to stage 2 and stage 3 first.
  - d. After the initial prioritization effort, technical teams must revisit ES priorities annually by MLRA to prioritize and plan new ES projects.
- 2. SPSD staff must verify a PES using field documentation that covers the geographic extent of the soils to which the PES is correlated.
  - a. Before planning field work, SPSD staff should evaluate all existing information and make full use of NRCS and partner data and information.
  - b. SPSD staff should design verification projects that answer the question, “What makes each PES distinctive and repeatable across the landscape?”
    - (1) SPSD staff should investigate similar or associated ES concepts at the same time using a combination of low-intensity reconnaissance and medium-intensity inventory (e.g., cover, production, soil pedon, or auger descriptions; see NESH § 631.12).
    - (2) Technical teams and local working groups will use all relevant data to differentiate ES concepts, lump or split ES concepts, adjust soil-site correlations in NASIS if necessary, and create new ES concepts for stage 1 development.
    - (3) SPSD staff will verify ecological site groupings (ESG) produced instead of ESDs during the PES Initiative by developing PES concepts within each ESG (stage 1) and developing field verification projects to verify the new PES concepts (stage 2).
- 3. Stage 2 is complete when the ESD meets the national minimum data standards for ES verification and has passed QC, QA, and SPSD internal review.
- 4. Upon stage 2 completion, the ESD will no longer be provisional.
- D. Stage 3 – STM Characterization
  - 1. SPSD, S&T, and state technical specialists expand upon and refine ESDs with detailed descriptions of ecological states, plant communities, transitions, STM interpretations, and other priority information to meet end user needs.
    - a. Stage 3 is iterative and is never truly complete. The generation of new ecological knowledge and the changing needs of end users require periodic refinement of ES concepts and the development of new STM interpretations.
    - b. Technical and management teams must collaborate to identify knowledge gaps in existing ESDs and STMs and prioritize and design ES characterization projects to meet high-priority user needs.
    - c. Low-, medium-, and high-intensity inventory such as monitoring protocols, lab analyses, and dynamic soil properties (DSP) protocols (see NESH § 631.12) may be necessary to address specific project objectives.
  - 2. To meet the diverse needs of users, full ES characterization will require multiple projects and experts in various fields.

3. Technical and management teams must rarely prioritize stage 3 projects when there are many high-priority stage 2 projects yet to be completed within the same MLRA, and only when user need for a stage 3 project is greater than for all other stage 2 projects.
  - a. SPSD can only proceed with stage 3 after stage 2 is complete.
  - b. S&T may produce STM interpretations during any of the three stages at the discretion of the management team to meet immediate user needs.
4. Each stage 3 project will require QC, QA, and SPSD internal review before publishing ESD updates.

### 306.3 Roles and Responsibilities

- A. The SSRA and S&T deputy areas share leadership responsibilities and coordination of ES work. Their collaboration with internal and external NRCS partners is essential for producing reliable ESD products. Roles are defined in NESH § 630.3 and NSSH § 608.1, with some clarifications outlined in this national instruction.
  1. SPSD leads the development of ES and STM concepts. This includes providing guidance and standards for the collection, analysis, data entry, and maintenance of data underlying ecological classification and correlation to soils (NESH § 631.2), followed by QC, QA, and SPSD internal review of ESD and STM products, excluding interpretations.
  2. The Ecological Sciences Division leads the development of STM interpretations. This includes providing guidance and standards for the development of all STM interpretations (e.g., rangeland health reference worksheets) as well as QA and SPSD internal review of STM interpretations.
  3. State, area, and field office staff within NRCS ensure ES projects and STM interpretations are prioritized to meet conservation planning needs. They also help develop ES and STM concepts, STM interpretations, and their applications in natural resource conservation.
  4. Soil survey regional office staff work with S&T and state office technical specialists to ensure interpretations align with ES and STM concepts during QC and QA reviews.
  5. The deputy areas should work together to identify, develop, and deliver training on the use of ESD products.
- B. Management teams, technical teams, and local working groups are outlined in NESH Part 630, Subparts B and C, NSSH § 608.1, and additional clarifications in this national instruction. Within this framework, technical discipline specialists from field offices, area offices, state offices, MLRA soil survey offices, soil survey regional offices, National Technology Support Centers (NTSC), Ecological Sciences Division, and partner groups work together to ensure ESD and STM products meet customer needs.

1. Technical teams and local working groups serve different purposes but may consist of many of the same technical specialists.
    - a. Technical teams perform formal roles including recommending ES project priorities to the management team, developing ES project plans, and executing ES projects from start to finish.
    - b. Working groups are less formal and provide flexibility in organizing technical specialists with specific expertise to address a particular ES development need.
  2. ES specialists must communicate regularly with technical teams and local working groups to:
    - a. Provide opportunities for feedback and contribution throughout individual ES projects and at all stages of ES development.
    - b. Incorporate the best available data, local and indigenous knowledge, and academic expertise into ESD and STM products.
  3. Soil survey regional ES specialists must communicate regularly with management teams and technical teams to:
    - a. Ensure ES projects and products align with national standards and established priorities.
    - b. Assist in assembling productive technical teams and local working groups throughout the region by identifying technical experts and encouraging active participation in regular technical team meetings.
    - c. Provide training on ES project planning and support execution of ES projects for the region.
  4. NTSC technical leads and state office technical specialists:
    - a. Collaborate with regional ES specialists to recruit technical experts to develop and review ES concepts.
    - b. Participate on the technical team and local ESD working groups where possible.
    - c. Collaborate with diverse partners on STM interpretations projects.
    - d. Provide QC and QA review of STM interpretations.
    - e. Provide ES training to state, area, and field office staff.
  5. State resource conservationists and state soil scientists ensure STM interpretations undergo QA review and S&T technical review before publication.
- C. The ES Focus Team is established and led by the national leader for ES to foster collaboration across deputy areas, engage outside partners, and work towards the outcomes specified in this national instruction. There are five subteams.
1. The Core Mission subteam sets the priorities and direction for the ES Focus Team nationally. The Core Mission subteam considers recommendations from other subteam leadership, as well as the National Cooperative Soil Survey, technical experts, stakeholder groups, and end users.

- a. The Core Mission subteam is co-led by representatives from:
  - (1) SPSPD, National Leader for Ecological Sites
  - (2) S&T, National Grazinglands Team Leader
  - (3) Bureau of Land Management, National Ecologist or Soil Scientist
  - (4) United States Forest Service, National Ecologist or Soil Scientist
  - (5) Agricultural Research Service, Jornada Experimental Range Research Leader
- b. The Core Mission subteam includes working groups led by members of the SPSPD Ecology Branch and partners.
2. The Standards subteam replaces the Standards Committee (NESH § 630.21) and ensures ES product quality by assessing national guidance and protocols and developing recommended updates.
3. The Customer Needs and Interpretations subteam assesses the needs of end users and develops recommended enhancements to ES products and STM interpretations to meet customer needs.
4. The Business Systems subteam replaces the Business Requirements Committee (NESH § 630.21) and makes recommendations to optimize ES data systems for efficient data management, streamline ES development workflows, integrate quality controls, and deliver user-friendly ES products.
5. The Research and Technology subteam replaces the Research and Development Committee (NESH § 630.21) and makes recommendations to integrate current scientific research and emerging technologies into ES workflows and products for improved efficiency and quality.
- D. The ES Focus Team will function as follows:
  1. ES Focus Team membership is open to general participation.
  2. Members must receive supervisor approval to participate.
  3. Subteam leaders must have approval of their supervisor and the Focus Team leader to serve in subteam leadership.
  4. Subteam leaders may assign one or more people to lead a working group with permission from the Core Mission subteam leadership.
    - a. Working groups perform a specific task requiring more than 1 year.
    - b. Working group leaders must receive supervisor permission before leading the working group.
  5. Subteam leaders may assign one or more people to lead a task force with permission from the Core Mission subteam leadership.
    - a. Task forces perform a specific task requiring less than 1 year.
    - b. Task force leaders must receive supervisor permission before leading the task force.
  6. ES Focus Team members are expected to actively participate. Inactive members may be removed from the ES Focus Team or subteams.

- a. Task forces and working groups meet multiple times per week or month to make progress on assigned tasks.
- b. Subteams meet at least monthly to communicate progress on assigned tasks and updates to priorities and direction from leadership.
- c. Subteam leaders meet at least monthly to communicate priorities and direction relating to the subteam goals.
- d. The entire ES Focus Team meets at least quarterly to communicate updates from each subteam, align efforts, and update priorities and direction from the Core Mission subteam.

## 306.4 Objectives and Outcomes

The long-term goal is nationwide coverage of reliable, accessible ESD and STM products that are aligned and integrated with conservation planning systems and processes. The following objectives specify strategic steps toward this long-term goal, and the outcomes listed are specific tasks to be achieved during FY 2024 through FY 2026, or earlier if specified.

1. Objective: Prioritize customer needs for the strategic development of ESD and STM products. Outcomes are:
  - a. Technical teams will prioritize ESDs by MLRAs and recommend to the management team which specific ES should be completed first (see NESH § 630.14).
  - b. An ES prioritization project should be completed in at least 50 percent of the MLRAs in each soil survey region.
  - c. Through the structure of the ES Focus Team, SSRA and S&T leadership will engage staff and partners to ensure ES user needs are clarified and addressed.
  - d. The Customer Needs and Interpretations subteam will develop recommendations for minimum ESD population standards to meet the needs of conservation planning and related business systems.
2. Objective: Deliver field-verified ESD products for use in every state (see section 306.5). Outcomes are:
  - a. Soil survey regions should verify ES concepts as quickly as possible using the national minimum data standard outlined in this national instruction and should complete two or more ES verification projects per MLRA in at least 50 percent of the MLRAs in each soil survey region.
  - b. ES verification projects should verify multiple similar (or associated) ES concepts simultaneously.
  - c. ES verification projects must result in no fewer than 4,000 new and existing vegetation data point observations entered in NASIS to support knowledge contained in ESD products.
3. Objective: Incorporate the best available information and science into ES products. Outcomes are:



- a. The Core Mission subteam will work with partners to update the Interagency ES Handbook for Rangelands<sup>5</sup> and expand guidance for all lands.
  - b. The Core Mission subteam will create a working group to integrate ESDs with other classification systems, including but not limited to USFS Terrestrial Land Unit Inventory, LandFire Biophysical Settings, and the National Vegetation Classification System.
  - c. The ES Focus Team will develop new guidance for incorporating data (e.g., remote sensing, legacy datasets), tools (e.g., automated processes and scripts, robust sampling design, statistical analyses), data standards (e.g., protocols, digital forms), and emerging science (e.g., ES scaling, novel ecosystems, climate change) into ES development workflows.
  - d. The Research and Technology subteam will build on the work of the National Instruction Research and Technology Workgroup, including but not limited to new automated data collection tools (e.g., Survey 123, Vegetation GIS Data System, Field Maps, etc.).
  - e. The Standards subteam will draft updated guidance for data collection protocols and streamline QC, QA, and SPSD internal review for all project types.
4. Objective: Ensure databases and related applications are functional and meet the needs of NRCS, partners, and end users. Outcomes are:
- a. SPSD will migrate the Ecosystem Dynamics Interpretive Tool (EDIT) database to NRCS servers in coordination with the Business Systems subteam.
  - b. The Business Systems subteam will make recommendations to enhance business systems, improve application function, streamline data entry, improve interoperability, and adjust ESD and STM sections as needed.
  - c. The ES Focus Team will recommend ways to streamline the ES workflows by developing new vegetation plot calculations, queries, interoperability, and reports in NASIS and EDIT, along with new ES QC validations and associated guidance.
  - d. The ES Focus Team will compile business requirements for replacing the Water Features section of ESDs with a Hydrologic Features section.
  - e. The Customer Needs and Interpretations subteam will work with the Business Systems subteam to develop business requirements for several STM interpretations (see section 306.7).
5. Objective: Align ES activities with the SPSD vision for the Dynamic Soil Survey. Outcomes are:

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<sup>5</sup> Forest Service and Natural Resources Conservation Service, US Department of the Interior, Bureau of Land Management. 2013. Interagency Ecological Site Handbook for Rangelands. 109 p. (Washington, DC, USA).

- a. The Ecology Branch of SPSD will work with diverse partners to develop ESG and concept tables for all MLRAs following guidance in the NESH and peer-reviewed literature.
  - b. The Ecology Branch of SPSD will work with the DSP Focus Team to identify a modal STM for prioritizing DSP project areas and will ensure a generalized STM is populated in the ESG catalog in EDIT to streamline STM interpretations development.
  - c. The ES Focus Team will work with the Dynamic Soil Survey Focus Team to develop business requirements for interactive STMs.
  - d. The ES subteam of the Digital Soil Mapping Focus Team will propose pilot projects for spatial prediction of ES classes and species distribution models.
6. Objective: Integrate STMs into conservation planning systems (e.g., Conservation Assessment Ranking Tool (CART), Conservation Desktop (CD), and related systems). Outcomes are:
- a. In FY 2024, the Customer Needs and Interpretations subteam will make recommendations on how to populate resource concerns for STM plant communities in EDIT, building upon existing drafted guidance (see 450 NI Part 309).
  - b. The ES Focus Team will recommend updates to EDIT that will add flexibility for selecting conservation practices related to STM transitions, community pathways, and restoration pathways since these vary over time and from state to state.
  - c. The Customer Needs and Interpretations subteam will work with partners from state and area offices to implement resource concerns in EDIT, with at least one project completed for each Land Resource Region (LRR).
7. Objective: Fully characterize the highest priority ESDs and STMs in every MLRA, including but not limited to soil and site features, states, plant communities, transitions, pathways, DSPs, resource concerns, and interpretations. Outcomes are:
- a. In FY 2024, the Customer Needs and Interpretations subteam will develop guidance for creating and reviewing STM interpretations.
  - b. The Standards subteam will integrate protocols and considerations regarding ESDs in different land types and land uses into NESH Part 632 by building upon existing draft guidance.
  - c. The Customer Needs and Interpretations subteam will work with partners from state and area offices to implement STM interpretation pilot projects, with at least one STM interpretation populated in each LRR.

### 306.5 Project Management

- A. SPSD staff must manage ES projects in NASIS and update milestones on a quarterly basis consistent with existing guidance and this national instruction.

1. To meet progress reporting requirements, current active projects must be migrated to the project type and subtype structure outlined in this national instruction or converted to or replaced by new projects following this structure.
  2. Any past ES projects that remain in NASIS for documentation purposes must not use the new project types and subtypes structure to ensure that they are not queried during tracking and progress reporting.
- B. SPSD staff assigns each project a type and subtype in the Project table in NASIS. All ESDs to be included in a project must be specified in the Project Ecological Site table in NASIS. Six possible ES project type and subtype combinations are as follows.
1. Project Type: Soil Inventory and Project Subtype: Various – ESDs developed as part of initial soil survey and soil survey update projects will be included in the overall soil survey project and do not require an ES-specific project.
  2. Project Type: Soil Inventory and Project Subtype: Inventory – The systematic enhancement of official ES information (e.g., tabular edits, entering pre-existing datasets). These ES data enhancements may be included as part of broader soil survey data projects or be an independent project specific to ES and vegetation data.
  3. Project Type: Ecological Site Inventory and Project Subtype: ES MLRA – These projects address all ESDs within an MLRA and include the PES Initiative, ES keys, ESG development, Land Resource Unit updates, and ES Prioritization projects. Each MLRA may not have more than one PES Initiative project in NASIS.
  4. Project Type: Ecological Site Inventory and Project Subtype: ES Provisional – These projects will be created after one or more new ES concepts have been identified through an initial or updated soil survey, ES verification projects, ESG refinement into ESDs, or partner contributions. Project duration will not exceed 1 year.
  5. Project Type: Ecological Site Inventory and Project Subtype: ES Verification – These will be standalone projects designed to verify two or more ES concepts and track progress toward the national minimum data standard and stage 2 completion. Project duration will not exceed 2 years.
  6. Project Type: Ecological Site Inventory and Project Subtype: ES Characterization – Each ES may have multiple characterization projects in NASIS addressing different portions of the STM or STM interpretations. Project duration will not exceed 3 years.
    - a. SPSD staff will not work on ES characterization projects for PES until a verification project is complete and the ESD is no longer provisional.
    - b. Data generated by DSP projects will be incorporated into STMs as part of an ES characterization project.
    - c. STM interpretations will be managed by S&T in cooperation with state

and area office technical specialists and do not require stage 2 completion or a NASIS project.

7. Minor edits to NASIS or ESD products, such as typographical errors, tabular edits, and grammar, do not require a NASIS project.
- C. S&T staff have primary responsibility to manage projects involving STM interpretations and will work with SPSD, state and area office technical specialists, the ES Focus Team, and partners to define new systems, structures, and processes necessary to manage these projects.
- D. Project plans are developed and prioritized by the technical team, reviewed and approved by the management team, and reviewed and revised by the board of advisors as outlined in the National Soil Survey Handbook (NSSH § 608.1). For more guidance on prioritizing ES projects, see NESH § 630.14 and NSSH § 610.5.
  1. All ES projects must be designed and prioritized to meet customer needs in a timely manner.
  2. If an ES is provisional at the beginning of a DSP project, the DSP project may proceed as long as the provisional ES receives higher priority for an ES verification project. The verification may be done concurrent with the DSP project.
  3. All projects should involve partners throughout and incorporate partner data, expertise, and resources to maximize the knowledge contained in the ESD and STM products.
  4. All ES projects must include review periods for technical teams and local working groups.
- E. ES projects will be entered into NASIS following chapter 24 of the NASIS user guide.
  1. The minimum data requirements for ES projects to be **approved** in NASIS are:
    - a. Project Table – User Project Identification (ID), Project Name, Description, Approved, Project Type (Soil Inventory or Ecological Site Inventory), Project Subtype, MLRA Soil Survey Office Area, State.
    - b. Project Ecological Site Table – Names and ID numbers of all ES in the project must be populated.
    - c. Project Concern Need Table.
    - d. Project Land Category Breakdown Table.
    - e. Project Milestone Table – Project Proposed Date, Project Approval Date.
    - f. Project Mapping Goal – Fiscal year.
  2. The minimum data requirements for ES projects to be **complete** in NASIS are:

- a. Project Table - User Project ID, Project Name, Description, Approved, Project Type (Soil Inventory or Ecological Site Inventory), Project Subtype, MLRA Soil Survey Office Area, State.
  - b. Project Mapunit Table – Optional, refer to regional guidance.
  - c. Project Ecological Site Table – Names and ID Numbers of all ES in the project must be populated.
  - d. Project Concern Need Table.
  - e. Project Land Category Breakdown Table.
  - f. Project Mapping Progress Sub-table – Progress Report Date, Update NRCS Acres.
  - g. Project Mapping Goal Table – Fiscal Year, Project Staff, Update NRCS Acres Goal.
  - h. Project Milestone Table – Project Proposed, Project Approval, Logistical Planning, Data Collection, Data Entry, Data Analysis, Project Review, QC Completed, QA Completed, Correlation Activities Completed, Project Completion.
  - i. Project Staff Table – NASIS Username, Project Leader.
  - j. Project Milestone Progress – Fiscal Year, Milestone Progress Amount, Milestone Progress Unit
3. Refer to the NESH and chapter 24 of the NASIS user guide for detailed guidance on managing ES projects in NASIS. More detailed ES project plans and milestones may be developed and managed within or outside of NASIS as needed to support project management.

### 306.6 Product Standards

- A. Draft ESDs are not publicly available because they are incomplete, require additional data, or need QC, QA, and SPSD internal review.  
Draft ESDs include:
  - a. Those that are actively being worked on during stage 1.
  - b. Initial reconnaissance placeholders for sites that may exist and need further investigation.
  - c. Archived ESDs, such as old range sites or woodland sites, that do not meet current ES standards but may be revised if needed.
- B. PES products vary significantly in both detail and scale of content, depending on the timing and circumstances of publication.
  1. Many states and MLRAs have had ES concepts under development for decades, resulting in PES supported by extensive data and expert knowledge.
  2. Other states and MLRAs lacked ES concepts before the PES initiative, resulting in PES with little or no supporting data. Still others created provisional ESG (following NESH §§ 631.2–10) instead of PES, which reflect a coarser scale of classification and description.
  3. PES are made publicly available once they meet the following standards:

- a. Every ES in an MLRA has a distinctive concept based on evidence of recurring patterns in soil and site features related to vegetation potential and dynamics.
  - b. Every major soil component in the MLRA has been correlated to an ES in NASIS.
  - c. A working ES key has been entered into EDIT and accounts for all ES concepts correlated to soils in the MLRA.
  - d. ES features have been populated in EDIT following the April 2021 checklist or, if published before April 2021, following the guidance available at the time.
  - e. A basic STM and ecosystem dynamics narrative that defines the major ecological states and primary drivers of transitions between states has been populated in EDIT.
  - f. QC and QA reviews and a technical review have confirmed that the ES concepts, soil-site correlations, ES keys, ES features, and STM reflect the best available information and adhere to standards defined in the April 2021 checklist and the general guidance in the NESH.
  - g. PES has been reviewed and approved through the SPSD internal review process before publishing in EDIT.
  - h. PES products have been properly labeled as such (450 GM Part 410, Subpart B).
- C. ESD products are those that meet the national minimum data standard. These products are verified with data and not labeled provisional or PES.
- 1. The national minimum data standard ensures consistency and reliability of ESD products.
    - a. All available data should be evaluated for quality, credibility, and relevance to ES development, and useful data must be entered into NASIS.
      - (1) Existing data that meets the population requirements of the national minimum data standard will be used to verify the ES concept. Existing data that does not meet the population requirements of the national minimum data standard often contain valuable information. Though incomplete, these supplemental data must be retained, entered into NASIS to the extent possible, and included in the data analysis used to develop ESDs.
    - b. Verified ESDs must have sufficient field data entered in NASIS, whether new or existing, that documents recurring ecosystem patterns across the extent of the soils to which the ES concept is correlated.
    - c. For legal reasons, some field verification data (e.g., National Resource Inventory data, Forest Inventory and Analysis data) cannot be entered into NASIS. These data sources can be used to meet the national minimum data standard but must be cited in the Inventory Data References section in EDIT.
    - d. New data should only be collected to meet the national minimum data standard when existing data sources are insufficient.

2. The national minimum data standard requires the following for each ES:
  - a. A minimum of 20 low- or medium-intensity observations, or five observations per soil component correlated to the ES, whichever is less, must be populated in the NASIS Vegetation Plot Object and related tables.
    - (1) Soil Survey Regional staff should require more observations for highly accessible sites (e.g., ES that occur near roads) or fewer observations for highly inaccessible sites (e.g., remote wilderness areas).
    - (2) These observations must be distributed across the extent of soil map unit components correlated to the ES and must account for variability in important physiographic, climatic, hydrologic, and soils features (e.g., elevation, precipitation, drainage classes, texture classes).
    - (3) Of the 20 required observations, at least 10 must represent the modal ES concept as described in NESH § 631.2(4).
  - b. A minimum of one medium-intensity modal observation, including community inventory and soil pedon description, must be in the reference or naturalized state. Other modal observations do not have to be in the reference state, but they must reflect the central concept that distinguishes the ES from other sites.
  - c. Soil components lacking modal observations should be targeted for sampling, and all components that do not fit the ES concept should be correlated to a different ES.
  - d. All plant communities in the STM must be documented with at least one observation in the Vegetation Plot object in NASIS or in historical records (e.g., pioneer journals), or must be reasonably inferred from existing data (e.g., a middle sere inferred to occur between documented early and late seres within the same state). Hypothetical plant communities that lack field observations, cannot be reasonably inferred, and lack historical documentation do not meet the national minimum data standard and will not be included in verified STMs at the end of stage 2.
  - e. A map of field observations should be prepared for review by the technical team and QC and QA reviewers. At a minimum, this map must include the MLRA boundaries, Land Resource Unit boundaries (if applicable), point locations of all observations recorded in NASIS, and a polygon shapefile of all soil map units with a component correlated to the ES.
3. National minimum standards for field data population in NASIS are:
  - a. Site Table – User Site ID, WGS84 Latitude and Longitude (convert from UTM as necessary). Optional: other site features documented in the dataset (e.g., elevation, hillslope position, geomorphology).
  - b. Site Observation Table – Observation Date, Observation Date Kind.
    - (1) Optional: Project Name, User Project ID, and other features documented in the dataset.
    - (2) All observations will be assigned a State ID and Name, and Community ID and Name.

- (3) If no State or Community ID is assigned to an observation, then the Text Entry field in the Vegetation Plot Text Table must explain why no State and Community ID is assigned.
  - c. Site Ecological Site History Table – Ecological Site ID, Ecological Site Name
  - d. Vegetation Plot Table – User Site ID, Vegetation Plot ID, Data Origin, Plot Size, Soil Profile? (yes/no), Associated User Pedon ID (if exists), QC Review Person, QC Review Date, QA Review Person, QA Review Date.
    - (1) If pedon data exists for the Vegetation Plot, it must be entered into NASIS and linked to the Vegetation Plot Table.
    - (2) If no soil pedon is associated with the Vegetation Plot in NASIS, then describe available soils information from the plot in the Text Entry field in the Vegetation Plot Text Table.
  - e. Vegetation Plot Text Table – Date, Text Entry (list photos and photo file locations; expound on data sources; if no ES ID or Name is assigned, explain why not; if no soil pedon exists in NASIS, describe available soils information; and transcribe any notes associated with the plot or transect observations).
  - f. Plot or Transect Sampling Protocol Used Table (or both) – Protocol Name
  - g. For protocols used in the dataset, populate relevant plots and transect tables following chapter 25 of the NASIS user guide. Optional: Plot Disturbance Table – Disturbance Type.
  - h. QC review of all NASIS data entry and QA reviews of 10 percent of NASIS data entry must be completed and recorded in the NASIS Vegetation Plot Table.
4. National minimum standards for new field data collection are:
    - a. Geographic location in WGS84 latitude and longitude.
    - b. Photographs.
    - c. Measured or estimated foliar cover, canopy cover, production, or similar abundance measures of dominant species.
    - d. Key soil information, including soil surface cover estimates, soil map unit, and classified soil pedon descriptions, that represent the ES concept (not necessarily representative of the mapped soil series).
    - e. Estimates and notes of important physiographic, hydrologic, and climatic features in the MLRA (e.g., elevation, slope, aspect, hillslope position, drainage class, precipitation zone, soil moisture, temperature regimes).
    - f. STM notes describing possible ecological state, community, and evidence of disturbance and land use history driving possible transitions.
    - g. Compliance with the NESH, the National Forestry Handbook, and National Range and Pasture Handbook and new guidance produced as part of objective 7 in this instruction.
  5. All data in EDIT must be updated to reflect new knowledge gained during stage 2 ES verification projects. ES keys must be updated in EDIT to reflect changes as necessary. Any changes to the soil-site correlations must be



reflected in the Component Ecological Site Table in NASIS for affected soil components.

6. National minimum standards for EDIT data population for each ESD are:
    - a. General Information – Site ID, Legacy Site ID, Name, Dominant Species, MLRA Notes, Ecological Site Concept, Associated Sites, Similar Sites.
    - b. Physiographic Features – Narrative, Landforms, Standard Properties (representative and actual low and highs), Aspect.
    - c. Climate Features – Narrative, Climate Stations, Climate Normals, Normal Monthly Precipitation, Normal Monthly Temperature (minimum and maximum).
    - d. Water Features – Narrative.
    - e. Soil Features – Narrative, Parent Material, Surface Texture, Family Particle Size, Standard Properties (representative and actual low and highs), Standard Properties by Depth (depths, representative and actual low and highs), modal Soil Profile Photo.
    - f. Ecological Dynamics – Narrative, STM Model Builder.
      - (1) States – Name, Sequence, Description, Photo (if possible), Dominant Species (tree, shrub, grass, other).
      - (2) Plant Communities – Name, Sequence, Description, Photo (if possible), Dominant Species (tree, shrub, grass, other).
        - (a) All modal observations recorded in NASIS must be represented in the appropriate plant community tables in EDIT – Forest Overstory Species, Forest Understory Species, Total Annual Production, Production by Groups, Production by Species, Canopy Structure, Ground Cover, Soil Surface Cover, Woody Ground Cover.
        - (b) If a plant community has more than one observation in NASIS, the data must be aggregated to portray a representative range of variability for entry in EDIT.
      - (3) Transitions, Restoration Pathways, and Community Pathways – Name, Transition Type, Mechanism, Context Dependence.
    - g. Supporting Information – Inventory Data References, NASIS User Site ID, Citations, Other References, Contributors. All modal observations must be listed in EDIT.
  7. Final QC, QA, and SPSP internal review are required before ESD publication. SPSP is responsible for all reviews of ES verification projects.
- D. Characterization of STMs, DSPs, and STM interpretations have their own standards. A single characterization project should not attempt to produce complete characterization of all ecological states, plant communities, transitions, DSPs, and interpretations for an ES. Characterization projects will be designed to formulate knowledge about a subset of high-priority ecological states, plant communities, and transitions to meet specific user needs. Most ESDs will never achieve full characterization of STMs, DSPs, and STM interpretations.

1. In addition to the requirements of the national minimum data standard, complete STM characterization standards require the following.
  - a. A minimum of three high-intensity modal observations of the reference state must be populated in the NASIS Vegetation Plot Object (and related tables) as outlined in this national instruction, along with a detailed soil pedon description for each. If representative locations for the reference state cannot be found, then a naturalized state can be used to meet minimum sampling requirements (NESH § 631.12(6)).
  - b. A minimum of three medium- or high-intensity modal observations of each plant community must be populated in the NASIS Vegetation Plot Object (and related tables) as outlined in this national instruction, along with a detailed soil pedon description for each. If a plant community no longer exists or cannot be found, then revert to the national minimum data standard in this instruction.
  - c. Collection of new field data must follow guidance in the NESH, the National Forestry Handbook, the National Range and Pasture Handbook, and new guidance produced as part of objective 7 in this instruction.
2. NASIS data population requirements for the characterization standard are the same as the national minimum standard, except:
  - a. All observations must be modal and be assigned an Ecological Site ID and Ecological Site Name in the Ecological Site History Table.
  - b. An Associated User Pedon ID and full pedon description must be entered in the Vegetation Plot Table for ES characterization projects to be complete.
  - c. QC review of all NASIS data entry and QA reviews of 10 percent of NASIS data entry must be completed and recorded in the NASIS Vegetation Plot Table.
3. In addition to the national minimum standard requirements, STM characterization data collection should maximize the use of quantitative measurements wherever possible, including but not limited to:
  - a. Full soil pedon descriptions at each medium- and high-intensity plot.
  - b. Soil surface features such as rock fragments, biological soil crusts, surface aggregate stability, pedoderm classes, surface litter, and downed woody debris.
  - c. Measured foliar cover (e.g., line point intercept) or canopy cover (e.g., Relève).
  - d. Measured production by species (e.g., double sampling, site index, basal area, culmination mean annual increment).
  - e. Fenceline contrasts, exclosures, fire scars, and other side-by-side comparisons of alternative management and disturbance histories.
  - f. Long-term monitoring datasets and publications.
  - g. Historic observation sites that may be revisited to assess transitions, thresholds, and restoration pathways.

4. EDIT data population requirements for the STM characterization standard are the same as the national minimum standard. The difference is in the quality and quantity of the underlying data.
  - a. All data in EDIT must be updated to reflect new knowledge gained during stage 3 ES characterization projects.
  - b. ES keys must be updated in EDIT to reflect changes as necessary.
  - c. Any changes to the soil-site correlations must be reflected in the Component Ecological Site for affected soil components.
5. Technical teams and QC and QA reviewers actively contribute to STM characterization projects. Final QC, QA, and SPSD internal reviews must be completed before publication.
6. For DSP projects, refer to the DSP minimum data standards in the DSP Guide<sup>6</sup>.
7. Under the leadership of S&T, standards and training for interpretations will be developed and implemented beginning in FY 2024.

### 306.7 STM Interpretations

- A. Interpretations should be developed for ecological states, plant communities, and transitions identified as priority to meet customer needs.
- B. Interpretations must be reviewed and approved by the state office with the most acreage of soil map unit components correlated to an ESD or ESG in cooperation with other vested states and partners.
- C. Priorities and workplans for STM interpretation development should be managed at the discretion of state office staff, regardless of ES stage or NASIS project status, and should address specific needs for information by land use and national conservation planning tools and directives.
- D. Applicable land uses and modifiers are limited to those currently recognized in the National Planning Procedures Handbook (NPPH, 2021<sup>7</sup>).
- E. Working groups will be assembled to develop standards, information and format prototypes, and business requirements for incorporating STM interpretations in EDIT. S&T will consider detail assignments to expedite this work and may identify other needed STM interpretations.
- F. The ES Focus Team will recommend standards and business requirements for the following STM interpretations:
  1. Resource Concern Components and Associated Risk Assessment – Draft instructions have been developed and require additional work to finalize.

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<sup>6</sup> NRCS, [Dynamic Soil Properties Guide](#) (2022).

<sup>7</sup>NRCS eDirectives, [National Planning Procedures Handbook](#), 1st Ed., Amend. 9, (2021).

2. Pasture Management – This serves as the model for other STM interpretations, with guidance and examples already developed for such features as adapted species, production values, growth curves, management inputs, management considerations, and Pasture Conditions Score Matrix.
  3. Forestry and Wood Products – The forestry working group of the Core Mission subteam will develop guidance for interpretations for wood products and forest management.
  4. Grazing Management – Accessibility ratings and limiting factors (e.g., slope, aspect, surface features, soil conditions, plant barriers) by grazing animal.
  5. Forage Preferences – Seasonal forage preference tables by plant species or functional group and animal (include domestic and dominant grazing and browsing wildlife).
  6. Annual Forage Table – Table for Low-RV-High forage production by grazing animal.
  7. Agronomic – Table of adapted crops, yields, management inputs, and management considerations (e.g., Soil Health Scoring Matrix).
  8. Recreational Uses – Table of recreation types, key characteristics, and potential limitations.
  9. Wildlife – Seasonal habitat suitability rating by key species group.
  10. Hydrology – Seasonal water budgets, hydrology, and erosion models.
  11. Fire – Tables for fire potential (occurrence and behavior), fuel model, fuel characteristics (volatility, size, amount, continuity, and location), and prescribed fire.
  12. Carbon Storage – Soil carbon and other dynamic soil properties.
  13. Climate – Table of impact, adaptations, potential mitigation, events.
  14. Rangeland Health Reference Worksheets – Currently under development using Interpreting Indicators of Rangeland Health Version 5.
  15. Local Interpretation and Information – Narrative and ability to upload images for other products (e.g., Indigenous ecological knowledge and plant uses).
- G. Publication of STM interpretations in EDIT requires approval of the state conservationist who has most of the acreage covered by the ES. Publication will only be authorized after QC, QA, and SPSD internal review are complete, with signatures from NTSC staff, and state office reviewers.