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Subpart A – Introduction

630.0 Purpose

A. The National Ecological Site Handbook (NESH) and other technical and procedural references provide the standards, guidelines, and definitions to support policies and indicated the responsibilities and procedures for conducting the collaborative process for development of ecological site (ES) concepts and ecological site description information. Responsibilities for ES activity are shared among disciplines, including soil science, range science, forestry, agronomy, wildlife biology, hydrology, and ecology. The steps needed to collect information on site attributes, site correlation and classification, site dynamics, and site interpretations are all separate, but they must be coordinated so that the expertise of the available interdisciplinary staff can be used to ensure facilitation of ES activity.

B. The process of developing an ES concept and its corresponding ES information consists of the collection, organization, and delivery of information. It includes managing diverse types of information, synthesizing existing scientific literature, collecting field data, organizing informal and formal knowledge, interpreting successional projections of change due to disturbances (such as management actions and natural events), and concisely summarizing all of the information in a format that is useful to decisionmakers. Thus, defining and describing ESs in a credible, transparent, and efficient manner is reliant on a well-defined system of information collection, organization, and delivery. This handbook describes the roles and responsibilities, tasks and products, and quality control and quality assurance necessary to provide quality information to decision makers.

C. The NESH is specific to NRCS, but it adheres to the guidelines established in the Interagency Ecological Site Handbook for Rangelands. The standards set in the NESH are as stringent, or more so, than those in the interagency handbook. The information in this version of the NESH pertains to rangeland and forestland. Standards and guidance for additional land types will be added to the handbook as the information becomes available.

630.1 Definition

An ecological site is a conceptual division of the landscape. It is defined as a distinctive kind of land based on recurring soil, landform, hydrology, geology, and climate characteristics that differs from other kinds of land in its ability to produce distinctive kinds and amounts of vegetation and in its ability to respond similarly to management actions and natural disturbances.

630.2 Principal References and Their Maintenance

A. Other NRCS manuals and handbooks, including the National Soil Survey Handbook (NSSH), Soil Survey Manual, National Range and Pasture Handbook, National Forestry Handbook, National Forestry Manual, and National Biology Manual, will refer to this handbook for guidance regarding operating procedures and technical information required for ES information. Interagency manuals and handbooks, such as the Rangeland Interagency Ecological Site Manual and the Interagency Ecological Site Handbook for Rangelands, were used extensively in the development of the NESH.

B. Updates to ES policy, procedure, and science will be included in future versions of the NESH. A citation for the handbook or manual containing the related procedure will be included. Every effort
will be made to provide a specific kind of information in only one document so that maintenance of the information will not require update of multiple documents.

630.3 Roles and Responsibilities

A. Specialists from the Soil Science Division (SSD) and Ecological Sciences Division, major land resource area soil survey offices (SSOs), State offices, field offices, soil survey regional offices (SSRs), and national centers work together to develop ecological site information, commonly with specialists from other agencies and partner organizations. The State office, particularly the State resource conservationists (SRCs) and their staffs, provides specialized expertise on vegetation, conservation planning, and resource management for development and certification of ES information. The SSD staff develops soil and vegetation groups, verifies soils, and facilitates or leads the ES planning, approval, and correlation processes (similar to the soil survey planning process). A list of general roles and responsibilities is provided in this section. Information on specific roles is given in the appropriate part of the handbook. For example, part 630, subpart B, lists the roles and responsibilities specific to the project planning process and part 630, subpart E, lists the roles and responsibilities specific to quality control, quality assurance, correlation, and certification.

B. At the national level, development and implementation of ES policy, procedures, and data management require the collaborative effort of many different disciplines within NRCS and of partners (Interagency Ecological Site Handbook for Rangelands, section 1.0.D).

C. Partners such as Forest Service (FS) national headquarters staff, regional staff, supervisors, and district office staff; Bureau of Land Management (BLM) national headquarters, State, district, and field office staffs; university staffs; staff from nongovernmental organizations; and others may participate or lead in any role or responsibility of ES activity. If ES information is to be used by NRCS or stored or referenced in a national database, such as the ES database or Web Soil Survey (WSS), it must undergo the correlation and quality assurance processes provided in this handbook to ensure that it adheres to NRCS policy.

D. National Headquarters (NHQ) Staff

(1) Deputy Chief for Soil Science and Resource Assessment—
   (i) Coordinates leadership for operations management and quality assurance of ES information in cooperation with the Deputy Chief for Science and Technology.
   (ii) Establishes and maintains an interagency workgroup to provide support and oversight of ES information development and to coordinate with other deputy chiefs as needed.

(2) Deputy Chief for Science and Technology—
   (i) Coordinates leadership for the development and use of ES information in cooperation with the Deputy Chief for Soil Science and Resource Assessment.
   (ii) Establishes and maintains an interagency workgroup to provide support and oversight of ES information development and to coordinate with other deputy chiefs as needed.

(3) Director of Soil Science Division—
   (i) Provides overall direction, policy, guidance, and leadership for management and quality assurance of ES operations in cooperation with the director of the Ecological Sciences Division.
   (ii) Establishes goals for the program and monitors progress.
   (iii) Ensures that the SSD is represented and ES information is incorporated into all applicable NRCS business and programs at the national level.

(4) Director of Ecological Sciences Division—
   (i) Provides overall direction, policy, guidance, and leadership for ES development and use in cooperation with the director of the SSD.
(ii) Ensures that the development and implementation of agency policy and procedures for ESs conform to interagency policy in cooperation with the director of the SSD.

(iii) Ensures that the Ecological Sciences Division is represented and ES information is incorporated into all applicable NRCS business and programs at the national level.

E. National Leaders

(1) National Ecological Site Team (NEST) leader—
   (i) Provides leadership for the development of technical concepts, tools, and support material for ESs, including planning, data collection and analysis, training, and implementation, for use by national, regional, State, and local staffs.
   (ii) Develops and implements agency ES policy, procedures, and standards in cooperation with the National Grazing Lands Team (NGLT) leader.
   (iii) Provides guidance and recommendations to other national leaders, division directors, and deputy chiefs to ensure that interagency policy is appropriately integrated and implemented throughout NRCS.

(2) Ecological Sciences Division national leaders—
   (i) Advise other national staff on ES policy, procedures, and technology and on use of ES information.
   (ii) Lead NRCS in cooperation with Federal land management agencies and other partners.
   (iii) Provide guidance and recommendations to other national leaders, division directors, and deputy chiefs to ensure interagency policy is appropriately integrated and implemented throughout NRCS.

(3) Other national leaders—
   (i) Develop and implement agency ES policy, procedures, and standards in cooperation with the NEST leader.
   (ii) Provide guidance and recommendations to division directors and deputy chiefs to ensure that interagency policy is appropriately integrated and implemented throughout NRCS.

F. National Centers

(1) NEST and other national teams—
   (i) Collaboratively lead national NRCS efforts in support of ecological site description (ESD) development and advancement of supporting science.
   (ii) Develop ES theory in cooperation with appropriate partners.
   (iii) Develop and revise technical tools and databases for the development of ES information.
   (iv) Develop and revise policy, procedures, and technical standards and guidance.
   (v) Coordinate activities with Federal land management agencies and other partners at appropriate levels (commonly at the national or regional level).
   (vi) Provide training, guidance, and technical assistance on the development of ES concepts and the development and use of ES information to the SSROs and national technology support centers (NTSCs).
   (vii) Lead development of training, guidance, and technical assistance material on the formulation of ES concepts and the uses and procedures for ES information for NRCS and partners.
   (viii) Present ES concepts to professional societies and organizations.

(2) NTSC technical specialists—
   (i) Support the development of theories, tools, policies, and procedures for ES information development as needed.
   (ii) Provide training and technical assistance on ES concepts and the development and use of ES information.
   (iii) Integrate ESs into conservation planning processes and tools.
   (iv) Work with universities and colleges to integrate ESs into curriculum.
(v) Present ES theories and uses for ES information to professional societies and organizations.

G. Soil Survey Regional Offices (SSRs)

(1) Soil survey regional directors (SSRDs)—
   (i) Coordinate and participate in project planning within SSRs.
   (ii) Provide leadership for development and quality assurance of ES information.
   (iii) Coordinate activities among Federal land management agencies and other partners at appropriate levels.
   (iv) Report progress on ES information development, including field reviews and correlations.
   (v) Develop all memoranda of understanding (MOUs), statements of work, agreements, and proposed amendments pertaining to ESs.

(2) Regional ES specialists—
   (i) Ensure all MOUs, statements of work, agreements, and proposed amendments comply with NRCS technical standards for ESs.
   (ii) Provide, coordinate, or recommend training and assistance to SSO ES specialists and others as needed.
   (iii) Present ES updates to professional societies and organizations.
   (iv) Provide guidance to ES technical teams.
   (v) Facilitate field reviews, providing quality assurance on data collection processes and database activities.

H. State Offices

(1) State Conservationists (STCs)—
   (i) Serve as members of board of advisors (BOA).
   (ii) Review proposed changes to office locations and MLRA boundaries and other delineations and provide recommendations to the SSRDs, who forward recommendations to the SSD director as appropriate.
   (iii) Certify ES information for inclusion in the State field office technical guide (FOTG).

(2) State resource conservationists (SRCs) or appointed designees—
   (i) Serve as members of the management team.
   (ii) Advise and assist STCs in allocating resources as effectively as possible to carry out all ES activities in the State.
   (iii) Assist STCs and SSRDs in monitoring progress to ensure that work schedules and timelines coincide with the plan of operations.
   (iv) Work with SSRDs and regional ES specialists on State-led agreements and MOUs, etc., related to ES information.
   (v) Develop schedules to meet ES program objectives and to assist STCs in technical ES service activities for conservation operations.
   (vi) Provide ES technical services and assistance within the State as needed.
   (vii) Work closely with SSR and SSO staffs to ensure that personnel meet the overall goals of the ES program.
   (viii) Ensure that existing ES information in the State is evaluated effectively by knowledgeable personnel, such as the technical team, cooperators, resource soil scientists, and other technical specialists, to identify possible deficiencies in the long-range plan.
   (ix) Provide technical input at any stage during development of ES information to ensure that it meets State needs for conservation planning, implementation, monitoring, and assessment.
   (x) Develop local ES interpretations as needed.

(190-630-H, 1st Ed., Amend. 1, March 2017)
(xi) Update and maintain ES information in the FOTG.
(xii) Develop cooperative relationships with regional soil survey cooperators, agencies, universities, SSRs, SSOs, and national centers for the development of ES information.
(xiii) Work with universities and colleges to integrate ESs into curriculum.
(xiv) Assist all users of ES information.

(3) State technical discipline specialists—
   (i) Serve on management team or technical team as assigned.
   (ii) Provide training and technical assistance to State, area, and field office personnel on the development of ES concepts and the development and use of ES information.
   (iii) Assist SSR in providing training and technical assistance to SSOs on ES concepts and development of ES information as assigned or requested.
   (iv) Provide technical input at all stages during development of ES information to ensure that it meets State needs for conservation planning, implementation, monitoring, and assessment.
   (v) Assist in development of project plans.
   (vi) Conduct field data collection and investigation needed to develop ES information.
   (vii) Present ES concepts to professional societies and organizations.

I. Area and Field Offices

Resource soil scientists, rangeland management specialists, foresters, agronomists, and other technical specialists—
   (i) Serve on SSO technical teams as assigned.
   (ii) Develop or assist in developing project plans.
   (iii) Respond to user needs for new ES interpretations and collect performance data.
   (iv) Provide technical input at any stage during development of ES information to ensure that it meets State needs for conservation planning, monitoring, and assessment.
   (v) Conduct field data collection and investigation needed to develop ES information.
   (vi) Evaluate adequacy of ES information.
   (vii) Provide coordinated ES information to all users.
   (viii) Train field personnel in use of ES information.
   (ix) Assist field offices with delivery of ES information.

J. Soil Survey Offices (SSOs)

(1) SSO leaders (SSLs)—
   (i) Provide management and support for ES activities within the SSOs.
   (ii) Schedule routine work activities in plans of operation and monthly and weekly plans, as appropriate, in consultation with responsible SSS, SRC, or SSRD.
   (iii) Support development of new and update ES projects within MLRAs.
   (iv) Serve as chair of ES technical team.
   (v) Create local project workgroups for ES information development.
   (vi) Keep maps and data related to ESs current to meet the changing needs of users.
   (vii) Perform investigations, maintain ES datasets, and prepare and revise ES information.
   (viii) Improve quality of digital line work to conform to landscape and ES concepts.
   (ix) Provide training to SSO ES specialists on soil morphology, geology, geomorphology, and hydrology as needed.

(2) ES specialists and other SSO staff—
   (i) ES specialists in the SSOs may be delegated any of the duties listed for the SSLs.
   (ii) Lead or coordinate development of new or updated ES information.
   (iii) Serve as member of SSO technical teams or coordinate activities of teams as designated by SSLs.
(iv) Develop ES project plans for submission to SSLs.
(v) Assist in developing appropriate ecological units and soil component groups that facilitate identification of ESs.
(vi) Conduct field data collection and investigation needed to develop ES information.
(vii) Evaluate existing ES information to identify deficiencies, overlapping concepts, and lack of soil-ES correlation for possible inclusion in long-range plans.
(viii) Enter data into ES database and ensure data quality as needed.
(ix) Provide training to SSO soil scientists on plant identification, ecological site concepts, and plant community dynamics.
(x) Provide technical input at any stage during development of ES information.
(xi) Assist in developing timeline for ES information development and project deliverables.

630.4 Progress Reporting

A. Project Progress

Ecological site project plans will be documented in NASIS. Progress on ecological site development will be monitored by project milestones. Project acres will be reported incrementally as the ecological sites meet the provisional, approved, and correlated milestones. Acres will be counted three separate times, once for each of these milestones. The progress acres reported in NASIS will be mined by the Performance Review System (PRS).

B. Milestones

Each project will include milestones and a timeline for completion of the milestones. The milestones will be used to track progress toward goals. Each milestone includes a task that has a scheduled start and completion date and a person responsible for the task. Milestones will be used to measure progress of projects, to assess whether responsible technical experts have the appropriate expertise for a task, and to determine whether project participants are meeting the approved schedule. Milestones are useful for project planners, supervisors, and quality control and assurance reviewers.

(i) National Milestones

- A set of unique national milestones and their definitions are presented in part 630, subpart H, section 630.70. Each of the milestones is included in the “NASIS Project Milestone” table. The scheduled and actual start and completion dates for each one can be tracked in this table. In NASIS, the names of the ES milestones all begin with “ES.” The national milestones will comprise a minimum set of goals for a new ES project; not all are needed for revision or update ES projects. National milestones will be used to track the progress of ES information development.
- In NASIS, each project milestone has a “Project Milestone Progress” child table, which is used to track the progress of the milestone.

(ii) Additional Milestones

The set of national milestones may not include all tasks necessary to complete a project. Some tasks routinely needed for all projects, such as English edit, are not included, but they can be added to ES project plans and tracked in NASIS as appropriate. These milestones will be used to assess the progress of individual projects.

C. Milestones for Levels of Completion

(1) Provisional ES Information

Provisional ES information is established as the site keys and ES concepts are developed for an MLRA. Provisional status is assigned when all potential ecological site concepts for the (190-630-H, 1st Ed., Amend. 1, March 2017)
MLRA have been established and an initial state-and-transition model (STM) is drafted. Provisional ES information will include draft site concepts, STMs, and STM narratives. ES concepts, STMs, and STM narratives will include basic disturbance regimes, effects of management on ecological processes, and conservation practice codes where appropriate. A name and identification number will be assigned to each provisional ES and entered into the ES database. The provisional ES information will contain sufficient information to distinguish it from associated ESs and a working copy of the STM. Before being made available to the public, ES information must undergo a quality control review and at least one quality assurance review and then the SSRD must verify with a signature that the ES information meets quality standards. Each provisional ES will be entered into NASIS as a project following the guidance in part 630, subpart B, section 630.13.

(2) Approved ES Information

Approved ES information must contain a defined set of criteria. This criteria will be determined on an MLRA basis and guidance will be provided by the SSR. Alternative states will require the same level of documentation as that required for the reference state. Before being made available to the public, ES information must undergo a quality control review and at least one quality assurance review and then the SSRD must verify with a signature that the ES information meets quality standards. Once approved by the SSRD and certified by the STC and partners, the ES information is available for agency and public use through the ES database and the State FOTG.

(3) Correlated ES Information

Correlated ES information must meet all standards as determined by the quality control review, final quality assurance review, and final correlation. The criteria for the correlated level of completion will be determined on an MLRA basis and guidance will be provided by the SSR. Alternative states will require the same level of documentation as that required for the reference state. Once correlated by the SSRD and certified by the STC and partners, the ES information is available for agency and public use through the ES database and the State FOTG. Correlated ES information is completed on an MLRA basis.

630.5 Correlated ESD Performance Measure

Reserved.
Part 630 – Procedures and Processes

Subpart B – Project Management

630.10 Purpose

An effective project planning process is needed to develop and maintain ES information. This involves the development, prioritization, and approval of project plans for work within a given MLRA. The formal process of project planning assists in organizing and prioritizing work on an annual, project, and long-range (about 5 years) basis and in analyzing workload and resources. The long-range plan will address completion of the site keys and provisional ES information for all MLRAs with SSURGO-certified, published soils information. Work on ES information will continue until approved status, and then finally correlated status, has been achieved for all ecological sites within an MLRA. Project management is necessary for developing and maintaining quality ES information. This standard follows the same basic steps outlined in Title 430, National Soil Survey Handbook (NSSH), Part 608, but it allows for additional participants, including partners, to acknowledge the interdisciplinary nature of ecological site projects.

630.11 Roles and Responsibilities

A. Board of Advisors (BOA)

(1) The BOA consists of the State Conservationist (STC) from each State served by a soil survey regional office (SSR). Representatives of Federal and State entities and others with affected land can serve as members. The soil survey regional director (SSRD) provides the necessary staff to plan work, conduct meetings, and present information. BOA members develop specific operating procedures and add other board members as needed.

(2) The BOA—

(i) Serves as a review board and provides advice, counsel, and broad management direction to the SSRD to ensure ES activities are relevant to agency goals and priorities and to conservation needs.

(ii) Reviews progress of ES activities in the region relative to agency goals and priorities and provides feedback to the Associate Director for Soil Operations for consideration during periodic performance reviews and annual evaluations of SSRDs.

(iii) Reviews management team recommendations of priorities for ES activities and provides concurrence or alternate recommendations to ensure that local needs are in balance with State and national issues.

(iv) Reviews management team recommendations regarding approval of project plans, SSO annual plans of operation, and memoranda of understanding (MOUs) within the soil survey region, including any proposed amendments, and provides concurrence or alternate recommendations.

B. Management Team

(1) The management team consists of the SSRD and the State soil scientist (SSS), State resource conservationist (SRC), and appropriate State technical leaders, as needed, for each State served by the SSR. Representatives from Federal agencies, nongovernmental organizations, State organizations, universities, and other NCSS partners can serve as members. NTSC staff and regional ES specialists may join or assist the team. The SSRD serves as chairperson. The management team is responsible for developing specific operating procedures and adding team members as needed.
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(2) The management team—
   (i) Reviews and approves, by consensus, technical team ES project plans. If the team is
       unable to reach consensus within an agreed-to time frame, the chairperson will make the
       final decision regarding approval of ES project plans.
   (ii) Reviews technical team recommendations regarding approval of ES MOUs within the
        SSR, including any proposed amendments, and provides concurrence or alternate
        recommendations.
   (iii) Reviews and approves technical team recommendations of priorities for ES activities or
        provides, by consensus, an alternate priority list to ensure that local priorities are in
        balance with State and national issues.
   (iv) Reviews and approves new and updated long-range and annual plans (including both soil
        and ES projects) proposed and developed by the technical team. If consensus cannot be
        reached, the chairperson will make the final decision.
   (v) Chairperson forwards all decisions and recommendations to the BOA.

C. Technical Team

(1) The SSO technical team consists of technical specialists that work cooperatively to develop
    ES information. The team includes SSO staff (SSL, ES specialist, and others); field, area,
    State, and NTSC regional specialists (soil science, range science, forestry, agronomy, and
    wildlife specialists, etc.); and applicable partners. Technical teams are made up of
    individuals with assigned roles and will provide guidance throughout the development of ES
    information and identify needed personnel and skills to complete the work (see part 631,
    subpart B, for information on local workgroups). If local assistance is limited or lacking,
    specialists from the SSR and NTSC may assist or join the team as needed. In most cases,
    regional and national specialists will provide assistance and training. The SSL serves as
    chairperson. Specific operating procedures are developed by the technical team as needed.

(2) The technical team—
   (i) Gathers and consolidates the State ES priorities and ES information development needs
       for inclusion in the SSO long-range plan of operation.
   (ii) Develops project priorities for proposal.
   (iii) Develops draft ES project plans and SSO annual plans of operation to address priorities
        and needs identified in the long-range plan and any other goals identified by the
        management team and BOA.
   (iv) Identifies personnel to complete tasks outlined in project plans.
   (v) Designates a quality control reviewer for each project, subject to SSO management team
       approval.
   (vi) Submits project plans to management team for review and approval.
   (vii) Accomplishes the tasks and milestones outlined in project plans within the agreed-to
        time frame.
   (viii) Participates in ES quality control activities as appropriate.

D. Soil Survey Regional Offices (SSRs)

(1) SSRDs—
   (i) Provide the necessary staff to plan work, conduct meetings, and present information to the
       BOA.
   (ii) Submit approved plans and other recommendations to the BOA for review.
   (iii) Serve as chairperson for the management team and coordinate all activities of the team.
   (iv) Ensure appropriate State technical leaders are on the management team.
   (v) Approve project, annual, and long-range plans if the management team is unable to reach
       a consensus for approval.

(2) Soil survey region ecological site specialists (SSR ESSs)

(190-630-H, 1st Ed., Amend. 1, March 2017) 630-B.2
(i) Assist the management and technical teams with technical and policy aspects of project planning and execution.
(ii) Become members of the management or technical team, or both, upon request or as assigned.
(iii) Provide quality assurance to all aspects of project management.

E. National Center Technical Specialists

(1) Assist management and technical teams with technical and policy aspects of project planning and execution.
(2) Become members of management or technical team, or both, upon request or as assigned.

F. State Offices

(1) SSSs and SRCs or appointed designees on management teams—
   (i) Provide training to ES staff as needed.
   (ii) Monitor progress of the management team to ensure that work schedules and timelines are being met according to the plans of operation.
(2) State technical discipline specialists on technical or management teams assist in development or review of ES project plans.

G. Area and Field Offices

Resource soil scientists, rangeland management specialists, foresters, agronomists, and other technical specialists—

   (i) Participate as members of the appropriate technical team as assigned.
   (ii) Assist in development of ES project plans.

H. Soil Survey Offices (SSOs)

(1) SSO leaders (SSLs)—
   (i) Provide leadership for the technical team.
   (ii) Develop long-range plans to include ES projects, based on findings from an MLRA-wide assessment and in consultation with SSO ES specialists and other technical specialists.
   (iii) Assess training needs of individuals identified in ES-related project plans and request training through the SSR, State, or center offices and the Ecological Site Training Committee.
   (iv) Ensure that individuals identified in the project plans have supervisory support to complete the project tasks.
   (v) Ensure that the tasks are accomplished as described in the project plans.
(2) SSO ES specialists and other SSO staff—
   (i) Develop or assist with development of ES project plans and annual plans to address the goals and activities identified as priority work by the management team and BOA.
   (ii) Perform investigations throughout assigned area, maintaining ES datasets and developing and revising ES information.

I. Partners

Partners, such as the Bureau of Land Management, Forest Service, National Park Service, and nongovernmental organizations (NGOs), may participate in any step in the project planning process or be included as members of the technical or management team as appropriate. Partners managing land affected by the project may also be members of the BOA. Outside contractors with appropriate knowledge, skills, and abilities may complete some tasks, as identified in the project plans. If an entity contributes funding, it may be appropriate to have a representative from the entity on the technical team, management team, or BOA.

(190-630-H, 1st Ed., Amend. 1, March 2017)
630.12 Workload Planning

A. The formal process of project planning assists the SSO in planning and prioritizing work on an annual, project, and long-range (about 5 years) basis. It also assists in analyzing workload and resources. The workload analysis planning process considers the work to be done, estimates the amount of time and resources required to complete each task, and provides a timetable for completing the work. SSO long-range plans, project plans, and annual plans will be used to support proposed ES activities. Long-range, project, and annual plans that include ES activities help to direct the human and financial resources available to accomplish identified activities.

B. Types of Documents for Planning and Managing ES Projects

(1) A long-range plan for an SSO describes the activities needed to complete an initial ES project or to update previous work to meet a common standard within 5 years or more (430-NSSH, Part 608, Subpart B, Exhibit 608-1). The format and level of detail for a long-range plan can vary. It should include development of site keys, identification of potential ecological sites within an MLRA, and enough information to effectively prioritize the workload for an MLRA. Existing long-range plans may need to be updated to incorporate ES activities.

(2) A project plan for an SSO describes the activities needed to accomplish one or more of the priority tasks identified in a long-range plan. Projects for ES activities can be individual or combined with other soil survey activities. Project plans outline the work to be done, and they include the personnel needed, geographic extent, milestones, and timeline. Reportable milestones are used to identify annual progress. It is expected that ES projects may take more time to complete than other soil survey projects (part 630, subpart B, section 630.13).

(3) An annual plan of operation is developed to guide the staff and provide specific focus as the project plans are being implemented. An SSO annual plan of operation, or business plan, is used to identify objectives, goals, responsibilities, and timelines during a fiscal year (430-NSSH, Part 608, Subpart B, Exhibit 608-2).

630.13 Project Plan Development

A. Project plans are the main tool for analyzing the workload (planning, scheduling, and coordinating activities) and tracking the progress of ES activities. The scope of project plans will vary. Site keys and provisional ES information will be developed for an entire MLRA before ES information is progressed to the approved stage. A project plan may simply involve the collection of additional data for updating existing ES information to the current standard. Each plan for provisional and correlated ES information will include the entire development process for an MLRA, LRU, or other geographic region. Plans for approved ES information may include multiple ecological sites. The actual length of time needed to complete a project plan will depend on the amount of pre-existing information and the scope and complexity of the project. Once provisional ES information has been developed for an MLRA, projects can be managed and completed more effectively. See part 630, subpart H, section 630.71, for an example of a project plan.

B. Project plans are managed in the National Soil Information System (NASIS) (NASIS 6.0 Training Materials, Chapter 24). The activities to be accomplished by the project are identified in NASIS.

C. Key milestones are entered into NASIS and are used to track progress (see part 630, subpart H, section 630.70, for a list of nationally approved milestones). Milestones are especially important for identifying the appropriate time for the acres recorded in the “NASIS Project Mapping Progress” table to be transferred to the Performance Review System (PRS).

D. A project plan that conforms to the standards in this handbook is not required for any ES activities in progress as of the date of release of the handbook; however, the final ES information
must go through and pass quality control and quality assurance reviews prior to correlation and certification. All ES activities initiated after the release of this handbook must have a project plan in compliance with the standards within it.

E. Project plans will include the following information, as a minimum:

1. Contact information.
2. Project Objectives.—Plan should include the objectives for the project, including what is to be accomplished, the scope of the work, and the justification for doing the work.
3. Project Area.—Plan should define the specific geographic area, commonly a MLRA, LRU, or other subdivision, and identify affected Federal land management agencies.
4. Justification.—Plan should include an explanation of the importance of the planned work, including rationale for making the project a priority.
5. Priority Recommendation.—Priority and justification for the plan should be clearly defined as recommended by the technical team.
6. Project Personnel.—Plan should identify the technical team members consisting of appropriate technical specialists (i.e., agronomy, biology, forestry, range science, soil science, and hydrology) needed to complete project tasks. Identified staff should have appropriate knowledge, skills, abilities, and supervisory support to complete the tasks. Plan may include staff from the SSO, State office, area office, field office, or other agencies or partners. Contractors with appropriate knowledge, skills, and abilities may complete some of the tasks.
7. Milestones.—Plan should identify milestones representing the major tasks. For national progress reporting, plans should include all applicable milestones as described in part 630, subpart H, section 630.70. Additional milestones may be included in a plan if needed. Each project task or milestone should identify the responsible individual and a projected start and completion date. For progress reporting, milestone completion dates can be used to estimate the percentage of a plan completed.
8. Optional Attachments.—Additional information may be attached, such as project area maps, soil maps, draft ecological site concepts, vegetation maps, climate maps, legacy plant sampling strategies, inventory data, and training, support, and equipment needs.

630.14 Prioritizing Project Plans

A. Proposed project plans must be prioritized in order of importance. Acres should not be used as the most important criteria for prioritization. Prioritization is needed to organize workloads, ensure efficiency, and distribute a workload over time. The technical team develops a draft priority list for all projects within an MLRA. The management team reviews and approves the project priorities. The BOA reviews and provides alternate recommendations, as needed.

B. Considerations for establishing priorities for ES projects—

1. Need for information to assist in land use planning and decisions.
2. Need for information to assist with initiatives developed by the Chief of NRCS (or other regional or State initiatives).
4. Need for information regarding ecologically significant areas or sensitive environmental issues.
5. Contributions of funding or staff.
6. Number of people benefiting from the project.
7. Relative importance of the project.
8. Size of area impacted by the project.
9. Other factors of local significance.
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C. Additional guidance for setting project priorities is in the 430-NSSH, Part 610, Subpart A, Section 610.4.

630.15 Project Plan Approvals

A. Project plans for an SSO are developed by the technical team. The technical team recommends an order of priority for completion of projects. The SSL forwards project plans to the SSR.

B. The SSR staff ensures that project plans are reviewed by the management team. The management team reviews and approves, by consensus, project plans and the order of priority. If consensus cannot be reached during the agreed-to decision period, the SSRD gives final approval and sets priorities for implementation.

C. The BOA reviews and provides alternate recommendations, as needed, to the management team regarding approval of a project plan and order of priority. The BOA communicates concerns regarding any project plan or priority to the management team.

630.16 ES Information Revisions and Updates

A. New information is acquired over time that may result in a need to revise or update ES information. This is a legitimate business need and is handled in much the same way as an initial project to identify and describe an original ES. It can apply to ES information at the provisional, approved, or correlated stage of development. Any end user or participant in ES business, both internal and external to NRCS, can identify new information or errors that result in a need for revision or update. New information can identify the need for revisions or updates to any item included in the ecological site data. Since the existing ES information is in the FOTG and in the ES database, the new information should be brought to the attention of the appropriate State resource conservationist and regional ES specialist.

B. Continuous feedback on the accuracy and usefulness of ES information is needed to meet the needs of internal and external customers. Revision efforts and manageable update projects provide consistent delivery of information to land managers regarding ESs and the impact of management and disturbance on all landscapes.

(1) If the new information is of minor extent, revised ES information will be produced. The State technical discipline specialist obtains approval from the management team by working with the SRC to coordinate the edits and move the revised ES information through the QC and QA processes.

(2) If the new information is of significant extent and fieldwork is required (e.g., identification of changes to the STM), updated ES information will be produced. The State technical discipline specialist presents the information to the technical team. The technical team then organizes a project in accordance with the guidance contained in this handbook. All other entities involved in workload planning perform their respective roles in the process as outlined. This includes QC, QA, and recertification that the ES information is accurate and meets business needs. Annual, project, and long-range plans are all impacted by update projects. Existing long-range plans should include periodic review of existing ES information to ensure that the most current scientific knowledge regarding ecological processes and disturbances is included.

(3) The State technical discipline specialist provides feedback to the original end user or participant. The feedback provides a brief summary of the results of the new information, expresses appreciation to the provider of the information, and encourages continued participation in the development of ES information.
(4) All revisions and updates of ES information should be tracked. An accurate tracking history of the reasons and concepts for needed changes, which is maintained in the ES database, allows users to more readily find, understand, and use the most current ES data. The tracking history should include a record of all decisions regarding a particular ES. Part 630, subpart G, of this handbook provides further guidance on storing ancillary data supporting ES information.
Part 630 – Procedures and Processes

Subpart C – Working Groups, Committees, Conferences, and Acquisition of ES Information Products

630.20 Purpose

Use of committees and other organized groups is important to facilitate communication and completion of ecological site (ES) information at all levels. Effective ES information development involves a variety of resources and knowledge.

630.21 Working Groups and Committees

A. General

(1) Working groups or committees are used to organize partners and a diverse array of discipline specialists involved in the development of ecological site concepts and ES information. Working groups or committees should meet regularly to discuss developments related to ecological sites, review projects (including those that cross organizational boundaries), establish project goals and objectives, monitor progress, and revise work efforts. Working group or committee membership should include specialists from various disciplines, such as soil science, ecology, agronomy, range science, forestry, and biology; specialists from various entities, such as Tribes, universities, other agencies, and nongovernment organizations; and landowners and other partners that can provide expertise.

(2) Standing committees are ongoing and generally formal and contribute regularly to the development of long-term goals and objectives for ecological site work. Technical teams are a type of standing committee. Ad hoc or informal committees or workgroups are established to address short-term and less complex ecological site work.

B. National Level

(1) The National Ecological Site Team, with the assistance of the Federal Interagency Ecological Site Workgroup, works with the Soil Science and Ecological Sciences Divisions to coordinate the technical and operational ecological site activities at the national, regional, and State levels through the use of committees as needed. Committees are also useful for activities such as coordinating training and ecological site research. Use of informal and formal committees at all levels is effective in resolving concerns, developing proposals, and making recommendations that support the development of ecological site concepts and ES information.

(2) Standing national committees include the ES Business Area Committee, Standards Committee, Research and Development Committee, and Training Committee. Standing committees will meet at least once per year. These committees are encouraged to meet to dealing with mutual topics. Other standing committees will be established as needed based on long-term goals and priorities. The Soil Science and Ecological Sciences Divisions must concur on the standing national committees.

(i) The ES Business Area Committee assesses database performance and needs and makes recommendations for database improvements.

(ii) The Standards Committee assesses ES information standards to determine whether they are adequate, need to be updated or replaced, or need additions.

(iii) The Research and Development Committee assesses needs for research and development to improve the science-based, conservation-focused ES information.

(iv) The Training Committee assesses training and training needs to ensure that the workforce is well prepared for all ecological site activities.

C. Project Level
Planning, scheduling, and coordinating at the project level through committees or similar workgroups are needed to develop and maintain quality ES information. Communication must occur on a regular basis through normal channels, such as teleconferences, emails, and face-to-face meetings. It is essential to establish formal or informal committees or workgroups to communicate and share ideas, to develop and review ecological site information products, and to ensure that the process, goals, and responsibilities for the ecological site project are clear to all interested and involved parties. These groups are useful for sharing and developing ecological site information, such as site concepts, vegetation patterns, management and disturbance responses, and management interpretations. Standing or formal committees are needed at the project level because the complex ecological systems, workload management concerns, and landowner or partner needs require long-term commitments. In many cases, the membership of the project level groups may be the same as the SSO technical team for the project, but some may be a subset of one or more SSO technical teams.

630.22 Conferences and Formal Meetings
Conferences, formal meetings, and similar avenues are excellent ways to share new technology, expand science and current information to advance ecological site work, and network with other professionals. Examples include the National Cooperative Soil Survey (NCSS) national conference, NCSS regional conferences, NCSS State conferences, professional society meetings, and similar conferences at the State, regional, and national levels.

630.23 Contracts, Purchase Orders, and Agreements
See the Title 120, General Manual, Part 401, “Agreements,” for guidance on the use and administration of contracts, purchase orders, and agreements. See part 630, subpart H, section 630.72, for an example of a statement of work.
Part 630 – Procedures and Processes

Subpart D – Working with Partners

630.30 Purpose

The premise behind ecological site (ES) identification, concept development, and ES information is that individuals with the most experience and knowledge of a particular area should be instrumental in the work. Regardless of the agency or institution involved, the goal is to empower the people best suited for the task at hand and give them the authority, responsibility, and accessibility that will result in the highest quality ecological site products.

630.31 Federal Interagency Ecological Site Workgroup

The Rangeland Interagency Ecological Site Manual was signed in 2010 by the Bureau of Land Management (BLM), Forest Service (USFS), and NRCS. This manual established policy for an interagency, interdisciplinary workgroup that recommends, develops, and supports policy and procedures for reviewing, approving, providing quality control and assurance of, and managing rangeland ecological site data. In 2013, the Interagency Ecological Site Handbook for Rangeland was signed by the three agencies and released. Although the workgroup is specifically responsible for rangeland ecological sites, it is conscious of the applicability of ecological sites in other ecosystems; thus, expansion of responsibility to include those is ongoing.

630.32 Project Management

As stated throughout part 630, subpart B, partners should be invited to participate in any part of the project planning process. When projects affect land managed by Federal or State agencies, appropriate personnel from these agencies should serve on the boards of advisors, management teams, and technical teams. If appropriate, memoranda of understanding can be used to help facilitate the communication and commitment of all concerned parties.

630.33 Working Groups, Committees, Conferences, and ES Information Product Acquisition

A. Each of the committees named in part 630, subpart C, should have representation from partners. This will help to ensure that customer needs are met, as partners commonly are more closely tied to the different customer bases. If it is determined that rotating the chairperson provides the best leadership for these committees, partners should be included in the rotation.

B. Invitations should be extended to partners for all conferences or meetings at which ecological sites will be a primary discussion. If invited, NRCS employees should also attend meetings sponsored by partners. These meetings provide an opportunity to discuss current efforts and to help minimize potential misunderstandings.

C. Partner contributions to ecological site efforts often occur as financial support. NRCS frequently enters into agreements and contracts with partner agencies and organizations. Third-party contractors are frequently also included. Due diligence to ensure that partner needs are met and that they receive a product commensurate with their financial commitment is expected. Partners should be involved in all contract reviews, if possible.
630.34 ES Information Quality Control, Quality Assurance, Correlation, and Certification

A. As stated in section 630.30 of this subpart, the goal is to empower those most qualified to conduct ecological site work and give them the necessary responsibility and accessibility to complete the work. Partners commonly are a source for individuals who are knowledgeable about a certain major land resource area or similar unit of land classification. These individuals should be sought out and used to increase the quality of ecological site information products. Partners can contribute to the collection and assimilation of data and assist in the quality control and quality assurance aspects of the workflow.

B. One way to incorporate the experience of partners is through the technical teams, which are mandatory for initial and update ecological site projects. Participation by all partners is not mandatory, but it is encouraged. The technical team leader will inform partners of meetings, initiatives, workflows, and progress as necessary. Efforts to keep the work moving forward will continue even if there is a lack of participation by partners. Another way to incorporate partners is as members of working groups or committees as discussed in part 630, subpart C.

C. Partners have the right and responsibility to certify ES information as appropriate for use within their agency or organization. A product that is adequate for all partners is the goal; however, if certain ES information meets the needs of one agency but is inadequate for another, an independent certification by that agency or multiple agencies may be completed.
Part 630 – Procedures and Processes
Subpart E – ES Information Quality Control, Quality Assurance, Correlation, and Certification

630.40 Purpose
A. Quality control (QC) and quality assurance (QA) ensure that ecological site (ES) concepts and their related information are accurate and consistent, meet the objectives outlined in the memorandum of understanding (MOU) or project plan, and satisfy the needs of the majority of ecological site information users. QC ensures the development of quality products that meet national standards. QA ensures that quality products are developed through interactive processes, such as providing technical standards and procedures, training, and guidance and collaborating with stakeholders during development.

B. QC is performed throughout the development process and on the end product. During the development process, QA addresses the consistency of the data and the people and processes involved to ensure that technical standards are met.

C. Correlation of ESs to soil map unit components establishes a relationship between an ES concept and the attributes of one or more soil components. This relationship is recorded in NASIS. It facilitates both tabular and spatial representation of ESs used to map, analyze, refine, and apply ES concepts. Accurate soil-ES correlations are critical because they allow ES developers and users to summarize the soil and physiographic information from NASIS as they relate to ES concepts. Soil-ES correlations should reflect repeatable patterns between soil properties and plant species composition, production, and disturbance response across the ecological site group, LRU, or MLRA scale. ES-soil correlations may be one-to-one or one-to-many, depending on the effects of variable soil component properties on plant community structure and ecological processes.

D. QC, QA, and correlation are essential tools for certification of ES information. These procedural checks are used throughout the implementation of an ES project.

E. Certification assures the correlated ES information is appropriate for use in conservation planning, implementation, monitoring, and assessment. Certification also assures that new ES information or significant changes to updated ES information is documented and that MOU deliverables and all project objectives are completed. Once certified by NRCS, the ES information is published in the field office technical guide (FOTG) and the ES database for public use. When certified by other partners, it will reside in appropriate locations determined by each partner.

630.41 Definitions of Quality Control and Quality Assurance
A. Quality Control (QC)
   (1) QC is the collective set of standards and procedures used to achieve a high level of accuracy. Controlling quality involves—
      (i) Coordination of activities for development of ES concepts and ES information to ensure that products meet the defined standards for content and accuracy.
      (ii) Direct review and inspection.
      (iii) Direction, consultation, and feedback.
   (2) The quality of ES information is controlled during each step of development, from fieldwork through publication.

B. Quality Assurance (QA)
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QA is the process of providing and ensuring adherence to technical standards and guidelines. QA also involves training, oversight, and review. This ensures that all products meet the specified standards and are produced using efficient and effective procedures to meet ES information production goals.

C. Correlation

The correlation process requires that ES data are collected and ES information is developed using the technical standards in this handbook. The process includes progressive correlation and final correlation.

(i) Progressive Correlation.—Progressive correlation identifies and records all the issues and decisions surrounding ES information throughout the course of a project, keeping pace with progress. Through field reviews and field assistance visits, the soil survey office (SSO), State office, and soil survey regional office (SSR) promote progressive correlation, maintain QC and QA, and ensure that technical standards are met. During each review or field assistance visit, any changes, deletions, or additions to ESs since the last review or assistance visit are evaluated and certified, if appropriate. For ESs that extend beyond the boundary defined for the project area, data and descriptions for the ESs on similar soils and landforms are considered in defining ranges for ES properties. The data are documented for the project in progress. All ES activities, including state-and-transition model (STM) development, field data collection, and interpretations development, are concurrent with the milestones and timetable in the project plan.

(ii) Final Correlation.—Final correlation is done when an ES project is near completion. If effective progressive correlation has taken place during the course of a project, the final correlation is primarily a review of the progressive correlation. The final correlation serves as a data check and identifies any work that needs to be completed prior to ES information certification.

D. Certification

Once final correlation is complete, the ES information is certified by the State and partners. ES information certification assures that MOU deliverables and/or project plan objectives are met and are appropriate for use in conservation planning, monitoring, and assessment. Once ES information is certified, it is published for public use in the FOTG (by each State using the information) and in the ES database.

630.42 Quality Control

A. Roles and Responsibilities

(1) QC is concerned with maintaining high standards of quality throughout all phases of ES information development. It is conducted during all stages and forms of data collection and interpretation, from the development of initial concepts to the completion of correlated ES information. Individuals that are responsible for conducting QC reviews should have knowledge of and experience in the identification of plant communities and their relationship to edaphic features (i.e., soils, geomorphology, and landscapes) and climatic features in the project area and in the process of developing ES concepts and ES information.

(2) Technical specialists that may be designated as QC reviewers include, but are not limited to—

   (i) SSO ecological site specialists
   (ii) State, area, and field office technical specialists
   (iii) National technology support center (NTSC) technical specialists
   (iv) Resource soil scientists

(v) Soil scientists
(vi) Technical specialists from cooperating agencies and organizations

(3) Coordination of QC at the field level is the responsibility of the SSO project leader, who may or may not be the direct supervisor of the QC reviewer. Individuals responsible for conducting QC reviews will be identified in the project plan. Periodic QC reviews will be performed by an individual other than the one identified in the project plan who is responsible for completing the task, thus ensuring an independent peer review.

B. Quality Control Reviews

(1) Each individual involved in ES activities is responsible for the quality of the work performed. The work should be done in a manner that results in ES information that meets standards. Therefore, much of the QC work is done on a day-to-day basis through direct interaction among the SSL, ES specialist, QC reviewer, and technical team members.

(2) In addition to these routine QC activities, systematic reviews are periodically conducted by the QC reviewer to document correctness of items completed, agreed-to items that need to be addressed, and any training needs. The specific details of the items to be reviewed will vary with the kind of activities being performed. As a project step is reviewed, the corresponding QC document should be signed by the QC reviewer and sent to the soil survey region ecological site specialist (SSR ESS) for a QA check, if needed.

C. Signature and Approval of Quality Control Review Reports

(1) The QC reviewer, identified in the project plan, conducts the review and is responsible for preparing and signing QC review reports and transmitting copies of the report to the SSL, SSO ESS, individual with QA responsibility, and others, as appropriate. The QC reviewer also checks the QC box, which is in the site management section of the ecological site description (ESD), in the ES database.

(2) Part 630, subpart H, section 630.73, is an ES QC review worksheet template, which should be adapted to reflect the review needs for a particular ES project. Examples of items that may be reviewed are—
   (i) Adequate resources are identified in the project plan to complete tasks.
   (ii) Proper ecological site-soil map unit component correlation is performed.
   (iii) Data methods and documentation levels and quality meet standards.
   (iv) Data analyses and interpretations are accurate.
   (v) Developed narratives and tabular information are consistent.
   (vi) Plant information is accurate and complete.
   (vii) Management interpretations are supported by data.
   (viii) All sampling data and ES information are properly entered into NASIS and the ES database.

D. Noted Deficiencies

Any issues or deficiencies in the ES information are noted as agreed-to items in the QC review report. The QC reviewer will inform the technical team and the SSL, who will provide management oversight to address the issues or deficiencies. Once all issues and deficiencies are resolved, the review process is resumed and a final QC review report is signed.

**630.43 Quality Assurance**

A. Roles and Responsibilities

(1) QA is primarily concerned with the process of providing technical standards and guidelines, oversight and review, and training to ensure that ES information meets standards. This
includes reviews to ensure adherence to policy and use of efficient, effective procedures to meet production goals. The SSR is responsible for ensuring the quality of ES concepts and ES information. The SSR ESSs perform this task under the overall leadership of the SSRDs. The SSR ESSs should have knowledge of and experience in the entire ES information development process and related policies, from identification of ES concepts to final edit, publication, and correlation of ES information. QA is performed by individuals other than those who completed QC activities.

(2) The QA reviewer is also responsible for preparing and signing all QA review reports. The SSRD signs the final reports and transmittal letters, which are then sent to the State Conservationist (STC), SSL, QC reviewer, and others, as appropriate.

B. Quality Assurance Reviews

(1) Quality assurance reviews are scheduled with regular frequency to ensure that technical standards are met, policy and procedures are being followed, and progress is consistent with the timelines and milestones identified in the project plan. Each initial ES project requires one initial QA review, at least one progress QA review, and one final QA review. Progress reviews will be conducted at least annually for multiyear projects. For update ES projects, the number and type of QA reviews will be stated in the project plan. A final QA review is required for all ES projects.

(2) Initial Reviews

(i) The purpose of the initial review is to guide the ES project at the start of the work, to review the collection and recording of ES data, and to complete preparation of draft ES concepts based on work completed and data collected to date. Part 630, subpart H, section 630.74, is a template for the “Initial Quality Assurance Review Worksheet.” This template should be adapted to a specific project or a new one should be developed for a specific project to reflect the activities to be reviewed.

(ii) Preparation, completion, and reporting of an initial QA review includes—

- **Preparation for an initial field review.** An approved ES project plan and any related MOU must be available for the initial review. The long-range plan of operation for the SSO must also be available. The project office assembles, reviews, and summarizes existing information about the MLRA and the subset project area. The technical team is in place and has worked in the area long enough to become familiar with the project area and any surrounding ESs. The project office staff prepares items such as the following for the initial QA review:
  - Approved project, annual, and long-range plans
  - List of technical team members on the project, including partners, and their primary responsibilities
  - List of available reference material
  - Available existing data or low-intensity ES characteristics data to help formulate site concepts
  - Preliminary ES concepts within the context of the MLRA
  - A first draft of the provisional ES list, such as the ES legend
  - Initial low-intensity data from sample areas for the provisional ES list
  - Field notes supporting tentative modal concepts for the ES
  - Information on geomorphology, soils, vegetation dynamics, and hydrology
  - Equipment and supply needs

- **Completion of initial QA review.** The SSR ESS assesses the following, as appropriate:
  - All initial preparations to ensure that they are adequate (takes necessary action if they are not)
  - Adequacy of project milestones, timeline, and deliverables

- Training needs for staff  
- Appropriate filing system, considering both digital and hard copies  
- Resources identified in project plan to ensure they are sufficient to complete tasks  
- Draft ES legend and inclusion of similar ESs  
- Join of soil map units and selected characteristics, in relationship to ecological sites, within the project area to adjacent map units (makes recommendations to SSL for those that are in question)  
- Provisional ES naming, identification and differentiation of ESs, and modal concepts  
- Long- and short-range activities needed for completion of the project  
- Schedule for subsequent progress field reviews and special studies, as needed

**Preparation of the report.** The SSR ESS prepares a report of the initial QA review, which includes an “Initial Quality Assurance Review Worksheet” (part 630, subpart H, section 630.74). The SSL approves the report. In addition to the worksheet, the report includes the following:

- Provisional ES legend (or list)  
- Draft descriptions of proposed ES concepts  
- Statement on accuracy of initial data and its interpretation  
- Notes recording important observations made during the field study  
- Instructions and agreed-to items for the technical team that relate to completion of the project plan, assignment of responsibilities, priorities, and dates of accomplishment  
- Transmittal letter distributing the report according to part 630, subpart E, section 630.43.E, in which the SSRD highlights significant issues and agreed-to items

(3) **Progress Reviews**

(i) These QA reviews assess progress and ensure that ES standards are met. Progress reviews emphasize progressive correlation consistent with the MLRA or LRU. Assistance may also be provided to the technical team on any issues with ES differentiation; ES concept development; state-and-transition model (STM) development; data collection, storage, and retrieval; and soil interpretation. These issues, however, generally are best addressed during a separate field assistance visit.

(ii) The frequency of progress reviews depends on the complexity of the work, rate of progress, experience of individuals working on project plan tasks, and type of ES project (initial, revision, or update) (part 630, subpart B, section 630.16).

(iii) The review is tailored to the specific type of work. The QA reviewer checks the adequacy of documentation and rate of progress for scheduled activities. If at any time assistance is needed to properly assess the project, the QA reviewer may request assistance from technical specialists through supervisors. The QA reviewer determines if actions have been taken to correct deficiencies and complete agreed-to items from previous reviews.

(iv) Part 630, subpart H, section 630.75, is a template of the “Quality Assurance Progress Review Worksheet.” This template may be adapted to reflect the activities to be reviewed for a specific project, or a new template may be developed. QA progress review activities may include, but are not limited to—

**Completion of the review.** The SSR ESS, as the QA reviewer, examines provisional ES concepts for correct ES identification and differentiation. The SSR ESS spends at least some time in the field observing examples of ES concepts and associated data to ensure that the local quality control procedures are effective. If problems are noted, the reviewer concentrates on solutions to avoid similar problems in the future. Additional checks by the QA reviewer during the course of the progress review include, but are not limited to, the following:

(190-630-H, 1st Ed., Amend. 1, March 2017)
- QC reports are current.
- Proper ecological site-soil map unit component correlation is performed.
- ES key adequately supports identification of ES concepts.
- Records for progressive correlation of ES work are complete.
- Proper methods, procedures, and protocols are used and reported for data collection.
- Data documentation levels and quality meet standards.
- Management and use of notes documenting important field observations and other data collected are adequate.
- Quality and status of ES concepts and STM development are adequate.
- Developed narratives and tabular information are consistent.
- ES naming protocols are followed.
- Field data is cross-checked with interpretations, such as forestry productivity, for completeness and accuracy.
- Rate of work and work progress are adequate.
- Plant information is complete and accurate.
- Management interpretations are supported by data.
- Progression (milestones) and completion are reported in NASIS.
- All sampling data and ES information are properly entered into NASIS and the ES database.
- Supporting data and prior site descriptions are archived properly.
- Data is correlated to other appropriate classification systems and hierarchies.
- Action has been taken to correct any deficiencies and to complete agreed-to items noted during previous field reviews.

- **Preparation of the report.** The SSR ESS prepares a report of the progress review. The report includes a “Quality Assurance Progress Review Worksheet” (part 630, subpart H, section 630.75). In addition to the worksheet, the report includes the following:
  - List of commendable activities by the technical team
  - List of agreed-to items, responsible personnel, and date scheduled for completion
  - Statement of the accuracy of field data
  - Progress map of ESs by correlated map unit components
  - Notes recording important observations made during the field studies
  - Record of additions, deletions, or other changes to the list of ESs
  - Evaluation and comments on status of scheduled actions from earlier progress reviews
  - Transmittal letter distributing the report according to part 630, subpart E, section 630.43E, in which the SSRD highlights significant issues and agreed-to items noted during previous field reviews.

(4) **Final Reviews**

(i) A final QA review is conducted when all activities included in the project plan are complete. It ensures that completed work is of acceptable quality and meets all ES standards. The review also ensures that all necessary modifications are completed before field operations end, as appropriate.

(ii) Part 630, subpart H, section 630.76, is a template of the “Final Quality Assurance Review Worksheet.” It provides an example of some important items to check before or during the final review. Prior to the final field review, most project activities are complete and the collected data are available. The activities for the review include—

- **Preparation.** The reviewer examines relevant data and interpretation information for correlation, completes draft of ES information with STM and database entries, completes any related investigations, and enters correlated ES names in NASIS and the ES database.

• **Completion of review.** The major portion of the review occurs in the office. Field checks take place if questions occur that can only be answered in the field. The activities noted for corrective action during the previous progress review receive special attention. Items to review include ES concepts and supporting information, STM and narrative, tables and associated data, and interpretations.

• **Preparation of report.** The QA reviewer prepares a report of the review. The report includes a “Final Quality Assurance Review Worksheet” (part 630, subpart H, section 630.76). It also includes the following:
  - List or legend of included ESs
  - List of correlated map unit components
  - Record of data collected in the project area
  - Evaluation of developed STMs
  - Evaluation and comments on the status of scheduled actions from any earlier progress reviews
  - List of commendable activities by the technical team
  - List of agreed-to items
  - Record of decisions made during the review
  - Preliminary correlation document, as described in part 630, subpart E, section 630.45
  - Transmittal letter distributing the report according to part 630, subpart E, section 630.43.E, in which the SSRD highlights significant issues and agreed-to items

C. Signature and Approval of Quality Assurance Review Reports

  (1) The QA reviewer is responsible for preparing and signing all QA review reports, preparing the transmittal letter, and preparing and transmitting copies of the reports according to part 630, subpart E, section 630.43.E, for review and concurrence signatures. The SSRD provides the final signature on ES QA review reports, thereby assuring that the ES project work meets the standards and specifications of this handbook. The SSR ESS also checks the QA box, in the site management section of the ESD, in the ES database.

  (2) Arrangements for managing QA review reports by participating cooperators can be documented in the MOU or project plan.

  (3) Signed reports are maintained at the SSR as part of the ES project record file.

D. Noted Deficiencies

  (1) Issues or deficiencies in the ES information are noted as agreed-to items in the QA report. The SSR ESS informs the technical team and the SSL, who provides management oversight to address the issues. When all issues or deficiencies are resolved, the review process is resumed and the QA review report is signed.

  (2) The SSR ESS must use discretion in determining which issues are significant enough to temporarily stop the review process and which can be addressed through agreement and documentation in the review report.

E. Distribution and Review of QA Review Reports

The SSR distributes QA review reports within 30 days after the final day of the review. QA review reports and attachments and a letter of transmittal are sent to the following:

  (i) SSL who is in charge of the project
  (ii) QC reviewer for the project
  (iii) Impacted STCs
  (iv) SSSs, SRCs, and others on the management team
  (v) Representatives from cooperating agencies

(vi) Others, as appropriate

630.44 Public Release of ES Information

When an ES has all the minimum information for provisional, approved, or correlated status, it should be made available to the public. It will be labeled as provisional, approved, or correlated ES information.

630.45 Correlation of ES Information

A. The correlation process includes progressive correlation, final correlation, and ongoing correlation with soil survey update work.

1. Progressive correlation identifies and records all the issues and decisions surrounding soil component and ES correlation throughout the course of a project, keeping pace with progress. Through field reviews and field assistance visits, the SSO, State, and SSR promote progressive correlation, maintain QC and QA, and ensure that technical standards are met. During each review of field visit, any changes, deletions, or additions to ES or associated soil components since the last review are evaluated. The information is documented.

2. Final correlation is done when a progressive soil survey and ES project is near completion. If effective progressive correlation has taken place during the course of the project, the final correlation is primarily a review of the progressive correlation.

3. Soil survey update work follows final correlation and is a continual effort. As ES information is revised or updated, the ES correlation to soil components should be re-evaluated. As soil survey update work is conducted to revise or update soil map units and/or components, the correlation to ES should be re-evaluated.

4. A final ES correlation document is developed and distributed after a progressive soil survey or an ES project is complete. During or after the final QA review, the SSO, State office, and SSR staffs schedule a final correlation conference, during which a correlation document is drafted. The correlation conference staff reviews the thoroughness of the progressive correlation and makes changes, such as revision of ES concepts, as needed. Changes are recorded in NASIS as correlation notes. The draft correlation document then goes to the SSRD for final correlation.

B. Roles and Responsibilities

1. Soil Survey Regional Offices
   (i) SSRD—
       • Coordinates and participates in correlation conference.
       • Completes final correlation.
       • Signs final correlation document.
       • Transmits correlated ES information, final correlation document, ES information certification sheet, and associated materials to the impacted States and partners for certification.
   (ii) SSR ESS—
       • Participates in correlation conference.
       • Prepares draft final correlation document.
       • Assists with final correlation and ES information certification sheet, as assigned.

2. State Offices
   (i) STC (or designee) participates in the correlation conference.
   (ii) SRCs and SSSs may participate in the correlation conference.
   (iii) State technical discipline specialists assist with the final ES correlation.
(3) SSO
   (i) SSL—
      • Participates in the correlation conference.
      • Ensures that all data to be reviewed has passed prior QC review.
   (ii) ES specialist or other SSO staff members—
      • Help to ensure that all data to be reviewed has passed prior QC review.
      • May participate in the correlation conference, as assigned.
(4) Partners may participate in the correlation conference, as appropriate.

C. Correlation Document

A correlation document is developed and distributed after a progressive soil survey or an ES project is completed. Part 630, subpart H, section 630.77, is an example format for this document. It includes items such as the following:

(i) Heading
(ii) Introductory paragraph
(iii) List (or legend) of ESs established
(iv) Ecological sites dropped or deactivated by correlation
(v) Associated map unit concepts
(vi) Names of cooperators and credits
(vii) Prior ES publications
(viii) Notes accompanying ES concepts
(ix) Miscellaneous items
(x) QC and QA certifications
(xi) SSRD signature

D. Final Correlation

Final correlation is done when a progressive soil survey or an ES project is near completion. If effective progressive soil correlation has taken place during the course of a project, the final correlation is primarily a review of the progressive soil correlation decisions that have been made previously. The final correlation serves as a data check and identifies work that needs to be completed prior to certification of ES information. The final correlation staff—

(i) Review and confirm ES identification and concepts, including:
   • Review and confirm ES common names and ensure that they conform to current naming convention and are consistent in the project area.
   • Review NASIS and ES database entries for accuracy, completeness, and consistency.
   • Review correlation of ES to soil components for accuracy and consistency.
   • Review draft correlation document and identify needed edits or changes.
   • Prepare and review supporting documents or information to be included in the correlation document. Items may include soil-vegetation-climate schema or models, special investigative studies, and references used throughout the course of the project.
   • Record the location of all field documentation, field maps, and other supporting material and information to be archived.
(ii) Review correlation notes in NASIS (from the correlation conference) and ensure that the reason for the notes is also recorded.
(iii) Record unique or unusual information about an ES that may be useful to future users.
(iv) Summarize and process final edits to ES information.
(v) Prepare the final correlation document.

E. Signature and Approval of Final Correlation
Part 630, subpart H, section 630.77, includes the signature template. Templates may be adapted (i.e., new headings developed) to reflect the activities to be reviewed for a specific project; however, the required signature does not change. The completed correlation document is approved and signed by the SSRD. The signed document is part of the ES record and is maintained at the SSR. The ES information is then ready for State and partner certification.

F. Correlation Document Distribution

The SSR transmits the final correlation document to the impacted SSLs, management team members (including SRCs and SSSs), STCs, and others, such as appropriate partners.

(i) The final correlation document is archived in the “ES Legend Correlation” table in NASIS.
(ii) The original hardcopy is maintained at the SSR.
(iii) Prior to certification of new ES information, the archived final correlation document can be amended for an initial project and hard copies redistributed. Amendments to the final correlation document are signed by and distributed to the same people as the original document.
(iv) Once ES information is correlated, subsequent correlation decisions are recorded in NASIS but the original correlation document is not amended.
(v) For updated ES information—
   - All changes made to ESs during correlation must be documented and recorded in NASIS. The archived correlation document, however, is not amended.
   - *In lieu* of amending and redistributing a hardcopy of the correlation document, a report that identifies all changes will be generated from NASIS. This report can be printed and distributed as the SSR deems necessary.
   - A formal correlation document may be prepared and distributed, if needed (e.g., to satisfy an agreement with a cooperator).

630.46 Certification of ES Information

A. Certification by various agencies or groups ensures that the ES information is appropriate for use. Certification also ensures that new or updated ES information is documented and that all MOU deliverables and project objectives are complete.

B. Roles and Responsibilities

The States and partners certify that the correlated ES information meets the needs for conservation planning, monitoring, and assessment. The ES information is then ready for use in conservation planning and related activities.

(i) STC (or designee)—
   - Reviews correlated ES information and correlation document.
   - Signs certification sheet.
   - Releases correlated ES information for public use by publication through the FOTG.
   - Notifies impacted parties of release.
(ii) Partners review correlated ES information and sign certification sheet, as appropriate.

C. Signatures

State conservationists (or designees) and applicable partners certify that ES information meets the needs for conservation planning, monitoring, and assessment by signing the “Certification Sheet for Correlated ES Information” (part 630, subpart H, section 630.78). This sheet and all related documents are maintained at the SSR as part of the ES project record file. State conservationists

(190-630-H, 1st Ed., Amend. 1, March 2017)
(or designees) and applicable partners also check the certification box, in the site management section of the ESD, in the ES database.

D. Publication of ES Information

Each STC notifies impacted parties of the public release of ES information and any subsequent amendments in the FOTG. Notification is done according to State-established policy for posting and distribution of FOTG material.

630.47 Deactivation of ES Information

A. The SSR deactivates established ES information as appropriate. Support information and documentation as to the reason for deactivation of ES information are entered into the ES database, including a recommendation for the disposition of the ES that has been deactivated. Before placing an ES on the deactivated list, the SSR sends a memorandum of intention and supporting documentation to all impacted State, area, and field offices. The memorandum includes the proposed reclassification to the appropriate ESs as described by NRCS or its cooperators. The SSR notifies other disciplines and cooperators who may use the ES information. The SSR allows 45 days for filing of objections to the recommendation. If deficiencies are the reason for deactivation, the SSR notifies impacted regions and works with local technical and management teams to determine if noted deficiencies should be addressed.

B. Deactivation is achieved when the SSR checks the appropriate box in the ES database, after waiting 45 days and making all efforts to mitigate the issues. Deactivated ESs are listed in the ES classification file, and deactivated ES information is stored in a permanent archive file at the SSR.
Part 630 – Procedures and Processes

Subpart F – Knowledge, Skills, and Abilities for Ecological Site Quality Control

630.50 Purpose

All NRCS employees and partners with quality control (QC) responsibilities for development of ecological site (ES) concepts and descriptions must possess specific knowledge, skills, and abilities. This standard establishes the minimum criteria to be met by NRCS employees and partners to perform quality control for ES data. The following knowledge, skills, and abilities should be integrated into position descriptions, job announcements, and training plans.

630.51 Knowledge, Skills, and Abilities

A. All individuals providing QC for development, revision, and update of ES concepts and descriptions shall be approved by the soil survey region (SSR) for the major land resource area (MLRA) in which the QC is to be conducted. This policy may be supplemented, as needed, to provide specific guidance; to comply with State, Tribal, and local laws and regulations; and to establish additional levels of certification and criteria as needed for the scope and complexity of ES work in a specific MLRA or other identified area.

B. To be approved, individuals performing QC must—

(1) Have demonstrated knowledge of NRCS policy and procedures, including the NRCS National Ecological Site Handbook.

(2) Possess the necessary skills, training, and experience to develop ES concepts, including literature search and review, expert knowledge acquisition, existing data search, and evaluation of quality and sufficiency of information.

(3) Have demonstrated skill in soil science, geomorphology, and vegetation ecology to gather and analyze data used to formulate ES concepts.

(4) Have demonstrated skill in development of state-and-transition model concepts and working with groups of local experts. This includes local knowledge of historic and current disturbance regimes. Individuals shall have demonstrated an understanding of conservation or restoration methods and success in conservation or restoration efforts in the MLRA.

(5) Have demonstrated skill in developing data sampling strategies. This includes identifying gaps in available data and needed data collection to address deficiencies. The individuals must have demonstrated the ability to design data collection plans using the appropriate sampling design, methods, and protocols to meet required needs.

(6) Have demonstrated knowledge of differentiating ecological sites using data analysis and expert knowledge. This includes identifying differentiating characteristics of ecological sites and working assumptions and hypotheses for abiotic-vegetation correlations.

(7) Have demonstrated ability in the development of management interpretations relative to ecological sites, using literature and expert knowledge.

(8) Have demonstrated a working knowledge of corporate databases.

(9) Have demonstrated an ability to communicate in writing. This includes editing documents to improve clarity of thought and concept.

C. Criteria 1 through 9 are also excellent qualifications for all personnel working on an ES project.

630.52 Roles and Responsibilities
A. The SSR, in collaboration with State Conservationists and other supervisors, will establish and implement a process to ensure training is provided to employees. This includes the following:

1. Identification of training needs and provision of access to training for employees conducting QC on ecological site information.
2. Development of a specific list of qualifications (knowledge, skills, and abilities) required for QC duties. These qualifications include those listed in section 630.51.B and may include others important within the region.
3. Assurance that all individuals providing QC for development and/or revision of ES information meet the minimum NRCS requirements.
4. Establishment and maintenance of a list of NRCS-certified QC persons in the States and MLRAs, consisting of NRCS employees, volunteers, employees of cooperating agencies, contractors, and other partners involved in ES information development and/or revision. The list will designate the specific MLRAs for which each person is certified.
5. Training provided through NRCS training courses, on-the-job training, professional society activities, and equivalent courses and methods recommended by the specialists’ training committee to meet the identified training need.
6. Recommendations regarding non-NRCS sources for potential QC reviewers that are in accordance with NRCS certification requirements.

B. All employees whose duties include assistance in the development of ES concepts and descriptions are encouraged to obtain and maintain QC knowledge, skills, and abilities by—

1. Ensuring that their position description, employee development plan, and performance work plan reflect these requirements.
2. Maintaining and updating individual development plans to reflect training needed to maintain or increase skill level. Training should be ongoing and timely.

C. For all non-NRCS individuals providing QC for the development and/or revision of ES information, training needs will be assessed and development plans designed to meet identified needs. Employees of soil and water conservation districts, volunteers, employees of other Federal agencies and State agencies, technical service providers, and employees of other partners who provide QC assistance should meet the knowledge, skills, and abilities requirements.
Part 630 – Procedures and Processes

Subpart G – Data Management

630.60 Purpose

A. Reserved – pending migration of ecological site information to a new corporate database.
B. Vegetation data are in the National Soil Information System (NASIS), in which data records can be entered, edited, and retrieved (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/tools/).

630.61 Responsibilities

Ecological site information is maintained in the NRCS corporate data systems designed for such purposes. It is the responsibility of NRCS to provide these systems, whether development and maintenance is conducted by NRCS employees or contracted with a separate entity. It is the responsibility of NRCS employees to use the corporate data systems. Other data systems may be developed and maintained by partners, States, or individuals, but data stored in these systems may or may not be suitable for integration into the corporate data systems.

630.62 Ancillary Data Storage Plan

The official storage site for all ancillary data pertaining to ecological site (ES) information is the soil survey office (SSO). Working copies may be maintained at the soil survey regional office (SSR), but the data will be transferred to the SSO and become part of the official record when it is approved. Likewise, State specialists and others may maintain working copies and then transfer the data to the official record at the SSO when it is approved. The SSO may establish “read-only” files that can be accessed by technical specialists for ecological site description (ESD) development.

1) Digital Storage

All ES information should be kept on a separate external hard drive with a large memory capacity because of current limitations in agency information technology. Most workstation computer hard drives do not have sufficient memory to handle the number of photographs and amount of documentation required to conduct ES work. An external hard drive suitable for ES work should be used in these cases. A backup copy should also be maintained at an offsite location. The digital file structure must always be the same, whether an external hard drive or an internal computer hard drive is used.

- The following guidelines must be used for naming files. An underscore will be used to indicate a space. For example, “Ecological Sites” must be “Ecological_Sites” as the folder or file name. This is important because some databases do not satisfactorily handle spaces in folder and file names. **Bold** characters are used for the folder and file names. This structure is recommended to ensure that anyone at any time can locate and recognize all information filed for a completed ES project.

- The filing structure should be consistent throughout all offices within an SSR. Two examples of such filing structures are shown in part 630, subpart H, section 630.79. If an office desires a filing structure that is different from the one recommended by the SSR, it must be described in detail in writing. It must then be made available to all individuals who may need to access the files or data and to a State office and SSR contact who has ES responsibility. This ensures that all affected parties have accessibility to all stored data.

2) Hardcopy Storage

(190-630-H, 1st Ed., Amend. 1, March 2017)
(i) A hardcopy, or paper, storage system should follow the same guidelines as those used for digital information. Modification of the filing structure should follow the guidance given for modification of digital filing structures.

(ii) Commonly, a hardcopy file of ES information is desired, particularly for use in the field or during a review. A six-part folder is suggested for easy, consistent organization. Suggested contents of the folder include the following:

- Part 1.—Maps, official series descriptions (representative soils), photographs, correlation documents
- Part 2.—Field and technician notes, correspondence
- Part 3.—Old ecological, range, forest, and pasture site descriptions
- Part 4.—Draft ESD, draft S&T diagram, site concept records, rangeland health matrices
- Part 5.—Technical data, such as transect data sheets, RANGE-417, and WOOD-5, etc.; cited literature
- Part 6.—Administrative records, project plans, QC and QA reports, location of digital data storage
Part 630 – Procedures and Processes

Subpart H – Exhibits
### 630.70 National ES Project Milestones

<table>
<thead>
<tr>
<th>No.</th>
<th>Ecological site milestone name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ES – Existing Information Located and Evaluated</td>
<td>Identify existing data and/or ES information within the MLRA, including ES data from partners (non-NRCS) and any ecological unit classifications (e.g., subsections [USFS]). Group existing sites by MLRA, LRU, or other appropriate spatial hierarchy. Review current soil maps, and verify GIS layers or develop GIS product as appropriate. Perform initial literature search, and identify legacy data (including land use history and historical documentation).</td>
</tr>
<tr>
<td>2</td>
<td>ES – Initial QA Review and Assistance Completed</td>
<td>Initial QA review by SSR ESS completed. Review to include personnel resources, training needs, project plan contents, and development and use of technical team. Assist technical team with evaluation of existing ES information for overlapping concepts, duplication among states, physiographic extent, and lack of soil-ES correlation.</td>
</tr>
<tr>
<td>3</td>
<td>ES – Low-Intensity Data Collection Completed</td>
<td>Low-intensity traverses focus on rapid characterization of plant communities and associated environmental settings to formulate ES concepts. If low-intensity data collection is in project plan, it should include GPS coordinates, photographs, verification of soils, identification of plants, ocular estimation of plant cover and/or production, and field notes.</td>
</tr>
<tr>
<td>4</td>
<td>ES – Draft Site Concepts and Initial State-and-Transition Model (STM) Developed</td>
<td>Use identified climatic, soil, physiographic, and hydrologic features. Use available land type subsection and association maps, draft list of soil map unit components, and sort or group soils. Consider all current and available data related to the ecological site. Involve interested local, State, and Federal partners and technical team members to establish a local workgroup for development of draft ES concepts and model.</td>
</tr>
<tr>
<td>5</td>
<td>ES – Provisional ESs Identified</td>
<td>Identify provisional ESs using draft site concepts, STMs, and narratives. ES concepts, STMs, and narratives will include disturbance regimes, effects of management on ecological processes, and community pathways, transitions, and thresholds. Ecological site name and number are developed for each provisional ES. Reviews for quality control (initial/progress) and quality assurance must be completed.</td>
</tr>
<tr>
<td>6</td>
<td>ES – Site Key Developed</td>
<td>Develop draft ecological site key for MLRA or LRU. Use site characteristics matrix to develop key.</td>
</tr>
</tbody>
</table>
7. ES – Medium-Intensity Data Collection Completed

Medium-intensity data collection is intended to be rapid, focusing on sampling environmental range of draft ES concepts. According to the project plan, it should include gathering qualitative and quantitative data, identifying plants, verifying soils, photographing sites, recording GPS coordinates, recording field notes, testing ES concepts and site keys in field for ranges of variability, and refining geographic/ecological extent of ESs.

8. ES – Data Analyzed, Managed, and Correlated

Maintain and manage all data (hardcopy and electronic) throughout process, perform statistical analysis of field data as appropriate, record and store metadata; standardize soil and vegetation data across political boundaries, and populate all applicable fields in the ES database.

9. ES – QA Progress Review Completed

Progress review by the SSR ESS should include review of training, data collection protocols, tabular and spatial data, STM narrative and diagram, and record/database management. It should also include consultation with the SSR.

10. ES – High-Intensity Data Collection Completed

High-intensity sampling provides additional detailed information on a few modal sites that represent the ES concept. High-intensity data are collected according to the project plan requirements. Intensive soil characterizations are combined with high-intensity measurements of vegetation.

11. ES – State-and-Transition Model Completed

Complete final state-and-transition model (including diagram and narrative) using literature reviews, knowledge from local experts, and collected data. Test and verify STM through field data collection.

12. ES – Plant Composition Lists Completed

Complete or update and verify plant species composition and structure for each community phase in the reference state (optional for others).

13. ES – ES Interpretations Completed

Develop or update narratives, including information on conservation management for grazing, wildlife, forests, recreation, and restoration as identified in the project plan.

14. ES – QC Review Completed

Quality control review of ESI tabular and spatial data, ES narrative, and STM narrative and diagram by staff identified in project plan. Document comments, findings, and agreed-to items.

15. ES – Final Quality Assurance Review Completed

Final quality assurance review for adherence to ES standards performed by SSR ESS.
<table>
<thead>
<tr>
<th></th>
<th>ES – Approved ES Information</th>
<th>Approved ES information completed according to standards, which include quality control review, at least one quality assurance progress review, and appropriate signatures. May be published in ES database and FOTG for interim public use.</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>ES – Correlated ES Information</td>
<td>Final correlation document signed by SSRD. Product is ready for certification by State and partners.</td>
</tr>
<tr>
<td>18</td>
<td>ES – Certified ES Information</td>
<td>Correlated ES information signed by STC and partners and ready for use in conservation planning, implementation, monitoring, and assessment. Published in ES database and FOTG.</td>
</tr>
</tbody>
</table>

(190-630-H, 1st Ed., Amend. 1, March 2017)
630.71 Ecological Site Project Plan—Example

ES – MLRA – 123A – Anywhere Mountains and Plateau ESD Project Plan

A. Contact/Address: Jane Smith, SSO leader and address  Date: 06/10/12

B. Justification: Why should this proposed project be approved?

Completion of this ES project will provide information about conservation management options in an area with deficiencies in the understanding of best practices. It will also provide prototype ES information for use in similar areas. The completed ES information will improve FOTG standards pertaining to seeding, wildlife management, and restoration. The ES information will aid in the implementation of Farm Bill conservation programs focused on forestry, grassland, and management and restoration of declining habitats.

C. Priority Recommendation: How important is this project?

High. This project addresses ecosystem processes and management in a currently underserved area that is of interest to agency partners, including the Forest Service and National Park Service.

D. Project Objectives: What are the main tasks to be accomplished?

The objectives include—

- Defining ESs within MLRA 123 based on similar physiographic and soil properties that support similar kinds and amounts of plants and have similar responses to management actions and natural factors, such as drought and other disturbances.
- Developing ES information for the most common ESs within the project area.
- Providing a foundation for conservation planning and land management decisions that achieve desired future conditions.
- Serving private and public land managers by collaborating with identified partners within the project area.

E. Project Area: Where is the project located? What is the areal extent?

Anywhere Mountains and Plateau ES Information Project, MLRA 123 Anywhere Mountains and Plateau. Approximately 10,000 acres.

F. Project Personnel: Technical team responsible for completing the project

List name, title, and/or agency, and contact information.

- Jane Smith, SSL (team lead), email
- Dave Jones, SSO ESS, email
- Mitch Adams, resource conservationist, email
- Chuck Green, area forester, phone number
- Stacy Williams, area resource soil scientist, email
- Kathy Sanchez, State rangeland management specialist (QC reviewer), email
- Bob Johnson, Forest Service, phone number
- Greg Redding, National Park Service, email

G. Milestones: Table of key tasks, responsible person, and due date

Milestones are recorded in NASIS as well as in the project plan. Each milestone is unique. Progress can be reported on each task or subtask in NASIS.
## Milestones

<table>
<thead>
<tr>
<th><strong>Milestones</strong></th>
<th><strong>Description</strong></th>
<th><strong>Responsible individual</strong></th>
<th><strong>Start date</strong></th>
<th><strong>Completion date</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>ES – Locate and Evaluate Existing Information</td>
<td>Identify existing data and/or ES information within the MLRA or LRU. Perform literature and historical data search.</td>
<td>Dave Jones, SSO ESS</td>
<td>11/1/12</td>
<td>1/30/13</td>
</tr>
<tr>
<td>ES – Initial QA Review and Assistance</td>
<td>Review by SSR ESS to include personnel resources, training needs, and project plan contents.</td>
<td>SSR ESS &amp; Jane Smith, SSL</td>
<td>12/15/12</td>
<td>3/15/13</td>
</tr>
<tr>
<td>ES – Develop Draft Site Concepts and Initial State-and-Transition Model</td>
<td>Consider all current and available data related to the ecological site. Involve interested partners and the technical team in establishing concepts and STM workshop. Coordinate development of site characteristics matrix and appropriate site name.</td>
<td>Dave Jones, SSO ESS</td>
<td>2/1/13</td>
<td>6/30/13</td>
</tr>
<tr>
<td>ES – Complete Medium-Intensity Data Collection</td>
<td>Include qualitative and quantitative data collection, plant identification, additional soil verification, photographs, and record of GPS coordinates.</td>
<td>Chuck Green, area forester</td>
<td>3/1/13</td>
<td>2/30/14</td>
</tr>
<tr>
<td>ES – Analyze, Manage, and Correlate Data</td>
<td>Maintain and manage all data (hard and electronic copies) throughout process, perform statistical analysis on field data as appropriate, and record and store metadata.</td>
<td>Dave Jones, SSO ESS</td>
<td>Ongoing, check at each progress review</td>
<td></td>
</tr>
<tr>
<td>ES – Perform QC Review</td>
<td>Quality control review by person identified in project plan. Review ESI tabular and spatial data, ES narrative, and STM narrative and diagram. Document comments, findings, and agreed-to items.</td>
<td>Kathy Sanchez, State rangeland management specialist</td>
<td>Ongoing, check at each progress review</td>
<td></td>
</tr>
</tbody>
</table>

### Optional Attachments

Examples include project area map, soil maps, draft ecological site concepts, vegetation maps, climate maps, legacy plants inventory data, and training, support, and equipment needs.
630.72 Statement of Work for ES Deliverables—Example

STATEMENT OF WORK
Ecological Site Information

PURPOSE
The purpose of this contract is to acquire high-quality ecological site information and supporting
information in association with NRCS soil survey project work in selected areas of non-Federal land
and selected areas of Federal land administered by the United States Department of the Interior,
National Park Service (NPS) and Bureau of Land Management (BLM), throughout California.

BACKGROUND
Public Law 74-46, 49 Stat. 163 (16 U.S.C. Section 590 a-f) and Public Law 89-560, 80 Stat. 706 (42
U.S.C. Section 3271-3274) authorize NRCS to conduct soil surveys and investigations and ES
information development on non-Federal land and to enter into agreements with other governmental
agencies to conduct surveys on Federal land. 16 U.S.C. Section 460l-1(g) authorizes NPS to obtain
from other Federal agencies information, data, reports, advice, and assistance needed to ensure the
existence of adequate outdoor recreation resources in the present and future. 31 U.S.C. Section 1535
and 48 CFR Section 17.503 authorize the BLM to provide payment to NRCS for actual costs of
obtaining soil survey and ES information on BLM-administered land.

The United States Department of Agriculture’s Natural Resources Conservation Service (NRCS) is
conducting National Cooperative Soil Survey (NCSS) and related ES inventory work throughout non-
Federal land in California and in selected areas of NPS- and BLM-administered land under terms of
interagency agreements between NRCS and those Federal agencies. In addition to conducting soil survey
mapping and data development, the soil survey efforts include (a) collecting rangeland and forestland
vegetation data, (b) producing ecological site descriptions that will be included in the soil survey
publications, and (c) collecting other interpretive and educational information on the soils and plant
communities.

NRCS staffs are carrying out extensive ecological site description fieldwork and database development
required for soil survey and field office conservation planning, but they lack adequate personnel time to
complete all aspects of collecting data and writing descriptions for selected areas.

PERFORMANCE
The development of ecological site descriptions is an involved technical process. It requires technical
knowledge of rangeland ecology and plant dynamics, forestry ecology and plant dynamics, soil and plant
interactions, plant identification and physiology, technical writing skills, field data collection, and the
physical dexterity for long days of hiking and camping in the field. It requires the skills of a rangeland
ecologist and forestland ecologist and an understanding of the mapping procedures and development of soil
surveys according to the National Cooperative Soil Survey. Furthermore, previous experience selecting
proper ecological sites and collecting data to support these sites is required to ensure the development of
the high-quality finished products desired by NRCS and NPS.

The contractor will participate in the preparation of ecological site descriptions, in full or part, in the
following possible project areas:

- Joshua Tree National Park Soil Survey (CA794)
The work consists of (a) literature review and initial draft of ES legend; (b) field visits for reconnaissance and training, consultation, and support; (c) field visits for ecological site selection and data collection; and (d) preparation of high-quality final draft ecological site information, including entry of data into databases. The resulting products will be in the ES database, the NASIS database, and soil survey reports. The ecological site information may also be extrapolated to areas of California that have not yet had ecological sites developed, which will assist NRCS field office staff in conservation planning for those areas. Ecological sites will be correlated to the ongoing soil survey. During the performance period, the contractor must provide a written draft of ES concepts, trip reports, data sheets, field notes, accompanying photographs, and final draft ES information with data entered into the ES database and NASIS.

A. Literature Review, Field Reconnaissance, and Initial Draft ES Legend (~5% of Total Effort)

The contractor must assemble existing resource inventory data, professional scientific literature, data from cooperating agencies and organizations, and data from personal knowledge and experience. A bibliography must be developed for this information. The contractor must analyze the information gained, travel to the survey areas to participate in field reconnaissance as appropriate, and synthesize the information into an initial draft ecological site descriptive legends to serve as a framework to assist in subsequent ES fieldwork and soil-site correlation.

The initial draft ES descriptive legends are to include—

1. Written concept ecological site information for expected sites derived from the literature review that include the following information, at a minimum:
   - Draft ES name (“placeholder”) using major plants or community names in title
   - Major species dominance
   - Parent material and landform differentiation, aspect dominance, and general slope range
   - Initial reference materials

2. Alphabetical identification legend of concept ESs

B. Field Visits for Ecological Site Selection and Data Collection (~40% of Total Effort)

Site selection and data collection consists of, but is not limited to, hiking with the soil scientists to locate soil map units on a regular basis, understanding soil mapping concepts, understanding soil and vegetation correlation procedures in order to correctly identify the proper boundaries for each ecological site and what ecological processes have occurred and are occurring to create and maintain that site, using GPS units to locate representative sites, and conducting data collection procedures (on at least three reference site locations) to gather vegetation information on annual production, frequency, canopy cover, and site index of tree species.

The contractor must deliver completed data collection forms, field notes, photographs, and all GPS locations and GIS shapefiles in hardcopy and digital formats. The contractor must also deliver an electronic copy of Access database files that include field data collection information.

**Data Collection Methods.**—Specifications of the work to be accomplished must meet NRCS standards. Ecological site development involves fieldwork and manuscript development. The fieldwork involves observations, investigations, and harvesting of some data on annual production of vegetation.

1. NRCS methods for rangeland ESs include line-point intercept and ground cover, production, and rangeland health.

   Line-point intercept is a rapid, accurate method for quantifying soil cover, including vegetation, litter, rocks, and biotic crusts. The measurements are related to wind and water erosion, water infiltration, and the ability of the site to resist and recover from degradation (Monitoring Manual, Volume I).
Title 190 – National Ecological Site Handbook

- Point-intercept data includes basal and canopy cover of live vegetation, gravel (<7.6 cm), cobbles, stones, boulders, bedrock, litter, bare ground, and cryptogamic crusts.
- Observers must collect point-intercept data along a 400-foot transect line, at 5-foot intervals, and totaling 80 ground cover points at each transect location.

Production and composition of a plant community are determined by estimating, by harvesting total annual forage production, or by estimating and harvesting (double sampling).

Rangeland health is useful in determining indicator values and degree of departure from the reference state on the ecological site for future rangeland health assessments. Observations are made in accordance with *Interpreting Indicators of Rangeland Health*; M. Pellant, P. Shaver, and J.E. Herrick; 2005; Bureau of Land Management TR 1734-6; 121pp.

2. NRCS methods for forestland ESs include zigzag transects, prism transects, fixed plot transects, and photo documentation.

In most cases, either the zigzag or prism method will be used to assess basal area and site index. Tree cores will be taken on some trees in areas where site differentiation can only be made based on the proper site index.

a. **Zigzag Transect Method.**—A common inventory procedure used by NRCS to do a simple and rapid forestland inventory. Information collected includes the following:
   - Average tree diameter
   - Range of tree diameter
   - Stocking rates (trees per acre)
   - Stand composition
   - Stand condition (health)

b. **Fixed Plot Sampling.**—A set of plots, generally all the same size, is located throughout the area. The sample plots can be located throughout the area in a number of ways. The most common method is to locate the plots at predetermined intervals on lines a set distance apart. Plots can be any shape, but circular plots are most common. The size and number of plots determine the percentage of the area sampled.

c. **Variable Plot Sampling – Prism Transects.**—Many features of variable plot sampling (sometimes referred to as “point sampling”) and fixed plot sampling are similar. The number and location of plot centers are determined in the same manner. Tree measurements (diameter, height, defects, etc.) are also measured or estimated by similar methods. The primary difference in these two sampling methods is that variable plot sampling does not require measurement of the plot radius because each tree has its own plot size dependent on the diameter of the tree. At each plot center, or “sample point,” a count is made of the number of “in” trees that are large enough in diameter to subtend the fixed angle of the angle gauge or prism.

*Photographs.*—High-quality digital photographs must be taken of each of the ecological sites that are developed, including photographs of the data transect locations, key features that define the ecological site, and a landscape view of the site. These photographs will be included in the ES information in the ES database and in the summary descriptions included in the soil survey publications. The contractor must provide a minimum of two transect photographs and four or five additional photographs at each ecological site to illustrate the key features that define the site. The selected finished photographs must be high-quality images that can be used in soil survey publications. Closeup photographs of the transect must include the site identification information (site ID, compass direction of the transect, and date) and must be taken looking directly down at the soil surface from a height of approximately 5 feet above the ground so that the ground cover is included. Down-transect photographs must also include the site identification information.

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information and be taken from a height of approximately 5 feet above the ground. These photographs should be taken in the direction the transect is running and should include as much of the surrounding vegetation as possible. Additional photographs should capture any site variability and key features, such as dominant plant species and indicative landforms.

C. Field Visits for Training, Consultation, and Quality Control and Quality Assurance Support (~5% of Total Effort)

The contractor must travel to the survey areas to work with NRCS plant and soil scientists and in cooperation and collaboration with NPS vegetation specialists, as appropriate, to orient to the area, identify plants and plant communities, and confirm and revise draft concept ES information. The contractor must also provide field assistance and training to plant and soil scientists assigned as soil survey area staff on the development of soil and ecological site mapping concepts; spatial distribution of ecological sites based on soil, climate, and landscape features with an understanding of and the ability to describe the plant community dynamics on each ecological site; and design of soil map units. The contractor must provide a trip report following each field visit that summarizes the agenda, activities, discussions, and recommendations.

D. Final Draft Ecological Site Information, Including Database Requirements (~50% of Total Effort)

The contractor must describe and record ecological site information at each ecological site. The NRCS State rangeland ecologist must concur with this ecological site information before it is approved and accepted.

1. The contractor must provide written draft ecological site information for all sites identified. The process includes acquiring and assembling all literature reviews, plot data, soil and ecological site correlation data, digital photographs, and type location coordinates (in accordance with the National Ecological Site Handbook and the Monitoring Manual for Grasslands, Shrublands, and Savannahs). The contractor will use this data (including conducting additional literature reviews, if needed, beyond those conducted during performance element A), personal and professional knowledge of these ecosystems, and knowledge of the NRCS State rangeland ecologist, soil scientists, and NPS vegetation specialists, as appropriate, to write specific portions of the ecological site descriptions (refer to Field Book for Describing and Sampling Soils).

2. Information must be entered into the ES database. Narrative information must be prepared using Microsoft Word and submitted to the State rangeland ecologist for review and approval prior to entry into the ES database. The contractor must pay careful attention to ensure use of proper grammar, punctuation, and spelling and use of proper vegetation names. The following information must be completed in the ES database for each site:
   a. Ecological site name (provided by NRCS; contractor to enter on template)
   b. Ecological site number (provided by NRCS; contractor to enter on template)
   c. Major land resource area (provided by NRCS; contractor to enter on template)
   d. Physiographic features narrative statement and the following features:
      • Landforms on which the site occurs (list up to three dominant landforms)
      • Elevation ranges of the site (feet)
      • Slope ranges of the site (percent)
      • Depth to water table (inches)
      • Flooding frequency and duration
      • Ponding depth (inches), frequency, and duration
      • Runoff class
• Aspect (in areas where aspect influences expression of plant community, including species composition, and/or production)

e. Climatic features:
  • Frost-free period (number of days temperature is above 32 degrees F)
  • Freeze-free period (number of days temperature is above 28 degrees F)
  • Mean annual precipitation range (inches)

f. Influencing water features narrative (if applicable), including wetland description (Cowarding classification) and stream types (Rosgen system)

g. Representative soil features narrative and the following features:
  • Dominant parent material (kind and origin)
  • Surface texture (up to 3 dominant soil surface textures for each site)
  • Surface texture modifier (up to 3 dominant modifiers for each site)
  • Subsurface texture group
  • Surface fragments (≤3” diameter; record as % cover)
  • Surface fragments (>3” diameter; record as % cover)
  • Subsurface fragments (≤3” diameter; record as % volume)
  • Subsurface fragments (>3” diameter; record as % volume)
  • Drainage class
  • Permeability class
  • Soil depth (inches)

h. Plant community narrative and data:
  • Ecological dynamics of the site (narrative of the dynamics of the site, combining all plant communities in the reference state). Describe interrelationships among the plant communities and natural events, such as fire (frequency, intensity), erosional processes, flooding events, and insects and pollinators, if known or documented. Cite all literature sources parenthetically within the narrative and list full citations in the “Supporting Information; References” section of the site description.
  • State-and-transition model diagram that includes narratives for each of the plant communities, transitional pathways, and thresholds.
  • Plant community description narratives for each of the plant communities identified in the reference state. In all cases, the desired “interpretive plant community” will be the reference state. If there is no data available for the reference state, describe the naturalized plant communities that occupy the site. The naturalized plant community that is most similar to the reference state becomes the “interpretive plant community.” Describe the relationship of each plant community to the associated plant communities in the model. Describe the transitions and any thresholds that may be crossed, including appropriate management strategies needed to transition from one state or plant community to another. Quantify the information to the extent possible (using literature citations and long-term personal and professional knowledge). For example, if natural fire plays a role in the reference state (or other plant communities identified), indicate the natural fire frequencies and intensities, the fuel loads required, and how fire has controlled the presence or absence of certain species. It is inappropriate to indicate a threshold or transitional pathway without fully describing it. To the extent that actual data exists, each plant community described in the state-and-transition model must be further described in the following tables within the ecological site information. If data for other plant communities does not exist, the tables will be populated only for the “interpretive plant community.”
• Plant species composition by lifeform, including the following:
  o Common names
  o Scientific names (using the most current taxonomy in the USDA PLANTS database)
  o Plant group number (list provided by NRCS upon award of contract)
  o Range of allowable production (lbs/acre) for the plant group
  o Range of total annual production (lbs/acre) for the species
  o “Structure” and “Cover” tables completed for soil surface cover and ground cover
  o “Structure of Canopy Cover” table completed (by lifeform)
  o “Annual Production by Plant Type” table completed (by lifeform)

• Ecological site interpretations section to be completed, including the following (if information is readily accessible or easily obtainable):
  o Animal Community.—This section typically contains a narrative description of how domestic livestock grazing management strategies affect the plant communities described and contains wildlife habitat interpretations.
  o Hydrology Functions.—Include a narrative statement of hydrologic interpretations for the site, if any.
  o Other Products.—Include narratives describing other products or values provided by the site. Noxious weed statements, Native American uses of the site, specific plant species, etc., may be discussed.
  o Other Information.—Include information specific to the ecological process of the site. Also include information on rangeland health indicators, if known. (Refer to Interpreting Indicators of Rangeland Health, version 4)

• Supporting information section, including the following:
  o Associated Sites.—List the ecological sites (names and site ID numbers) that are geographically associated with the site being described. Include a brief narrative describing the associative relationship.
  o Similar Sites.—List the ecological sites (names and site ID numbers) that are similar to, and could be confused with, the site being described. Include a brief narrative describing the similarity relationship and how to distinguish one site from the other.
  o Completed “Inventory Data References” table
  o Type Locality.—If using UTM coordinates, the datum must be specified.
  o Other References.—List all literature cited and literature sources that have not been cited for the ecological site but contain pertinent information on the vegetation community, soils, landscape, etc., of the ecological site. The template contains an example of the proper format for citations.

3. Vegetation information correlated to soil map unit components must be entered into the NASIS database. The soil scientists involved in the soil survey projects will have final review and approval authority for the sections of the NASIS database that the contractor populates. The contractor must populate the following tables at a minimum (however, the soil survey staff may request the contractor to populate other tables):
   a. Component Existing Plants
   b. Component Forest Productivity
   c. Component Canopy Cover
   d. Component Ecological Sites
   e. Annual Production Ranges (lbs/acre) for each soil map unit

4. Draft narrative range and forestry general sections for the soil survey manuscript must be prepared by the contractor for selected projects if these sections are specified as “deliverables.”

5. The contractor must provide a Microsoft Word document that contains summaries of the ecological

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sites. These summaries will be included in the soil survey manuscript for selected projects if they are specified as “deliverables.” This document will summarize the key components that distinguish each ecological site. High-quality photographs for each ecological site must be submitted with this document.

6. The contractor must respond to queries and requests for edits to the draft ES writeups and database entries following quality assurance reviews by the NRCS State rangeland ecologist and State forester. These State employees have final approval authority for ES information. The contractor will respond to queries, incorporate requested edits, and deliver final ES information in a timely manner.

**SPECIAL REQUIREMENTS**

1. **KNOWLEDGE**

   Knowledge of plant community dynamics and soil and ecological site interactions to provide the proper assistance to soil survey activities in major land resource areas (MLRAs) 30 and 31 for the development of soil and ecological site mapping concepts and understanding of the spatial distribution of ecological sites based on soil, climate, and landscape features and state-and-transition theory that will result in the completion of written ecological site information.

   Knowledge of soil science and soil survey and mapping procedures to interpret specific soil mapping concepts for locating representative areas and conducting resource inventories, to plot vegetation transect locations on maps or photographs, and to determine ecological site boundaries.

   Knowledge of the ES database and NASIS, which store and manage resource inventory data.

   Knowledge of computers and software to store and manage digital photographic images and download files and programs using the Internet, and knowledge of word processing and spreadsheet software.

2. **EQUIPMENT**

   NRCS will provide standard equipment for ESD field data collection. NRCS will enable permissions and passwords to access the ES database and NASIS. Contractor must provide computer with capacity to handle the required use of the ES database and NASIS, large datasets, and photographs of each site. Contractor must provide digital camera. Contractor must provide vehicle for traveling to field sites (four-wheel drive not required, but pickup highly desirable for ground clearance).

3. **TECHNICAL EXPERIENCE**

   California plant identification (especially specific to habitats within Joshua Tree National Park) and rangeland and forestland resource inventory using NRCS methods to gather necessary vegetation and related data for describing ecological sites. Experience in collecting data and selecting sites for development of ecological site descriptions and previous experience in writing site descriptions to ensure high-quality finished products.

4. **ABILITIES**

   Not a personal services agreement. Personnel must be able to detect and correct minor data discrepancies independently.
**CONTRACT ADMINISTRATION**

**NRCS CONTRACTING REPRESENTATIVES**

Contracting officer:  Ray Miller  
Address:  USDA-NRCS, 430 G Street, Davis, CA 95616  
Telephone number:  530-792-5679    Fax number:  530-792-5731  

Technical representatives:  Kendra Moseley, State rangeland ecologist  
                         David W. Smith, State soil scientist  
Address:  USDA-NRCS, 430 G Street, Davis, CA 95616  
Telephone number (K. Moseley):  530-792-5632    Fax number:  530-792-5793  
Telephone number (D. Smith):  530-792-5640    Fax number:  530-792-5794  

Consultations in writing or by telephone with the technical representatives are encouraged to ensure uninterrupted workflow. The contracting officer (CO) is responsible for administering the performance of work under the contract. In no event, however, will any understanding, agreement, modification, or amendment; change order; or other matter deviating from the terms of the contract be effective or binding upon NRCS unless formalized by proper contractual documents executed by the CO prior to completion of the contract. The CO must be informed as soon as possible of any actions or inactions by the contractor or NRCS that will change the required delivery or completion times stated in the contract.  

The contractor must communicate with the CO on all matters that pertain to the contract terms. If the contractor believes that the technical representative has requested work outside the scope of the contract, the CO should be so advised. If the CO and contractor do not agree on the coverage of the contract, the contractor should notify the CO immediately, preferably in writing if time permits. Proceeding with work that does not have proper contractual coverage could result in nonpayment.  

All matters that pertain to technical terms should be addressed to the technical representatives, Kendra Moseley, State rangeland ecologist (primary), and David W. Smith, State soil scientist (alternate). All materials provided to the contractor remain the property of NRCS and are to be returned to the technical representatives upon completion of the project.

**DELIVERABLES**

Joshua Tree National Park Soil Survey (CA794)  

Conduct a portion of the work as defined under performance elements A, B, C, and D (working as a team with NRCS staff, who will also conduct parts of the work) for the soil survey.  

- Work with the State rangeland ecologist, ecological site specialist, and soil scientists to identify the remaining ecological site workload for the soil survey and help to develop a workload analysis for the remaining data collection and development.  Provide report describing the workload analysis.  
- Work with the State rangeland ecologist, ecological site specialist, and soil scientists to visit and collect data for all remaining soils and vegetation reference locations, ensuring that all site development properly correlates with soil mapping.  Data sheets, photographs, and field notes should be created and provided.  
- Work with State rangeland ecologist and ecological site specialist to complete vegetation data entry in NASIS and the ES database.  Populate all sections of NASIS and the ES database as described in the minimum requirements.  Provide a report describing data that was entered and all ES products that were worked on and completed.  Provide a copy of all completed ES information.  
- Work with State rangeland ecologist and ecological site specialist to write the narrative sections for the ecological site products and create the state-and-transition models.  Provide a report describing
all ES products that were worked on and completed. Provide a copy of all completed ES information.

- Work with State rangeland ecologist and ecological site specialist to complete a rangeland narrative for the soil survey manuscript. Provide completed narrative (see example in “Specifications and References” section).

Developing ES information is a complex process. It is difficult to predict the exact amount of time required for each part of the work in various ecological and project settings. Furthermore, it is difficult to set an exact schedule of fieldwork due to seasonal variations in climate and plant growth. The scheduling of the work components may overlap; therefore, select components of ES information development must be carried out incrementally as “packets” of work conducted at various times. The specific number and timing of deliverables is not set. Rather, the expectation is to complete as much high-quality work as possible as efficiently as possible.

The components of ES work for each deliverable project include the following:

- Meetings for coordination, review, consultation, and training (provide written trip report)
- Field visits for reconnaissance, review, consultation, or training (provide written trip report)
- Field data collection (provide paper and digital copies of data collection forms, field notes, photographs, and GPS locations)
- Data point spreadsheet (provide written document tabulation of geo-referenced data points)
- Draft ES concepts and outline (provide written document)
- Draft ES legend (provide written document)
- Literature review (provide list of references)
- Draft state-and-transition models (provide written ecological dynamics and diagram)
- Data analysis, quality review, and tabulation (provide evidence of worksheets or summary notes)
- ES database data entry (provide evidence of data population)
- ES narratives typed directly into the ES database or created as Microsoft Word documents and then copy-and-pasted into the database (provide evidence of data population)
- Draft ES information (provide initial or final draft documents generated from the ES database)
- Other (describe task and product to be provided)

Payment will be made for the selected components of ES work as they are accomplished. The contractor must keep a record of hours worked by deliverable project number and the component of the work and will bill accordingly. Payments will not be made more often than monthly. The work will be reviewed by the NRCS State rangeland ecologist and evaluated in terms of quality and amount of time spent before payment is issued.

All edits needed as a result of comments made by NRCS staff on initial drafts of ES information must be incorporated into the ES products by the contractor within the specified time period agreed on by the State rangeland ecologist and the soil survey project leader. After the edits have been made, the contractor must submit the final drafts to the NRCS State rangeland ecologist. Submission of all initial and final drafts will be made via email to all parties identified (email notification of completion in the ES database is acceptable; NRCS will review the drafts in the database).

The contractor must deliver a hardcopy and digital copy of completed data collection forms, field notes, photographs, and all GPS locations and GIS shapefiles. The contractor must deliver an electronic copy of an Access database file that contains field data collection information. Data collection (double sampling) for each of the ecological sites identified must be completed as ordered during the field seasons of 2010. Each ecological site will have three data collection locations. Data collection must be recorded by the contractor on the SCS-Range-417 form (or agreed-on similar form) and entered into the ES database (or agreed-on similar database, such as that at ARS Jornada). Five to seven digital photographs of each site

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are required, including two transect photographs, one representative landscape photograph, and three or four additional photographs identifying key features of the site. All digital photography files must be labeled as described by NRCS. The contractor must provide all digital imagery to NRCS on compact disk.

All material supplied to the contractor by NRCS must be returned, in similar condition, to the State rangeland ecologist by March 31, 2010. This material includes, but is not limited to, double sampling forms (SCS-Range-417 or similar form) and digital images of each site.

INSPECTION AND ACCEPTANCE

PERIOD OF PERFORMANCE

The work required by the contractor (deliverables) must be completed and delivered to NRCS, California, Soils Staff, in increments by December 31, 2009.

INSPECTION AND APPROVAL

Work is to commence approximately on February 1, 2010, and be completed by March 31, 2010. The contractor must submit to NRCS the deliverables on an incremental basis within the allotted time. The NRCS technical representative will review the work and notify the contractor of approval on a periodic basis before the final completion date. Increments of completed work must be submitted monthly to quarterly for review and acceptance by the technical representative.

Work is considered complete when the technical representative provides notification to the contracting officer that acceptable quality work has been completed within an acceptable amount of time. Payments will be made when a proper invoice is received, but not more often than monthly during the performance period. Conducting at least quarterly reviews will minimize the time required by a technical representative to review and accept completed work for payment.

SPECIFICATIONS AND REFERENCES

- National Range and Pasture Handbook, Revision 1, December 2003 (chapters 3, 4, and others as needed)
- Interpreting Indicators of Rangeland Health, Version 3
- National PLANTS Database, USDA-NRCS
- Field Book for Describing and Sampling Soils, Version 3.0, USDA-NRCS
- Monitoring Manual for Grassland, Shrubland, and Savanna Ecosystems
- Sampling Vegetation Attributes, 1999, Technical Reference 1734-4
- PRISM climate data
- Western Regional Climate Center climate data
- Example ecological site description
- Example rangeland narrative from “Use and Management of the Soils” section of the Soil Survey of Pinnacles National Monument

(190-630-H, 1st Ed., Amend. 1, March 2017)
630.73 Ecological Site Quality Control Review Worksheet Template

Quality Control (QC) Review Documentation

<table>
<thead>
<tr>
<th>Final QC</th>
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<tbody>
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<td>(QC approval of ES information)</td>
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| Progress QC |  |

This QC worksheet helps to ensure that the ecological site (ES) information is science based, the MLRA concept is used for the ES keys and correlation to soil map unit components, and the ES information meets the standards and specifications presented in sections II and III of the National Ecological Site Handbook. Each step may be reviewed at a different time, depending on workflow during the year; however, each completed step must be reviewed within 1 year. QC is performed under the overall leadership of the SSL.

After a step is reviewed, the corresponding QC document should be signed and sent to the soil survey region ecological site specialist (SSR ESS) for a quality assurance (QA) check.

GENERAL INFORMATION

Ecological sites reviewed:

<table>
<thead>
<tr>
<th>Site ID Number</th>
<th>Site Name</th>
<th>ES Level (Provisional or Approved)</th>
<th>Major Land Resource Area</th>
<th>Land Resource Unit (if applicable)</th>
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</table>

Date:

Reviewers:

Individuals present for review:

Dates of previous reviews:

Project leader:
Agency with responsibility for ES information development:

Cooperating agencies:

Status of memorandum of understanding:

Has a long-range plan been developed?

Has a project plan been developed and approved?

Have the project plan and milestones been populated in NASIS?

**ECOLOGICAL SITE INFORMATION**

*General section*

Has the ecological site concept been defined?

What criteria are used to separate the ecological site from others?

Has an ES key been developed for the MLRA or LRU?

Is the ES key consistent with information in the ES information?

Is the ecological site properly named according to part 631, subpart D, section 631.31?

Are reviewers, technical contributors, and authors correctly credited?

Comments:

*Physiographic Features section*

Is the narrative consistent with information contained in the other data elements of this section?

Do the data elements fit the described ecological site concept and match the modal concept and attributes of the soil map unit components to which the ecological site is or will be correlated?

Do the physiographic features fit conceptually with the other sections of the ES information?

Comments:

*Climatic Features section*

Are the narrative and data tables consistent between them?

Do the climatic features fit the described ecological site concept and match conceptually with the other sections of the ES information?

Comments:
Influencing Water Features section
Do the narrative and other data elements in this section fit the described ecological site concept and other sections of the ES information?
Comments:

Representative Soil Features section
Does the soil information distinguish the ES from others?
Is the narrative consistent with the data tables? If not, is the difference explained?
Is any followup needed for soils or ES correlation? If so, describe.
Has the ES been correlated to soil map unit components in NASIS?
Has a soil correlation document been completed?
Are updates to soil maps or soil map unit components needed to properly correlate soils to the ecological site?
Is the ES key consistent with information in this section of the ES information?
Comments:

States and Community Phases section
Is the ecological site concept clearly defined within the context of the ecological dynamics narrative?
Are there unnecessary redundancies between the ecological dynamics section and the plant community descriptions?
Does the state-and-transition model (STM) conform to the current format and numbering conventions?
Do all of the states, community dynamics, transitions, community pathways, and restoration pathways depicted in the diagram correspond to a narrative?
Does the information in the narrative match other tabular data in the ES product?
Are the photographs representative of the state and community dynamics?
Are captions provided for the photographs?
Do the narratives for the state and community dynamics identify and describe the indicators, feedbacks, at-risk community phases, and triggers?
Are the narratives for the state and community dynamics, community pathways, transitions, and restoration pathways concise, brief, and informative?
Are the narratives for the state and community dynamics, community pathways, transitions, and restoration pathways consistent with the STM and its legend?
Do the STM concepts support the current concepts for the ecology of the plant species included?  
Is the source of the data in the narratives cited?  
Does the available vegetation data support the species and amounts listed in the plant composition tables?  
If not, explain why some species may be included without actual documentation.  
Are the plant species in the “Plant Species Composition” table grouped appropriately?  
Are the production values in the “Plant Species Composition” table congruent with the values in the “Total Annual Production by Plant Type” table?  
Are the values in the “Cover” and “Structure” tables congruent with the “Plant Species Composition” table?  
Is the “Plant Species Composition” table congruent with the vegetation described in the “Plant Community Phase” narratives?  
Comments:  

*Interpretations section*  
Are plant communities identified if appropriate?  
Are the interpretations adequate for the uses and products associated with the site?  
Comments:  

*Supporting information section*  
Are the “Associated Sites” and “Similar Sites” tables correctly described to explain the association or similarity?  
Are all citations in the text listed in the references? Are the references formatted according to NRCS standards?  
Is the type location identified and representative of the ecological site concept? If not, why?  
Have all the contributing authors and technical reviewers been credited?  
Comments:  

*RANGELAND HEALTH REFERENCE WORKSHEET*  
Has the worksheet been completed?  
Does the information in the worksheet coincide with the values reported for the reference state (reference community) in the ES information?  
Comments:
Databases
Has the ES information and associated “Rangeland Health Reference Worksheet” (if applicable) been properly entered into the ES database?

Are the most current ES products and “Rangeland Health Reference Worksheet” linked to section II of the eFOTG?

Comments:

Data Storage and Documentation
Is there an official file established for the ecological site? If so, where is it located?

Have all appropriate vegetative data sheets been geo-referenced and entered into the ES database or another approved database? This includes photographs, STMs, vegetation data, soils data, GPS data, GIS projects, data analysis, and outside data sources.

Is all hardcopy and digital ecological site documentation stored in a safe place? Have backup procedures been implemented?

Are hardcopy and digital data being kept according to guidance in part 630, subpart G?

List the number of representative sampling locations and points for each ES. List by community phase for each sampling point.

<table>
<thead>
<tr>
<th>Sampling Site Number</th>
<th>Community</th>
<th>Total Reconstructed Production (lbs/ac)</th>
<th>SI Calculation</th>
<th>Sampling Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

What sampling methods were used? Are they appropriate for the ecological site under review?

Has the full geographic and ecological range of the ecological site been sampled?

Describe and list other vegetation data or references used.

Comments:
Quality Control Documentation

The following components have been reviewed for completeness and adherence to standards:

<table>
<thead>
<tr>
<th>Site name:</th>
<th>Number:</th>
<th>Level:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Provisional</td>
<td>Complete</td>
</tr>
<tr>
<td>Ecological Site Key for MLRA</td>
<td>R</td>
<td>R</td>
</tr>
</tbody>
</table>

**GENERAL INFORMATION**

| Ecological Site ID and Name | R | R | R |
| Hierarchical Classification (if applicable) | R | R | R |
| MLRA Notes (if applicable) | R | R | R |
| Site Concept Narrative | R | R | R |
| Locator Map Image | S | S | S |

**PHYSIOGRAPHIC FEATURES**

| Physiographic Features Narrative | S | R | R |
| Physiographic Diagram | S | S | S |
| Physiographic Tables | R | R | |

**CLIMATIC FEATURES**

| Climate Features Narrative | S | R | |
| Climate Features Tables | R | |

**WATER FEATURES**

| Water Features Narrative | S | R | R |
| Hydrologic Processes Diagram | S | S | S |
| Wetland Description | S | S | |

**REPRESENTATIVE SOIL FEATURES**

| Soil Features Narrative | S | R | R |
| Soil Profile Image | S | S | |
| Soil Tables | R | R | |

**COMMUNITY DYNAMICS DATA**

| Ecological Dynamics of the Site | R | R | R |
| State-and-Transition Diagram | R | R | R |
| Legend for Transition Pathways (matrix) | R | R | R |
| Legend for Recovery Pathways (matrix) | R | R | R |
## Reference State

<table>
<thead>
<tr>
<th>Photographs (if available)</th>
<th>R</th>
<th>R</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrative for State, Community Dynamics, Transitions, and Pathways</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Supporting Community Dynamics Documentation</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Community Composition</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Species Productivity (herbaceous/shrub)</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Canopy/Foliar by Species</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Annual Production by Plant type (herbaceous)</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Structure of Canopy Cover</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Percent Surface Cover by Type</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Overstory Canopy Cover (tree dominant)</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Overstory Table (tree dominant)</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Understory Table (tree dominant)</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Forest Site Productivity</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Growth Curve</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Downed Wood and Tree Snags for Soil Surface Cover</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
</tbody>
</table>

## Each Alternative State/Community

<table>
<thead>
<tr>
<th>Photographs</th>
<th>R</th>
<th>R</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community Dynamics Narratives</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Narrative for State, Community Dynamics, Transitions, and Pathways</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Supporting Community Dynamics Documentation</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Community Composition</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Species Productivity</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Forest Site Productivity</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Total Annual Production</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Canopy or Foliar Cover</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Structure of Canopy Cover</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Percent Surface Cover by Type</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Overstory Canopy Cover (tree dominant)</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Overstory Table (tree dominant)</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Understory Table (tree dominant)</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Growth Curve</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
</tbody>
</table>
### ECOLOGICAL SITE INTERPRETATIONS

<table>
<thead>
<tr>
<th>Animal Community Narrative</th>
<th>Hydrology Feature Narrative</th>
<th>Recreational Uses Narrative</th>
<th>Wood Products Narrative</th>
<th>Other Products Narrative</th>
<th>Other Information Narrative</th>
<th>Plant Preference by Animal Kind</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
</tbody>
</table>

### SUPPORTING INFORMATION

<table>
<thead>
<tr>
<th>Associated Sites</th>
<th>Similar Sites</th>
<th>Inventory Data References</th>
<th>Agency/State Correlation</th>
<th>Type Locality</th>
<th>References</th>
<th>Site Authors</th>
<th>Rangeland Health Reference Sheet</th>
<th>Rangeland Health Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td>S</td>
</tr>
</tbody>
</table>

**Comments:**

Additional equipment and/or training needs:

Commendable items:

Action items and recommended items:

Have all previous agreed-to items been completed?
I certify that the above ecological site descriptions have received a quality control review for technical accuracy.

<table>
<thead>
<tr>
<th>Role</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality Control Reviewer</td>
<td></td>
</tr>
<tr>
<td>Ecological Site Specialist – Author</td>
<td></td>
</tr>
<tr>
<td>Soil Survey Office Leader</td>
<td></td>
</tr>
</tbody>
</table>
630.74 Initial Quality Assurance Review Worksheet Template

A. Supporting Documentation Needed Prior to Review (reference only, if applicable)
   - Approved project, annual, and long-range plans.
   - List of technical team members and the primary responsibilities of each member.
   - List of reference material.
   - Available existing data (e.g., old range site descriptions, woodland suitability groups, provisional ESs, and supporting vegetation data).
   - Numerical legend of provisional ecological sites, including acreage and completion level.
   - Alphabetical legend of provisional ecological sites, including acreage and completion level.
   - Soil map unit and ecological site correlation table.
   - Supporting GIS layers and material.
   - Soil map units and draft provisional ecological sites.
   - Preliminary ES concepts within the context of the MLRA.
   - Draft MLRA ES key.
   - Field notes supporting draft ES concepts.
   - Ecological site progress report with completion dates.
   - Draft state-and-transition models for new ecological sites created as a result of field review.
   - Numerical list of all competing similar ecological sites.
   - QC worksheets for project.
   - List of action items from QC review.
   - List of commendable items from QC review.
   - Equipment and supply needs.

B. Initial Review Checklist
   - Are preparations for QA review adequate?
   - Has the project area been identified, refined, and researched as needed?
   - Has review of literature and existing data been initiated?
   - Who are the members of the technical review team (list by agency affiliation)?
   - Do responsible individuals have access to appropriate databases needed to complete assigned tasks in the project plan?
   - Has a list of training needs, equipment, supplies, etc., been identified for the individuals in charge of ecological site development?
   - Has the management team approved the project plan? Has the board of advisors (BOA) reviewed the plan? Have they provided recommendations, as appropriate?
   - If there is an MOU, has it been reviewed by the management team and/or BOA and have recommendations been provided to the SSRD or State Conservationist, as appropriate?
Has a project plan been drafted and submitted to each member of the technical team for review?
Has the project plan been approved and integrated into the MLRA long-range plan?
Are milestones being used in the project plan, and are they entered into NASIS? Are milestones, timelines, and deliverables reasonable?
Are qualified persons responsible for ensuring timely accomplishment of the milestones outlined in the project plan?
Has a qualified QC reviewer been identified in the project plan?
Has the technical team reached an agreement with the QA reviewer and SSRD on how progress on the milestones will be reported?
Has the draft ES legend been compared to similar ESs?
Is the join adequate between soil map units and selected characteristics within the project area and adjacent map units?
Is documentation adequate for the ecological sites being combined or deleted?
Are the provisional ES names, draft identification and differentiation of ESs, and modal concepts appropriate?
Is a filing system in place to store supporting hardcopy and digital documentation?
Does the ES key support the correct identification of ES concepts?

Comments:

Actions and/or recommended items:

Additional equipment and/or training needs:

The initial quality assurance review was completed by:

________________________  ____________________
Soil Survey Region Ecological Site Specialist  Date
C. Initial Quality Assurance Review Report Signature Page

*Initial QA review report completed by:*

___________________________________________     ________________
Soil Survey Region Ecological Site Specialist   Date

**QUALITY ASSURANCE CONCURRENCE**

*We, the undersigned, have reviewed the initial QA review report and concur with its findings.*

___________________________________________     ______________________
Soil Survey Office Leader   Date

Partner(s)     Date

State Soil Scientist(s)     Date

State Resource Conservationist(s)     Date

State Conservationist(s)     Date

**QUALITY ASSURANCE CERTIFICATION**

*As of _______________ (date), this ecological site project meets the standards and specifications of the “National Ecological Site Handbook.”*

___________________________________________     ______________________
Soil Survey Regional Director, Region ______   Date
630.75 Quality Assurance Progress Review Worksheet Template

**Quality Assurance (QA) Review Documentation**

<table>
<thead>
<tr>
<th>Final QA</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(QA approval of ES information)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Progress QA</th>
<th></th>
</tr>
</thead>
</table>

This QA report ensures that the ES information development process has been followed and the ES products adhere to technical standards and guidelines, related policies, and current ES concepts. QA also identifies and ensures that training and technical assistance needs are met. QA is performed under the overall leadership of the SSR.

Once final QA is completed, the ES information is certified by State specialists and partners.

**GENERAL INFORMATION**

<table>
<thead>
<tr>
<th>ES Number</th>
<th>ES Name</th>
<th>ES Level (Provisional or Approved)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Date:

QA reviewer:

Individuals present for review:

Dates of previous QA reviews:

Project leader (author):

Are quality control reports current?

The following QC reviews have been received and reviewed for QA:

<table>
<thead>
<tr>
<th>Progress QC or Final QC</th>
<th>Date of Review</th>
<th>Name of QC Reviewer</th>
<th>All Agreed-To Items Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Have long-range and project plans been developed?
Is work progress current with project plan milestones and reported in NASIS?
Has an ES technical team been developed?
Has an ES technical team meeting been held and used properly?
Is the STM and information in the ES information congruent with current academic principles and ecological theories as well as literature references?
Have ES naming protocols been followed?
Has an ES key been developed?
Are site concepts supported by data? Have they undergone a peer review by soils and vegetation specialists?
Has adequate field data been collected?

**DATA ENTRY AND MANAGEMENT**

Are hardcopy and digital data being kept according to guidance in part 630, subpart G?
Is there an official file established for the ecological site? If so, where? (Must not be stored on H drives.)
Who spot checked the data and data analysis for the QC reviewer?
Do the STMs follow approved NRCS standards with respect to naming and numbering?
Do the narrative sections of each state and community phase contain sufficient information to explain the dynamics, species composition, flora and fauna interactions, and other pertinent features?
Do the narrative sections of each state and community phase agree with the STM and plant species composition tables?
Are proper methods, procedures, and protocols being used?
Has the ES information been properly entered into the ES database?
Have the ES products been reviewed by an editor?
Comments:

Additional equipment and/or training needs:

Commendable items:

Action items and/or recommended items:

Have all previous agreed-to items been completed?

_I certify that the above ecological site products have received a quality assurance review for adherence to technical standards and guidelines, related policies, and current ES concepts and the ES information development process has been followed._

<table>
<thead>
<tr>
<th>Soil Survey Region Ecological Site Specialist</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Soil Survey Regional Director, Region ________</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>
Certification—Quality Assurance and Quality Control Concurrence

We, the undersigned, have reviewed the quality assurance progress report and concur with its findings. This ecological site information can be used for conservation planning.

<table>
<thead>
<tr>
<th>State Resource Conservationist, State</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>State Resource Conservationist, State</th>
<th>Date</th>
</tr>
</thead>
<tbody>
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<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>State Soil Scientist, State</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>State Soil Scientist, State</th>
<th>Date</th>
</tr>
</thead>
<tbody>
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<td></td>
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</table>

<table>
<thead>
<tr>
<th>Partnering Agency or Group,</th>
<th>Date</th>
</tr>
</thead>
<tbody>
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<td></td>
<td></td>
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<td></td>
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</table>

<table>
<thead>
<tr>
<th>Partnering Agency or Group,</th>
<th>Date</th>
</tr>
</thead>
<tbody>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
630.76 Final Quality Assurance Review Worksheet Template

A. List of Ecological Sites Correlated (by number)

1. __________________________ 2. __________________________
3. __________________________ 4. __________________________
5. __________________________ 6. __________________________
7. __________________________ 8. __________________________
9. __________________________ 10. __________________________

B. Final QA Review

Project Plan ID _____________________

Administrative Information
Are the QC review reports complete? If not, identify deficiencies by ecological site.
Does the ES information meet current standards and editorial guidelines?

Project Management
Are deficiencies and agreed-to items from previous QA reviews resolved or addressed?
Are policies and procedures in the National Ecological Site Handbook being followed?
Is progress reporting of the project complete?
If sites have been divided or recorrelated, are notes sufficient for needed followup? Where are notes stored?

Correlation
Has the ES been correctly correlated within the MLRA? Has work been completed for initial development, proper recorrelation throughout the MLRA, and resolution of MLRA boundary issues?
Do the ES ID numbers and names conform to NRCS policy?
Have all the map unit components been updated to the current ES?
Do MLRA or LRU descriptions need to be updated?

Ecological Site Investigations
Was a thorough search conducted for literature and existing data to support the site concepts?
Do plant names follow current guidelines?
Has the appropriate sampling strategy been used for the ESs in this project?
Are the extent and intensity of data collected sufficient for the variability of the site?
Have all the field data collected for each ES been properly analyzed?
Were type locations available for investigation of the ES?
Are the criteria used to separate this site from others justified and documented?
Has there been a peer review of the site concept and STM?

**Ecological Site Information**

Does the ES information meet minimum requirements as outlined in the part 630, subpart H, section 630.73?

Are STM diagrams, boxes, and narratives written for all ecological sites?

Do the STMs meet current standards and definitions?

Have the ES products been edited for grammatical and editorial accuracy?

If the site name or number has been updated, is it noted in the final ES product?

**Database Management**

For new ecological sites, have all tables been populated in appropriate databases?

For updated ecological sites, have the appropriate changes been made in the databases?

Have the conversions and calculations for plot and vegetation data been done correctly?

Have field notes of site data been summarized, geo-referenced, and stored according to policy?

Have the appropriate linkages in the databases been verified, including those for non-technical descriptions, range and forestry production tables, existing plants and canopy cover, and other technical information?

Have photographs and other data been stored according to policy in part 630, subpart G?

Has the SDQS reviewed the map unit component and site concept correlation data in the appropriate databases?

Can the data analysis be tracked?

**Ecological Site Interpretations**

Do the ES interpretations meet policy as stated in part 631, subpart F, section 631.57?

Have appropriate disciplines participated in the development and review of the interpretations section?
C. Final Quality Assurance Review Report Signature Page

The final quality assurance review report was prepared by:

______________________________  __________________
Soil Survey Region Ecological Site Specialist   Date

QUALITY ASSURANCE CONCURRENCE

We, the undersigned, have reviewed the final quality assurance review report and concur with its findings.

______________________________  __________________
SSO Leader   Date

______________________________  __________________
Partner(s)   Date

______________________________  __________________
State Soil Scientist(s)   Date

______________________________  __________________
State Resource Conservationist(s)   Date

______________________________  __________________
State Conservationist(s)   Date

QUALITY ASSURANCE CERTIFICATION

As of _________________ (date), this ecological site project meets the standards and specifications of the “National Ecological Site Handbook.”

______________________________  __________________
Soil Survey Regional Director, Region _____   Date
**630.77 Example Format for ES Correlation Document**

This exhibit outlines the format and content of items and data ordinarily contained in a correlation document. It does not preclude the inclusion of other information pertinent to the project or explanation of actions taken during the correlation.

**A. Heading and Nondiscrimination Statement**

UNITED STATES DEPARTMENT OF AGRICULTURE  
Natural Resources Conservation Service

Identification of Ecological Sites  
Any Area, Any MLRA, Any State

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Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA’s TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

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1. mail:  
   U.S. Department of Agriculture  
   Office of the Assistant Secretary for Civil Rights  
   1400 Independence Avenue, SW.  
   Washington, DC 20250-9410;

2. fax:  
   (202) 690-7442; or

3. email:  
   program.intake@usda.gov.

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**B. Introductory Paragraph**

Include persons participating in the ES project, date, location, data reviewed, basis for correlation, and other pertinent items. For example, “John C. Smith, SSO ES specialist, and David G. White, AnyState office, Natural Resources Conservation Service; and Joseph I. Black, associate professor, AnyTown State University, AnyTown, AnyState, prepared this correlation the week of October 21-25, 2013. This correlation was based on information in the ES database and on field notes, interpretations, and material from related ESs.”

(190-630-H, 1st Ed., Amend. 1, March 2017)
C. **Ecological Sites (ESs) Established by This Correlation**
   List of ESs correlated (by number)—
   
   1. 
   2. 
   3. 
   4. 
   5. 
   6. 
   7. 
   8. 
   9. 
   10. 

D. **Ecological Sites Deactivated**
   List of ESs that were dropped or deactivated by the correlation. For example, “The XX-XX ES is made inactive by this correlation.” Enter “None” if no ESs were dropped or deactivated.

E. **Associated Soil Map Unit Components**
   List soil map unit (MU) components associated with each ES and the estimated acreage of each ES.

<table>
<thead>
<tr>
<th>ES</th>
<th>Associated MU Components</th>
<th>Total Acreage</th>
</tr>
</thead>
</table>

F. **Names of Partners**
   List the names of partners to be published with the ES information.

G. **Prior ES Publications**
   For ES updates, indicate the references to prior ESs. Enter “None” if there are no prior publications.

H. **Notes to Accompany the ES Concepts and Differentiation**
   Include any general notes that contribute to the understanding of the correlation. For example, “This ES project area is in a transitional zone between temperature regimes. Soils that have a mesic or thermic temperature regime are correlated to the ESs.”

   In the notes, include items such as—
   
   (1) Pertinent information about ESs being established.
   (2) How similar ESs differ from the ES concepts.

I. **Miscellaneous Items**
   Use additional headings, as appropriate, and include items pertinent to the correlation or publication of ES information. For example, the soil-landscape-climate schema or concepts used for correlation of the survey area should be included. Another example is a summary of special investigative reports that were used as guidance for the project.
J. Quality Control and Quality Assurance Certifications

The correlation document certifies that—

1. ES concepts have been tested and verified.
2. Supporting soil and vegetation data have been collected and archived appropriately.
3. Documentation on modal soil properties used to correlate the site to appropriate soil map unit components is available.
4. The soil attributes of the correlated soil map unit components fit the described ecological site concept and match conceptually with the other sections of the ES information.
5. Documentation that characterizes the site concepts is available.
6. Soil, ES, and management interpretations are complete and have been correlated across physiographic and political boundaries for the project area.
7. Appropriate technical reviews have been performed by assigned SSRDs, SSLs, SRCs, and other agency staff, as appropriate.
8. Appropriate QC was performed.
9. Appropriate QA was performed by the SSR staff.
10. All appropriate databases and ES products are updated.

K. Approval Signature and Date

These ES products have received quality assurance review for adherence to standards and specifications at the approved level. They meet the guidelines for identification, delineation, description, and interpretation.

___________________________________    ________________     ________________
Soil Survey Regional Director                SS Region                  Date
# 630.78 Certification Sheet for Correlated ES Information

Correlated ESDs:

<table>
<thead>
<tr>
<th>Site ID</th>
<th>Site Name</th>
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</tbody>
</table>

We, the undersigned, certify that the listed correlated ES products are ready for use in conservation planning, implementation, monitoring, and assessment and will be made available to the public in the appropriate databases and field office technical guide.

State Conservationist | State | Date
----------------------|-------|------

State Conservationist | State | Date
----------------------|-------|------

State Conservationist | State | Date
----------------------|-------|------

Partner (as needed) | State | Date
---------------------|-------|------

Partner (as needed) | Area of responsibility | Date
---------------------|-------------------------|------

(190-630-H, 1st Ed., Amend. 1, March 2017)
630.79 Sample Filing Structures

Example 1

There must be one PRIMARY FOLDER, Ecological_Sites. Within this folder must be ES_Projects, Literature, Approved_ES Information, Final_Certified_ES Information, LRU_Information, MLRA_Information, LRR_Information, Policies_and_Protocols, Presentations, Existing_Range&Woodland_Sites, and Uncorrelated_Data subfolders.

(1) ES_Projects

This subfolder must house all information on current projects related to ecological site development. Commonly, a different approach is used by each project leader and files must be organized so that they are accessible and follow a format required by the project leader. There must be some overall order to the structure as well, so that anyone new to the project is able to locate and understand all of the information. NOTE: There must also be documentation available in an active project that explains the filing procedures for that project.

(i) Each folder in the ES_Projects subfolder must be labeled by project area name, such as CA630_Central_Sierra_Foothills.

(ii) Within each of the ES_Projects subfolders must be Data, Maps & Aerial_Photos, GIS, Summary_Documents, Photos, STMs, Hydrology_Information, Draft_ES Information, and Uncorrelated_Data folders.

1. The Data folder must contain Vegetation_Data, Data_Analysis, Field_Notes, QA-QC_Information, Correspondence, Soils_Data_Reports, and Existing_Range_Sites subfolders. All plot data (Access database), spreadsheets with correlation information, other data (for example, density), site index comparison data (if not in database), species lists, etc., are housed in the Data folder.

(a) The Vegetation_Data subfolder must include all data sheets that have been entered digitally. Eventually, digital data forms will be available for entering and automatically calculating information for all land types. Hardcopy-only forms should be scanned. Additional folders may be created within this folder for line-point intercept data, production data, site index data, etc.

(b) The Data_Analysis subfolder must contain all data that has been compiled for analysis for the ecological site. This data will likely be Access databases and/or Excel spreadsheets and graphs. Additional folders may be created within this folder for separate types of analysis, such as cover and production.

(c) The Field_Notes subfolder must contain all notes collected pertaining to the ecological site. It is recommended that all notes collected in the field be typed to reinforce the ideas and for better archival capabilities. These documents should be named by project area; soil survey area; associated ecological site, pit number, or associated transect; and date.

(d) The QA-QC_Information subfolder must contain all documents and information that has been provided or created for the QA and QC individuals. This includes documents specifically related to the ES.

(e) The Correspondence subfolder must contain all saved correspondence regarding the ecological site. This may include saved emails, notes, office meeting reviews, discussions, etc.

(f) The Soils_Data_Reports subfolder must contain any information pertaining to the soils for that ecological site. This may include digital 232s (hard copies can be scanned), lists of pit numbers associated with the ecological site, etc.

(g) The Existing_Range_Sites subfolder must contain digital copies of any old range sites and related information that pertain to the project area.
2. The **Maps_&_Aerial_Photos** folder will house any maps or aerial photographs that may be useful to the development of the ecological sites in the project area. The following folders must be within this folder:

3. **GIS Folder.**—This folder will house the GPS spreadsheet with plot locations and other GIS information. It must include spreadsheets with UTMs and any other pertinent information regarding the GPS locations. The active GIS map can be saved in this folder.

4. **Summary_Documents Folder.**—This folder will house the legend with correlated ES information, the ES summary document, other correlation documents, phase concepts, etc.

5. **Photos Folder.**—This folder will house all photographs. They must be labeled by pit number so that they can be cross-referenced to the soil pits created by the soil mappers. There must also be a master file spreadsheet in this folder that links all photographs to an ESD and a list of any uncorrelated photographs.
   
   (a) Photographs will be sorted by project area within this folder. The folders are to be named similarly to project areas. For example, **CA630_Central_Sierra_Foothills**.

   (b) The photographs in each folder must be labeled by project area number and pit number. For example, **CA630_1249####**. Photographs that have pit locator numbers must remain in this folder so they can be linked to the soils information in the project. The photographs must also be copied to the **ES** folder and renamed with the ecological site name when the ES concept is firm so they can be located easily by ES after a project has been completed.

6. **STMs Folder.**—This folder will contain additional folders named by major vegetation dominance within the project area. Within each of those folders must be a .ppt file and a .jpg file of each STM that has been developed for a major vegetation type. For example, the **Mountain_Big_Sagebrush** folder houses several STMs; therefore, **R021XE044CA_Cool-Loam12-16_Final_6-4-10.ppt** and **R021XE044CA_Cool-Loam12-16_Final_6-4-10.jpg** are two of the files included in the folder. If preferred, the **Mountain_Big_Sagebrush** folder may include subfolders labeled by ecological site number. For example, **R021XE044CA** would have subfolders that house narrative documents for the STM for that ecological site and all draft STMs that have been developed, in .ppt and .jpg file formats. All STMs must be labeled by name, date, and status. For example, **R021XE044CA_DRAFT_12-7-10.ppt** and **R021XE044CA_DRAFT_12-7-10.jpg**.

7. **Hydrology_Information Folder.**—This folder will house any information related to the hydrology for each ecological site or for the project area as a whole.

8. **Draft_ES Information Folder.**—This folder will house all current draft ES information for the active project area. If multiple iterations of ES information are drafted, include at the end of each file name the date of development of each iteration of the information. For example, **R021XE044CA_Draft_5-11-10.doc; R021XE044CA_Draft_6-30-10.doc; and R021XE044CA_Draft_8-22-10.doc.**

9. **Uncorrelated_Data Folder.**—This folder will house all data that is currently not correlated to an ecological site. If data is not correlated by the end of a project, the information must be saved in a folder named as the project area within the **Uncorrelated_Data** folder. For example, **Uncorrelated_Data, CA630_Central_Sierra_Foothills.**

(2) **Literature**

This subfolder of the **Ecological_Sites** folder will house all literature and research information that is useful for ecological site development in the entire area of responsibility. This folder can have subfolders for different types of information. For example, **Life_History_Traits, Climate_Information, Land_Management_Activities, Fire, and Drought** are potential subfolders. This folder can also be subdivided by vegetation phases in the area of responsibility and then further subdivided by topics, such as those listed above.
(3) **Approved_ES Information**
File contents and structure must follow the same guidelines as for **Final_Certified_ES Information**.

(4) **Final_Certified_ES Information**
This folder will house all approved ES information in .pdf and/or .doc file format and must be subdivided by MLRA and then by ES number. For example, ES–MLRA_4 – R004BY100CA. Within this folder must be the subfolders named **ES Information**, which includes a link to the most current version of the E information (in the ES database); **Data**; **STM**; and **Photo**.

(i) The **ES Information** folder will house the most current copy of the ES information. It may also include draft or approved ES information, but these must be in subfolders titled appropriately.

(ii) The **Data** folder will house all compiled data supporting the ecological site. This folder may be subdivided to separate information. For example, **Vegetation_Data**, **Soils_Data**, **GPS shapefiles**, and **Field_Notes**.

(iii) The **STM** folder will house all approved formats of the STM for an ecological site (.ppt and .jpg files) and named with the ecological site number, STM, and date. For example, **R004BY100CA_STM_12-9-10**.

(iv) The **Photo** folder will house all images pertaining to an ecological site. This must include both the original images and compressed images. The suggested naming convention for all images is **R004BY100CA_PC1.1_12-9-10**, **R004BY100CA_PC2.2_12-9-10**, or **R004BY100CA_Landscape-N-NE_12-9-10**.

(5) **LRU_Information**
This folder will house information that is specific to and covers an entire land resource unit. See **MLRA_Information** for an example of how this folder must be organized.

(6) **MLRA_Information**
This folder will house information that is specific to and covers an entire major land resource area. Within this folder must be the **Climate_Information**, **Soils**, **Maps_&_Aerial_Photos**, **Hydrology**, **MLRA-wide_Noxious_&_InvasiveSpp**, **Wildlife**, and **Uncorrelated_Data** subfolders. The **Uncorrelated_Data** subfolder is for any additional MLRA information that does not appropriately fit under one of the other subfolders.

(i) The **Climate_Information** subfolder must include **Climate_Stations**, **PRISM_Maps**, **Climate_Statements**, and **Climate_Data** subfolders.

1. The **Climate_Stations** subfolder will house all climate station information for the MLRA (for example, [www.wrcc.dri.edu](http://www.wrcc.dri.edu) for climate information from western States). It may be helpful to create a subfolder for each climate station so if information is compiled or analyzed based on an individual climate station it can be stored in the appropriate folder. Climate stations must be labeled by name and number. For example, **Hayfield_Reservoir_043855**.

2. The **PRISM_Maps** subfolder will house all PRISM maps that have been created for the MLRA. This could be divided into subfolders by seasons and annual totals. For example, **Spring, Summer, Fall, Winter, Annual_Precipitation**, and **Annual_Temperature**. Subfolders for other types of PRISM climate information, such as **Extreme_Lows** or **Extreme_Highs**, may also be needed.

3. The **Climate_Statements** subfolder will house narrative information for ecological sites within the MLRA. A climate statement for the MLRA and one for the more localized climate are required for each ecological site.

4. The **Climate_Data** subfolder will house information that has been collected and compiled for the MLRA. It includes analysis and assessment of climate information for the MLRA, etc.

(ii) The **Soils** subfolder must include **OSDs**, **Soil_Maps MLRA**, and **Soils_Ecological_Sites** subfolders.
1. Official Soil Series Descriptions (OSDs) are available at http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/soils/survey/class/data/?cid=nrcs142p2_053587. The OSDs subfolder will house several additional subfolders that separate the soil series in the MLRA by different important soil properties or characteristics. For example, Soils_SandySurfaceTexture, Soils_Argillics, or Soils_Serpentine. The soil series information must be copied and pasted from the OSD website into a Microsoft Word document and then saved to the subfolder under the soil series name. For example, Petescreek.doc. If available, also include a photograph of the modal soil profile (or another representative soil profile) and a photograph of the landscape that is associated with the profile. Save these as Petescreek_SoilProfile and Petescreek_Landscape.

2. The Soil_Maps_MLRA subfolder will house all soil maps pertaining to the soils in the MLRA. This can include pit location maps, soil map unit maps, soil stability rating maps, etc.

3. The Soils_Ecological_Sites subfolder will house files pertaining to soil-ecological site correlation. This must include all soil-ecological site legends and lists identifying soils that are associated with certain ecological sites within the MLRA. It is recommended that several different subfolders be used. Examples include soils by major vegetation groupings, such as soils under mountain big sagebrush in MLRA 21; shallow and very shallow soils and associated sites; and soils on valley bottoms and associated ecological sites.

   (iii) The Maps__Aerial_Photos subfolder will house all maps and aerial photographs that pertain to the area of responsibility, under subfolders by MLRA.

   (iv) The Hydrology subfolder will house any information that pertains to the hydrology of the MLRA or area of responsibility. This subfolder could have additional subfolders, by MLRA, but it is not necessary. Files may include hydrology models, watershed level projects, etc.

   (v) The MLRA-wide_Noxious__InvasiveSpp subfolder will house all information on noxious and invasive species, by MLRA. This subfolder can be organized as necessary, but it must be arranged in an easily understandable format. A suggested organization includes subfolders such as Distribution_Maps, Photos, Literature_on_Species, Restoration_Techniques, and Plant_ID_Information.

   (vi) The Wildlife subfolder will house all information on the wildlife species in the area of responsibility. This subfolder can also be arranged as necessary, but it must be arranged in an easily understandable format. A suggested organization includes subfolders such as Distribution_Maps, Special_Status_Maps, Photos, Literature_on_Species, Habitat_Restoration, and Habitat_Needs.

   (vii) The Uncorrelated_Data subfolder will house all other information that does not appropriately fit into one of the other folders.

(7) The LRR_Information folder will house information that is specific to and covers the entire land resource region. See the MLRA_Information section above for information on how this folder must be organized.

(8) The Policies_and_Protocols folder will house all information on ecological site policies and protocols, including any area-wide, statewide, region-wide, and nationwide policies and protocols. It must also include copies of the National Range and Pasture Handbook, National Forestry Handbook, National Forestry Manual, and National Soil Survey Handbook.

(9) The Presentations folder will house all information on presentations related to ecological sites.

(10) The Existing_Range&Woodland_Sites folder will house all digital copies of old range and woodland sites and any other digital data that pertains to the old sites. It must also include a master spreadsheet file that correlates the old site to the new ecological site.

(11) The Uncorrelated_Data folder will house all information that has not been correlated to an ecological site. This folder must have a subfolder for each project area. Each project area
subfolder must have Vegetation_Data, Soils_Data, and Photos subfolders. For example, Uncorrelated_Data-CA630_Central_Sierra_Foothills-Vegetation_Data-photo name.jpg. All data in this folder must have accompanying metadata that explains where it came from, why it has not been correlated, where it was taken from on the landscape, and any other information that can help a user correlate it later.
Example 2

(1) There must be one (1) PRIMARY FOLDER, Ecological_Sites. Within this folder must be the Databases, LRR_Information, MLRA_000, Policies_Protocols, Presentations, and Uncorrelated_Data subfolders.
   (i) Databases.—This subfolder houses large datasets that contain information from multiple sites, LRUs, and MLRAs, including DIMA and outside data sources, that the user does not want to split up and is used for update purposes. Use of appropriate subfolders for various sources is recommended.
   (ii) LRR_Information.—This subfolder houses information general to the LRR. Use subfolders as appropriate.
   (iii) MLRA_000.—This subfolder houses all data relevant to a particular MLRA (subfolders described under number (2) below). Create a separate subfolder for each MLRA that will have stored data. Most MLRA offices have correlation work or have responsibilities with neighboring MRLAs for which the stored data will be used, or they will use the stored data for reference.
   (iv) Policies_Protocols.—This subfolder houses national and regional guidance, handbooks, methodology manuals, etc.
   (v) Presentations.—This subfolder houses all presentations and education, outreach, and training material that are relevant to ESs in general but are not for a specific site. Use subfolders as appropriate, and name them by session, topic, or date.
   (vi) Uncorrelated_Data.—This subfolder houses all data for a particular site, LRU, or MLRA that is not correlated. It may temporarily house modal concepts prior to establishment of a site or project. Use subfolders as appropriate.

(2) The MLRA_000 must have the X000XX000XX, ES_Projects, LRU_Information, and MLRA_Information subfolders.
   (i) X000XX000XX.—This subfolder houses the site ID for each ecological site (subfolders described under number (3) below).
   (ii) ES_Projects.—This subfolder houses the administrative records, tracking of work group meetings, and organization information in subfolders by project name. No vegetation or soil data should be in this folder unless it is correlation work.
   (iii) LRU_Information.—This subfolder houses general information about LRUs in the MLRA. Subfolders may be used as appropriate for maps, climate, wildlife, etc.
   (iv) MLRA_Information.—This subfolder houses general information about the MLRA. Subfolders may be used as appropriate for maps, climate, wildlife, etc.

(3) The X000XX000XX subfolder must have the Admin, Correspondence, MapsPhotos, ArchiveDescription, Data, and ES subfolders. The most current approved and certified ES information must be housed in the X000XX000XX subfolder, not in any of its subfolders.
   (i) Admin.—This subfolder houses the QA/QC reviews, readme files, and project plan information, if specific at the site level.
   (ii) Correspondence.—This subfolder houses field notes, work sessions specific to the site, and organization information.
   (iii) MapsPhotos.—This subfolder houses map products (.pdf and .jpg files) at the main level and photographs in subfolders. The suggested photograph naming protocol is <siteID>_<photosource>_<topic>.
   (iv) ArchiveDescription.—This subfolder houses old site descriptions that were approved. The date and version must be included in the file name. For example, <siteID>_Ver3_2005-03to2012-09.
   (v) Data.—This subfolder will likely require subfolders for various datasets and/or analysis, soils, vegetation, and literature. Use file naming protocol for literature (<author>_<year>_<title>).
(vi) **ES.**—This subfolder houses all the pieces and parts, drafts, and versions of the ES information. Possible subfolders include **STMs** and **Plant Tables**.
The following are the resulting file structures as they appear on a computer screen. (These structures could also be formatted in a table to further clarify which are parent folders, subfolders, etc.)

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(190-630-H, 1st Ed., Amend. 1, March 2017)
Part 631 – Development of Ecological Site Concepts and Descriptions

Subpart A – Ecological Site Concepts

631.0 Purpose

A. An ecological site (ES) is a unique combination of abiotic and biotic factors, including climate, geology, geomorphology, soils, hydrology, vegetation, and disturbance regimes. The concept for each ES is identified, differentiated, and described based on an interpretation of how relationships among those factors influence land use and management, including soil-plant interactions, plant community composition, vegetation structure, net primary production, and other ecological processes. The information documented for an ES includes the following:

1. Biotic and abiotic properties and characteristics that differentiate a site (e.g., climate, physiography, soil characteristics, and hydrology).
2. Ecological dynamics of a site, which are illustrated and described in a state-and-transition model (STM). The STM shows how changes in disturbance processes and management can affect the structure and function of a site.
3. Interpretations about land uses, management strategies, products, and ecosystem services that an ES can support.
4. Appropriate practices for achieving conservation and management objectives, such as maintaining or achieving a specific plant community.

B. The purpose of Part 631 of the National Ecological Site Handbook, is to provide the guidance necessary to systematically define and describe an ES and its primary element, the state-and-transition model.

631.1 Definition

An ES is a conceptual division of a landscape based on recurring soil, landform, geological, hydrological, and climatic characteristics that result in distinctive potential plant communities or total production and distinctive responses to management actions and natural disturbances. The fundamental assumption of an ES concept is that soils, climate, geomorphology, and vegetation dynamics can be grouped with sufficient precision to increase the probability of success for site-specific predictions and decisions. Natural systems seldom have distinct boundaries in space or time; therefore, an ES has a certain amount of variability and uncertainty. Accounting for and describing the variability and uncertainty are key to providing credible, accurate, and usable ES information.

631.2 Defining the Ecological Site Concept

The identification and characterization of an ES are based on the fundamental premise that the behavior of plant communities under various land uses is governed by the environmental factors of energy flow and availability of moisture and nutrients and is modified by natural and anthropogenic disturbance regimes. The environmental factors vary because of differences in climate, geology, topography, and edaphic characteristics. Collectively, these factors determine soil temperature, moisture availability, and nutrient constraints that interact to affect vegetation patterns and ecological processes associated with an ES.
(1) The Land Resource Hierarchy

(i) ESs are part of a nested spatial hierarchy used to subdivide landscapes to help organize information for management and policy decisions. For natural resource management, quantitative factors such as climate, soil, landform, and geology can be used to guide these multiscale subdivisions. The goal of the NRCS Land Resource Hierarchy is to assist users in gaining a better understanding of the factors that govern how land responds to management and to serve as a basis for organizing these factors.

(ii) Each level in the hierarchy represents a unique set of attributes, scale, and products. Critical in the analyses and development of products at all levels is explicit definition of the concepts that distinguish individuals within a level.

- Land resource regions (LRRs) are at the highest level of the hierarchy. They represent broad agro-physiographic divisions. LRRs are identified by a letter and a name. For example, E—Rocky Mountain Range and Forest Region (USDA Agriculture Handbook 296, pages 113-114).

- Major land resource areas (MLRAs) are at the next level of the hierarchy. They are defined as a single physiographic province or a characteristic subset thereof. They represent areas that have similar potentials or limitations. MLRAs are identified by a number and a name. For example, 35—Colorado Plateau (USDA Agriculture Handbook 296, pages 96-99).

- Land resource units (LRUs) are subdivisions of MLRAs. They are characterized by ecologically distinctive properties that are interrelated. An LRU is distinguished by at least one of seven factors—geology, physiography, water

Figure 631-A1: NRCS Land Resource Hierarchy for soil survey (left) and ecological site inventory (right). Redrawn from Salley et al., 2015.
resources, climate, soils, land use and management history, and biology. The
more factors that differ at a boundary, the stronger the boundary concept. Soils
within an LRU share defining characteristics, but they are unique based on
spatial patterns, particularly landscape components (e.g., mountains, hills, and
valleys). LRUs are identified by a letter and a name (Title 430, National Soil

- Ecological site groups (ESGs) are subdivisions of LRUs that have similar soil,
climate, and landform attributes; thus, they also have similar ecological state
attributes (i.e., vegetation species/lifeform relationships) and transition processes
(i.e., disturbance regimes and management actions). The species composition
and primary production of the ecological sites in a group differ as do the rate of
change and the magnitude of disturbance necessary to cause transitions. ESGs
are developed for landscape-scale management or to describe large, complex
landscapes. ESGs should provide the context for individual ESs based on the
similarity of dynamics at the landscape scale and the management objectives for
the landscape. ESGs are analogous to the STATSGO2 (General Soil Map) level
in the Soil Land Resource Hierarchy.

- ESs are groupings of abiotic factors that have similar vegetation attributes,
dynamics, and management responses. This level of precision represents the
relation of soil properties to vegetation behaviors at the smallest scale. The
variability in soil properties grouped into an ES should reflect the current
understanding of soil-site interactions and the impacts these interactions have on
behaviors. For mapping purposes, individual ESs are associated with soil map
units (SSURGO) in the Soil Land Resource Hierarchy. Because map units
commonly are composed of multiple components, multiple ESs can be tied to a
single map unit (Associated Ecological Sites in the Ecological Land Resource
Hierarchy).

(iii) Because of the wide range of spatial scales (precision) used in creating soil map
products, it may be difficult to partition the spatial variability of a single ES into
accessible map products without further ad hoc site-specific investigations. Spatially
juxtaposed ESs commonly interact as part of a larger landscape, integrating multiple
ecological processes that collectively influence ecosystem services. Thus, an
understanding of the relationships and interactions among multiple ecological sites
on a landscape is critical for conservation planning, implementation, and assessment.

(iv) If an individual ES concept can be defined clearly, corresponds to identifiable and
important differences in ecological potential and management, and is operational or
accessible to users (i.e., few in number and readily verified in the field), an ES is the
preferred initial option in the development process. Existing individual ESs can be
combined into ESGs later to test and refine concepts. An ESG is the preferred option
if a climate-soil-vegetation environment is highly complex, has ambiguous
boundaries, and is burdensome for users to distinguish or requires intensive effort to
distinguish. The ESG hierarchical level is most useful for ecological and
management interpretations at a landscape scale. ESGs may be a logical initial
approach in complex environments for which ES concepts have not been developed
yet. The ESGs are valid soil survey products.

(2) Soil Properties as a Basis for Applying Ecological Site Concepts
(i) The composition, distribution, and behavior of plant communities are strongly
influenced by soil properties, such as temperature and the availability of moisture and
nutrients. These properties are used to differentiate ESs at both the conceptual and
applied levels. Key soil properties are identified by well-defined soil survey
principles:
Stratigraphy incorporates observations and measurements of parent material, soil layers, and diagnostic horizons. These include features such as depth to bedrock or another restrictive layer, argillic horizon, calcic horizon, and water table.

Pedology refers to the study of the development and nature of the physical and chemical properties of soil, such as texture, water-holding capacity, pH, and salt content.

Geomorphology is the study of the physical features of the earth’s surface and their relationship to geologic structures. Landscape, landform, landform position, elevation, slope shape, and aspect are considered in making key geomorphic subdivisions.

Hydrology includes an understanding of how water moves through a landscape and how the movement defines ecological site concepts. Hydrology encompasses processes such as runoff, flooding, ponding, root zone moisture, and water table dynamics.

(ii) Carefully selected indicator plant species may be observed and documented to help develop and test ES concepts.

(iii) An understanding of soil properties, as expressed in the description of map unit components, is necessary to correlate ES concepts, behaviors, and attributes with soil survey products and to generate credible maps and field guides.

(3) Reference Conditions for Ecological Sites and States

(i) ES reference concepts are the climatic, soil, and ecological factors and relationships that can be used to develop quantitative descriptors of conditions that differentiate ESs and ESGs and can provide a basis for interpreting dynamics. If these variables are grouped correctly, the result is mappable landscape units that exhibit distinctive kinds and amounts of vegetation and distinctive responses to disturbance and management. The development of ESs begins with logical and clearly expressed concepts that are a basis for definition and differentiation.

(ii) Once concepts of a spatial pattern across a landscape are defined and verified, temporal dynamics can then be developed and refined based on general rules of vegetation behavior. The inherent complexities of vegetation dynamics require a synthetic understanding of the initial conditions associated with historic vegetation, past and current disturbance regimes, and the effects of variabilities in climate. Although long-term trends in vegetation can be described through use of techniques such as pollen analysis and dendroecological studies, the historical ecological information generally is not relevant for management-appropriate timeframes. To facilitate communication, the period immediately preceding widespread Anglo-European settlement commonly is used as a timeframe for assumed climatic conditions and disturbance regimes that influence vegetation dynamics for the reference condition. This arbitrary time period should be interpreted with caution because significant anthropogenic modification may have preceded Anglo-European settlement in some areas and assumptions about presettlement conditions are difficult to verify.

(iii) Because of the importance of reference conditions in evaluating current land conditions and determining management goals, objectives, and practices, the selection and documentation of specific reference communities should be transparent. Although reference conditions must be relatively precise to support quantitative assessments, the uncertainties should be documented to allow for a realistic assessment of management opportunities. ES developers should provide extant examples of reference state plant communities that can be used as a basis for long-term observations to validate and refine reference conditions. If suitable examples of
extant communities are not available, developers should provide strong inferential evidence (e.g., reliable historical documents or proximate analogous sites and communities) to support the designation of reference states and plant communities.

(iv) The reference state may have multiple plant communities within the historical range of variability and natural disturbance regimes that have been verified by ecological data or published literature. Attributes of the reference state are derived from historical information, expert knowledge, and current observations and measurements in the MLRA.

(v) Reference state or community conditions should not be regarded as the default management goal; however, these conditions generally provide land managers the most options for future objectives. ES developers should consider the range of ecosystem services when defining, differentiating, and communicating reference state and community concepts.

(4) Modal Concepts for Ecological Sites

(i) Modal concepts of ESs are the foundation for the more detailed descriptions of state and community attributes and dynamics. The modal concepts should be defined by a specific combination of the controlling abiotic factors for an ES or ESG. The modal concepts provide a basis for distinguishing an ES from competing sites and describing the range of behaviors associated with a unique combination of factors. Important vegetation attributes and behaviors may be included as part of the modal concept, but they should not be considered proximate causes in the concept.

(ii) The modal concept should account for the natural range of variability in important factors across the spatial extent of an ES. The concept should include a description of the vegetation attributes and behaviors (e.g., species composition by weight, foliar cover, and total production, etc., and vegetation dynamics). The range described should cover the most representative and extensive areas of an ES, not the absolute range for all areas of an ES.

631.3 Describing Ecological Dynamics

A. An accurate description of the temporal dynamics of an ES is essential for identifying management goals and objectives, selecting and implementing actions, monitoring progress, and assessing effects. A state-and-transition model (STM) is the preferred method to describe the temporal dynamics of an ES or ESG. STMs display and describe the range of multiple stable states (unique combinations of biotic and abiotic attributes) and the transitions between states (driving forces, processes, and thresholds). An STM provides a general graphical overview of ecological states and transitions, and the accompanying narrative describes these in detail. ESs that have similar dynamics can be combined into an ESG.

B. When describing ecological dynamics in an STM, developers should—

(1) Limit the discussion to ecological processes, events, mechanisms, and practices that can drive a change from one state or community to another.

(2) Avoid assumptions of land use goals or objectives.

(3) Avoid qualitative assessment terms (e.g., good/bad or desirable/undesirable).

631.4 Parts of a State-and-Transition Model

A. STMs are used to organize, synthesize, and contextualize information relevant to management (Bestelmeyer et al. 2017). They are not intended to be predictive beyond the information and relationships they contain. Few, if any, ESs have been investigated sufficiently to support an STM developed solely from field data. Thus, the assumptions and logic that underlie an STM
must be clearly stated. In the absence of experimental information, process and logic are sufficient to support the development and application of STMs for management decisions. All STMs are iterative and subject to continual testing and refinement. The strengths and weaknesses of STMs, individually and as groups, should be primary considerations in determining priorities for data collection and testing.

B. STMs can include a single stable state or multiple stable states, depending on the ecosystem. Description of the state transitions in an STM should incorporate the concepts of ecological resistance and resilience (Briske et al. 2008, Bestelmeyer et al. 2009). Ecological resistance is the inherent ability of an ecosystem to undergo disturbance without significant change. Ecological resilience, as it applies to ESs, is the amount of change or disruption required to transform an ecosystem from being maintained by one set of mutually reinforcing processes and structures to a different set of processes and structures (state change). Conditions sufficient to modify the structure and function of a state beyond the limits of inherent ecological resilience result in an alternative state. Transitions, without regard for desirability, are the ecological processes, mechanisms, and feedbacks that can enable change from one state to another. Management actions can be used to direct transitions.

C. STMs include a diagram and a written narrative. They have four fundamental parts—states, transitions, plant communities, and community pathways. Refer to part 631, subpart C, section 631.25, for examples and details on formatting, labeling, naming, numbering, and lettering STMs.

(1) Ecological States
   (i) An ecological state is 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. Ecological function is defined as the way in which a soil-plant community processes water, energy, and nutrients. The existence of states on an ES can be supported only by information describing these processes and how one state differs from others on a site.
   (ii) Each ecological state has unique attributes important for decision making, such as resilience and the specific management actions and disturbance regime needed to maintain the state (Bestelmeyer et al 2017). Although this information is critical, it may be too complex for nonexperts. Thus, readily accessible soil and vegetation indicators of each state should be included. These can be used by nonexperts to distinguish one state from others.
   (iii) The possibility that different states may be on the same site over time means that information (inventory) about the current state is needed to make land management decisions, including those for conservation planning, implementation, and assessment. If known, the expected ecosystem services should be included in the description of each state.
   (iv) Each state has an inherent range of variability in vegetation and soil properties (both static and dynamic). The ecological processes, mechanisms, and disturbance regimes (natural and management actions) that maintain a state or lead to a change to another state should be thoroughly described. Variations in land use on an ES are ecological state changes, and processes that lead to change (i.e., tillage, planting, abandonment, flooding, etc.) are transitions. The impacts of disturbance regimes in driving ecological state changes should be described in terms of ecological processes, mechanisms, and associated management actions. Include assessment of risks, but do not include assessment of desirability.
   (v) Generally, the available information associated with ecological states (attributes, indicators, and services) is not uniform. It is reasonable to organize the information

based on available literature, observations, and logic. It can then be presented as indices, relative rankings, probabilities, and estimates to support decision making.

- **Reference State**
  - Designation and description of a reference state (sec. 631.2 of this handbook) is required for each ES. The reference state has traditionally been arbitrarily defined as the community in existence at the time of Anglo-European settlement. This approach has become too narrow because of a more nuanced understanding of changes in climate over the past millennia, the impact of changes in large-scale disturbance regimes, and the universal importance of human influence in land management. Selection of a reference state may be based on multiple criteria, including the ecological state that is most resistant to change, offers the most options to achieve management objectives, and reflects a defined “natural” disturbance regime. Regardless of the logic that underlies the selection of a reference state, the description should include community-scale vegetation attributes, dynamic soil properties, and animal communities dependent on a clearly defined disturbance regime that reinforce the continued function of the ecological state through their interaction. The reference state should be acknowledged readily by a variety of stakeholders.
  - Because of the inherent variability in the interactions among soil properties, fluctuations in climate, and disturbances at the ES level, reference conditions may circumscribe easily reversible shifts among multiple plant communities. These are defined as transient dynamics. Some ESs may have a reference state characterized by a single plant community, such as those in high-elevation alpine areas, grass-dominant areas, and some forested areas that have a udic soil moisture regime. All plant communities in the reference state have a similar rate and magnitude of ecological processes such as nutrient cycling, hydrology, and energy flow. Shifts between plant communities in a reference state can be relatively rapid or occur over a long period, but the communities remain ecologically similar in terms of the controlling processes and management needed to maintain the reference state.
  - Designation of a reference state and its attributes is necessary for the development and application of quantitative and qualitative assessment tools (i.e., rangeland health assessment and soil health assessment). Credible estimates of the natural range of variability in the precise attributes is critical for accurate assessments. The reference state and plant communities should not be the default management objective in conservation planning, program implementation, or policy development.

- **Alternative States**
  - An alternative ecological state is one of several potential states of an ES that is functionally different from the reference state in terms of important ecological processes, kinds and amounts of ecosystem services, and management requirements. The STM should organize all the possible states for an ES under common land use and management regimes. Developers do not need to account for every potential use or management action; however, they should exercise judgment in anticipating trends that signal rapid, widespread changes in how a particular ES or landscape might be used.
  - As with the reference state, each alternative state should be based on direct observation of extant examples or strong inferential evidence. The requirements for documenting and describing an alternative ecological state are the same as for the reference state. STMs and individual ESs should be evaluated and refined continually. Evidence to support the reference and
alternative states should be sought and evaluated over a long period. A plan is needed to verify and test each STM.

- An alternative state implies that substantially different management is needed to maintain the state or transition to other states; therefore, evidence for an alternative state should be identified and evaluated carefully. The assumptions, methods, and supporting data or literature used to define alternative states and thresholds in STMs should be documented, peer reviewed, and if needed, further developed. These include the properties of the reference and alternative states, ecological mechanisms causing transitions and precluding recovery of reference states or other states, sources of evidence, assumptions, and level of confidence in portions of the STM based on these factors. Care should be taken not to confuse dynamics among plant communities in a state with transitions between states.

(2) Transitions and Thresholds

(i) Transitions are the sum of changes in biotic or abiotic influences or events, acting independently or in combination, that contribute directly to loss of resilience of a state and result in change to another state. A transition is the result of processes causing a change between states (controlling variables, triggering events, feedbacks, and thresholds) that culminate in a new equilibrium, or state.

(ii) State changes in STMs must include information on the associated transition (changes in ecosystem processes that push the system across a threshold). The presence of a threshold implies that the processes and events maintaining a state are not sufficient to avoid change, a significant difference in the disturbance regime has caused a change, and intensive efforts are needed to reverse the transition or the change is practically impossible to reverse. Description of a transition should address these implications. Generally, there should be separate states and a transition only if a threshold is described. It is not necessary to precisely define a threshold. In most cases, a precise definition of a threshold is not practical and can be misleading in a management context.

- Transitions
  - For each transition in an STM, the following components should be described:
    -- Mechanisms of the transition (external drivers, triggering events, feedbacks, and indicators)
    -- Thresholds, including timelines
    -- Requirements and constraints for reversing the transition
  - Descriptions of transitions between states should emphasize the soil, hydrologic, and vegetation indicators that signal impending change and the dynamic processes that reduce the resilience of a state. The approximate length of time required to reduce resilience and the triggers needed to cross a threshold should be described. Care should be taken to describe the specific ecological processes and resulting impacts (e.g., “loss of native seed bank” or “loss of deep water infiltration because of shallow-rooting species,” not “introduction of invasive species”).

- Thresholds
  - Transitions describe the process of change between states, including the drivers and mechanisms. Thresholds describe the conceptual boundaries between two states. Thresholds are difficult to define precisely and even more difficult to measure and manage in a practical sense. They can best be thought of and expressed as the point in time when processes that impart resilience to a site (negative feedbacks) are overwhelmed by processes that drive change to a different state (positive feedbacks).
Changes in vegetation processes and dynamic soil properties should be included in the description of a transition. Examples of dynamic soil properties include soil organic matter, bulk density, pH, salinity, soil erosion, and aggregate stability. These properties parallel changes in plant communities and transitions between states, and they can be used to help understand the complexity and risk of transitions. Changes in soil properties commonly lag changes in vegetation dynamics, and changes in soil processes can be difficult to detect.

(3) Plant Communities

(i) Plant communities are unique assemblages of plants and associated abiotic properties that can develop over time on an ES. Plant communities identified and described as part of the STM should be recognizable and have documented management or ecological significance. Plant communities in states frequently change as a result of natural disturbances or relatively minor alterations in management. Plant communities in a single state (transient dynamics) may have similar floristic or functional groups, but the ecological processes and ecosystem services can be influenced by changes in composition. Collectively, the plant communities represent the range of variation in a state, including conditions that place the state at risk for transition. Plant community dynamics are best considered a continuum or gradient of an ecological state, but they can be recognized as discrete entities for management purposes.

(ii) An at-risk plant community is indicative of low resilience, and it is likely to undergo a transition to a new ecological state. At-risk communities can be designated in the reference state and in an alternative state. “At risk” indicates that a more resilient plant community can be recovered in the state if appropriate prescribed management actions are applied.

• Indicators

Indicators that can help land managers recognize vulnerability to the initial stages of a transition should be identified and described. Indicators should be robust enough to be reliable across the range of conditions for an ES. They should also be adequately accessible so that management for specific responses can be implemented without repeated data collection or statistical analysis.

• Management Actions

Documentation of the ES includes the management and conservation practices (with reference to standards) that influence maintenance of various states and plant communities or transitions between states as identified in the STM. This information can assist the landowner in determining the cost:benefit ratio associated with various land use and management options in conservation planning.

(4) Community Pathways

Community pathways describe the causes for shifts among plant communities. Community pathways can include the concepts of episodic plant community changes as well as traditional ecological concepts of succession. In contrast to transitions between alternative states, shifts in plant communities are reversible through succession, natural disturbances, short-term climatic variations, and use of practices such as grazing management. When describing community pathways, care should be taken to provide detailed information on the specific causes for change from one plant community to another (e.g., more detailed information than “time and growth”). Change within an
ecological state is likely to be continuous rather than discrete; thus, it can be shown graphically as a continuous relationship or described in text.

631.5 Role of State-and-Transition Models

STMs are developed to provide actionable information about the ecological dynamics of an ES, the processes and mechanisms of ecosystem change, and the management actions that can be used to influence change (sec. 631.4 of this subpt.). STMs are developed iteratively using relevant published literature, expert knowledge, field reconnaissance and inventory data, existing agency inventory and datasets (e.g., National Resources Inventory, Forest Inventory and Analysis, and BLM Assessment, Inventory, and Monitoring data), and data on the monitored effects of management. Ideally, STMs are developed initially using existing information and then are field-tested and refined with data collection that is well defined and for a specific purpose.

631.6 General Guidelines for Developing State-and-Transition Models

When developing STMs—

1. Describe all ecological states and plant communities that are typical and known to occur on an ES and all common land use and management scenarios. If empirical data are lacking, expert knowledge can be used but it should be justified and well documented. Develop the model with the best available information, and ensure that the process of information collection, synthesis, and interpretation is logical and transparent.

2. In all narratives associated with the states and plant communities of the STM, describe in detail the ecological processes affected by the disturbances and management actions that drive change in the ES. For example, if fire removal is the reason that shrub encroachment occurs, explain why or how it increases encroachment and cover potentials (e.g., shifting of resources due to shading and more nutrient uptake by woody species than by herbaceous species, increased competition for soil water at a greater depth, etc.). If possible, identify the rates of intensity and timing for disturbances or management actions, such as the frequency, severity, and duration of a disturbance (e.g., ground surface fires every 3 to 5 years).

3. Describe at-risk plant communities, if applicable. These communities are vulnerable to change to another state and are early indicators of impending change, regardless of the relative desirability.

4. If known, include explicit reference to dynamic soil properties, applicable health indicators, and other indicators that provide information on expectations for transitions between states.

5. If known or can be estimated, describe the timeframe for community pathways or transitions in the STM.

6. Include all relevant drivers and natural and human-induced disturbances, such as the impact of wildlife and livestock, wildland fire or lack of fire, recreation activities, tillage, alterations to water hydrology, introduction of invasive species, and other management actions.

7. Be as quantitative as possible. A high degree of accuracy in predictions for most indicators commonly is impossible. The best information about the rate and probability of change is essential to providing working hypotheses that can lead to improved communication and provide an understandable basis for further research.

8. Describe the relationships between ecological states and plant communities and ecosystem services. Although it is unlikely that all ecosystem services can be addressed, information about relative changes and tradeoffs can be important in decision making.
631.7 Recognizing a State Change Versus a Different Ecological Site

A. Seemingly permanent changes that affect the potential of a site can make developing ES information difficult. These changes can be in the regional climate, the geomorphic or edaphic properties that define a site, or in the vegetation dynamics of a site. Alternative ecological states may persist for many decades without evidence of transition to the reference state even with aggressive management actions. In most cases, the ecological potential for a site is not permanently altered merely because an alternative state persists. The inability to restore an alternative state to a reference state because of cost or lack of knowledge or technology does not mean that a new ES is needed. Alternative states are recognized and described if the physical or ecological processes on a site are severely altered and cross a threshold. A new ES should not be developed if the soil and physiographic characteristics used to define the ES concept are unchanged.

B. If a proposed revision of an ecological site is a result of changes in climate, accompanying changes in the regional and landscape context for all soils and sites at the MLRA or LRU level should be included in the evaluation and potential change. This is best accomplished by a soils update project through the National Cooperative Soil Survey (NCSS). If the geomorphic or edaphic properties of an existing site have changed sufficiently in spatial extent to warrant development of a new site, accompanying recorrelation of the soil map unit components that conforms to soil survey protocols should be included.

C. Some ESs have been invaded or planted with non-native species. These species may become well established, or naturalized, and persist in plant communities of states that have recovered much of the historic structure and composition. Invasion or introduction of non-native species results in an alternative state; it is not a basis for establishing a new ES.

D. In some areas, naturalized plant communities largely have replaced native plant communities (parts of Hawaii, the Caribbean, and the annual grassland in California). These changes occurred before the flora and fauna of the areas were extensively documented; thus, it is impossible to reconstruct the reference state from historic data or by sampling extant sites. The naturalized plant communities in these areas are used to define the reference state for the ES information; however, approval is needed from the relevant national program leaders of the cooperating agencies.
Part 631 – Development of Ecological Site Concepts and Descriptions

Subpart B – Steps for Ecological Site Differentiation and Development of Ecological Site Information and Products

631.10 Purpose

A. The process and methods for differentiation and description of ecological sites (ESs) involve several steps of this handbook. The steps can be divided into two distinct and complimentary stages—production of provisional ecological site products and development of iterative products. Given that the factors that define ESs and the products and interpretations derived from ES information change frequently, ESs are always subject to revision.

B. Work in the provisional stage is centered on gathering and synthesizing existing information and data to create initial ES concepts, link soil properties (map unit components) to important ecological processes, and develop preliminary management interpretations. The endpoint of the preliminary stage of ES development is the provisional ecological site. Provisional ESs should be completed as a group at the major land resource area (MLRA) level (or sub-MLRA level in complex MLRAs) to ensure consistency and aid in correlation. Preliminary stages involve development and documentation of ecological site groups (ESGs) or individual ESs. The following products result from the preliminary stage:

1. An ES key
2. Soil properties (map unit components) correlated to ESGs or individual ESs
3. Generalized state-and-transition models (STMs)
4. Identification of ecological state dynamics, including driving processes, mechanisms of change, and important management actions (conservation practices)

C. At each stage, the concepts that have been developed are tested against existing data and knowledge. If there is insufficient data or lack of expert agreement in the preliminary products, a plan to resolve uncertainties should be developed. The plan may include experimental data collection, structured observations, or enhanced techniques to organize and document expert opinion. If new field data collection is warranted, an a priori plan approved by the technical team should include hypotheses, methodology, and statistical treatment, including confidence estimates. Lack of data for a specific site or a specific ecological state is not sufficient reason for field data collection. All sources of information should be thoroughly investigated before new field data projects are undertaken. If there is sufficient expert agreement in the preliminary products, collection of new field data is not needed.

631.11 Preliminary Stages

A. Establish Local Workgroups

To make use of local expert knowledge, an interdisciplinary workgroup should be formed at the local level. Persons living on and managing the land on a regular basis may have practical knowledge about the ecosystem functions, so they should be included in this group. For ESs that include both private and public land, personnel from the agency managing the public land should be in the workgroup. Every effort should be made to involve local experts such as scientists, academics, agency professionals, conservation partners, landowners, and land managers. At all stages of development, expert workgroups are efficient for organizing existing information, identifying knowledge gaps, and agreeing on priorities for future work. The Handbook for Collaborative State-and-Transition Model Development provides a detailed guide for organizing
and conducting partner and customer workshops for all phases of ES development

B. Define Geographic and Ecological Extent

(1) Currently, the major land resource area (MLRA) and land resource unit (LRU) concepts will be used in differentiating the geographic extent of a single ES.

(2) Some ES concepts may extend beyond the mapped boundaries of an MLRA. Most MLRAs have small areas, typically tens of square miles or less, that do not fit within the overall description of that particular MLRA but may fit within the description of an adjacent or nearby MLRA (USDA Agriculture Handbook 296, 2006). Generally, immediate adjustment of the MLRA boundary is not required, but any issues should be identified for consideration in the next MLRA update.

(3) Occasionally, it might be useful to refine the geographic and ecological extent of the study area for a new ES project to an area smaller than an MLRA or LRU. The area of study could be based on certain landforms and/or parent material within an MLRA or LRU. This narrows the focus and makes it easier to prioritize analysis of the existing information and literature available. It also limits the area that needs to be covered during the reconnaissance phase. In this phase, ES developers should attempt to reconcile differences among agency-specific spatial hierarchies, such as those of the Forest Service (FS), NRCS, and the Environmental Protection Agency (EPA).

C. Gather Background Information

(1) Review ecological literature, data, and local expert knowledge relevant to the defined geographic and ecological extent, including information on local climate, geology, soils, and current and historic vegetation. Published literature and mapping of the area should be reviewed. Existing ecological and vegetation classifications provide knowledge and information useful for developing ecological site concepts. These classifications, such as potential natural vegetation (PNV) and habitat type, commonly describe ecologically significant plant species (indicator species) or potential plant communities associated with soil moisture, nutrient, and temperature gradients and differences in ecological potential within landscapes. The final ES product supplements the information provided by these classifications.

(2) Background information includes, but is not limited to—

(i) Current community ecology (synecological) information.
(ii) Historical literature documenting the historic vegetation (journals, survey notes, prior investigations, etc.).
(iii) Past vegetation data.
(iv) Vegetation and ecological classifications and descriptions.
(v) Plant species (autecological) information.
(vi) Natural disturbance regimes.
(vii) Botanical references.
(viii) Physical environment.
(ix) Soil surveys and other land inventories.
(x) Hydrologic information.
(xi) Zoological information.
(xii) Farm, ranch, and research station data and records.
(xiii) Interviews with longtime residents and land managers that provide information on management actions (grazing, use of fertilizer or herbicides, timber harvesting, haying, etc.), vegetation, disturbances, and other factors.
D. Evaluate Existing Data

(1) Existing data sources provide information previously collected for an area that can be used in the development of ES concepts and descriptions. Assemble and review all of the most useful and relevant data currently available for the defined geographic and ecological extent. The completeness, precision of estimation, accuracy, and methods of measurements of the data may vary. Depending on the source, type, and quality of the data (plot data, data from remote sensing systems, etc.), it may be suitable for—
   (i) Developing the ES concept.
   (ii) Stratifying the landscape for reconnaissance or further sampling.
   (iii) Using as plant community data for developing state-and-transition model (STM).
   (iv) Using as interpretations for the descriptions, such as data on wildlife habitat and fuels, etc.

(2) This information may include vegetation, soil, and other physical data collected concurrently from integrated plots or vegetation data only. Vegetation data should be assessed to determine the metrics recorded (e.g., production, cover, density, frequency), the concepts used (e.g., foliar or canopy cover), and the techniques used (e.g., double sampling, harvesting, estimating). Data may differ in how plant species attributes were determined (e.g., species production, species canopy cover, basal cover, vegetation structure) and in the detail of soil descriptions (e.g., not a full soil pit description, soil only described to a shallow depth, auger cores).

(3) Sources include maps, data from remote sensing systems, research, publications related to ecological sites, and inventory and monitoring plot data from government agencies and nongovernment organizations. Ensure that the correlation of soils to the vegetation data has been verified. Data from Web Soil Survey and published soil surveys may not be precise enough to be used as plot-level data because of the order used in soil mapping. If available, a Form 232, or a similar document that describes the soil properties at the sampling site, is preferred.

(4) The product from this step should be a preliminary, testable grouping of climate/elevation zones, parent material, soil properties, and vegetation behaviors that results in a preliminary ESG or provisional ES. Literature-based research should be combined with field reconnaissance and resulting data collection covering the extent of the preliminary ES concept. This ensures that the complete range of variation in the area is considered in developing the ES concept.

E. Conduct Reconnaissance – Low-Intensity Traverses

(1) Reconnaissance is an observation of the area to become familiar with the general features of the landscape, such as landforms, vegetation patterns, plant species, surficial geology, and soils. It is also helpful for determining the tests for ES differentiation. If a modern soil survey for the area has been completed and published, much of the information necessary for this step is already accessible. Reconnaissance is a chance to review the existing site-specific information to ensure the concepts are valid and consistent with preliminary observations. Low-intensity inventory techniques are used to form a rapid characterization of plant communities and associated environmental settings, which is then used to formulate the ES concept. Spend adequate time gathering information, but avoid methods that require an excessive amount of time at a sampling point.

(2) Traverses are used to observe environmental gradients within, and sometimes outside of, the defined geographic and ecological extent. Subjectively observe many points, and document changes in vegetation and landform patterns associated with environmental factors and disturbance processes. Auger core samples or shallow pits are used to examine the soils and determine the taxonomic family or series classification at the points. Commonly, points are
selected while driving along roadways in the defined geographic and ecological extent and are used to traverse major landforms, landform components, and distinct plant assemblages. Previous soil surveys, digital elevation models, and small-scale vegetation maps provide insight into patterns associated with environmental gradients and disturbance processes and can be used to identify traverse routes. Reconnaissance may include field checking of preexisting plot data. Several specific soil or ecological map units established in previous soil surveys or ecological unit inventories may be targeted for observation.

(3) Initial concepts for ESs, states, and intrastate dynamics are confirmed during the reconnaissance process. Soil characteristics, landforms, slope, aspect, and plant community relationships are documented, including GPS coordinates. Digital photographs may also be taken for examination and analysis later. The data can be used to evaluate vegetation-soil-landform relationships, especially if coordinates are projected on existing geospatial coverages.

(4) During the reconnaissance process, local workgroup members can provide valuable information about historical events, biotic-abiotic relationships, common land use practices, and management actions in the area of extent.

(5) The primary objective of this phase is to cover the range of environmental gradients in the geographic and ecological project area and to gain understanding about the vegetation, soil, and landscape patterns. Land units not covered by existing concepts and groupings and important multi-site interactions are identified during the reconnaissance phase. Document possible sites for medium-intensity sampling (sec. 631.12 of this subpt.).

F. Develop STMs

(1) STMs are developed using historical information, local and professional knowledge, and inventory, monitoring, and experimental data. Background information and existing data can be combined with local and professional knowledge from workgroups to develop initial diagrams and narratives for each component of an STM.

(2) Development of an STM typically begins with identification and description of the natural disturbance regime and the resulting impact on ecological dynamics. Changes in the natural disturbance regime and the resulting impacts are described next. This is followed by description of the plant communities associated with the ES concept that were identified during review of existing data and field reconnaissance. Plant communities are grouped based on structural and functional relationships that control ecological processes important to site level dynamics. Narratives describing the states, plant communities, community pathways, transitions, and restoration pathways are then developed.

(3) Revise STMs as needed during the ES development process and as new information or data are collected.

(4) STMs are developed best by a team consisting of individuals that are knowledgeable about the ecological dynamics of the ES concepts. The STM development team ensures, by consensus, that the ES concept has a solid foundation of expert information and research.

(5) After an STM development team is identified, an STM workshop is held to efficiently draft STM diagrams and narratives. Preplanning and preparation for the workshop are essential. All of the information previously collected will be assembled and made available at the workshop.

(6) After the field reconnaissance, data collection, data analysis, and field testing of the ES concepts and STMs are complete, hold another workshop that includes the entire local workgroup. Because some field testing and data collection has occurred, the group can focus on the specific ecological dynamics of the ES concepts being developed.

G. Develop Sampling Strategy
(1) ES concepts identified during the reconnaissance phase are used to develop the sampling strategy and design the medium-intensity field inventory for testing and refining the concepts. Sample locations across the project area include those selected using maps, aerial photography, or applicable web-based data and those documented during the reconnaissance phase. Determine and document the data collection strategy that best will capture the spatial and temporal variations of ESs across the landscape. Select sampling sites that have relatively uniform landform, topographic position, and vegetation. Use a specific protocol or combination of protocols that is sufficient to characterize the soil diagnostic horizons and their properties (e.g., soil texture, soil texture modifiers, depth to a restrictive layer); landform; topographic features (slope and aspect); plant species; variations in plant species production, cover, and structure; and soil surface properties.

(2) If a soil survey has been completed for an area and ES products are being developed or revised for that area, sampling can be stratified by soil map unit component. If the area includes land managed by the Forest Service for which terrestrial ecological unit inventories have been completed, sampling is stratified by ecological unit. If soil surveys or ecological unit inventories have not been completed for the area or are being completed concurrently with the development of the ES concepts, sampling is stratified by elevation, landform, slope, aspect, geologic parent material, and vegetation patterns using information gathered during the reconnaissance phase, aerial photography, and spatial data. Aerial photography and data from remote sensing systems can be useful for stratifying the landscape prior to or during field sampling.

H. Select Sampling Methods

(1) Select sampling methods best suited to meeting the ES criteria, descriptive attributes, and end user interpretations chosen for development and description of the ES concepts. Vegetation plots and soil pedon descriptions comprise an integrated plot. Sampling methods are described during the process of ES concept development, included in project plans, and designed with consideration of data analysis. Data from remote sensing systems (e.g., LiDAR, LandSat, etc.) must be evaluated and tested on the ground for accuracy.

(2) Detailed descriptions of appropriate sampling methods for plot size, plot shape, and vegetation are in existing handbooks and technical guides and references, including the following:
   (i) Sampling Vegetation Attributes (Cooperative Extension Service and others; 1996; revised in 1997 and 1999)
   (ii) Monitoring Manual for Grassland, Shrubland, and Savanna Ecosystems (Herrick and others, 2009)
   (iii) Ecological Site Inventory; USDI, Bureau of Land Management, Inventory and Monitoring Technical Reference 1734-7 (Habich, 2001)
   (iv) National Vegetation Classification Standard, Version 2 (Federal Geographic Data Committee, 2008)
   (v) Terrestrial Ecological Unit Inventory Technical Guide (Winthers and others, 2005)
   (ix) National Resources Inventory (NRI) Grazing Land On-Site Data Collection Handbook of Instructions (USDA, Natural Resources Conservation Service, 2013)

(3) Methods for soil data collection are in the following:
   (i) Field Book for Describing and Sampling Soils, Version 3.0 (Schoeneberger and others, 2012)
(ii) Soil Survey Manual (USDA, Soil Survey Division Staff, 2017)
(iii) National Soil Survey Handbook (USDA, Natural Resources Conservation Service, 2018)

4) Determining Number of Samples and Locations
   (i) The number of samples needed is assessed based on complexity, existing inventory information available, and staffing and funding available. Different tools are available to assist in determining the number of sample locations (plots) or samples per plot needed to capture the most information and variation.
   (ii) The sampling locations are determined based on the ES concepts and draft STM. Sampling locations should adequately represent the plant community. Avoid transitional zones, unique minor soil components, and ecotones to ensure that data reflect only the modal concepts for specific ESs.

631.12 Iterative Stages

The iterative stages implement the sampling strategy and methods identified in the preliminary stages, including initial field sampling, analysis of data, defining ES characteristics, field testing of differentiations, and modifications as needed. Differentiation of ESs and associated plant communities in reference or alternative states consists essentially of testing a working hypothesis. The differentiation can be refined or augmented as new information or knowledge becomes available. Medium-intensity sampling is required to formalize the ES concepts.

(1) Data Collection – Medium-Intensity Sampling
   (i) Medium-intensity sampling is intended to be a rapid process that focuses on the environmental range associated with initial ES concepts. Data are collected to determine relationships among climate, vegetation, soil properties, landforms, and relief. Relationships among disturbance processes, vegetation composition and structure, and dynamic soil properties can also be considered.
   (ii) Collect field data according to the sampling strategy. Use sampling methods identified from the resources in section 631.11.H of this subpart. Ideally, soil scientists, range management specialists, vegetation ecologists, biologists, and other specialists (as needed) work together as an interdisciplinary team.
   (iii) Examples of Information That May be Used to Validate the ES Concepts
      - A full list of species for each described plant community
      - Canopy cover by species, growth form, and vertical strata
      - Production by species (e.g., dry-weight rank and comparative yield, site index and culmination of mean annual increment (CMAI))
      - Basal area of overstory trees by species
      - Vertical structure of vegetation
      - Inherent soil properties
      - Topography (landform, slope, aspect, elevation, and slope shape)
      - Surface ground cover (bare ground, basal vegetation cover, litter, gravel, rock, and biological soil crust (includes mosses, lichens, and cyanobacteria))
      - Photographs of landscape setting and dominant vegetation components
      - Canopy gaps
      - Basal gaps
      - Responses to management actions
   (iv) Locate integrated sample plots that have relatively homogenous vegetation, landforms, and topographic positions and reflect similar environments. Partial descriptions of soil profiles are used to identify key soil characteristics that can be verified by examining soil profiles.
auger cores or shallow soil pits. Ecologically important soil attributes are observed (e.g., soil horizons, soil structure, rock fragments, depth to argillie horizon, depth to root-restrictive layer), and samples of horizons are collected for possible laboratory analysis. This information is used to test and refine initial ES concepts by identifying relationships among key soil properties, site factors, and indicator plant species that differentiate sites.

(v) Both ocular estimation and quantitative calibration is needed for consistency and to minimize variability by examiners. Variability associated with ocular estimates commonly is negated by the larger sample size used in medium-intensity sampling. An ocular estimation is recorded at the start of an inventory project and then periodically throughout the field season and the duration of the project.

(2) Data Analysis

A variety of analytical methods and tools are used to differentiate sites based on biotic and abiotic factors. Rather than specifying a standard analysis method or tool for use, it is best to select the method or methods that will meet the objectives of the differentiation. Methods used to differentiate ESs may be different than those used to identify plant communities for describing ES dynamics. Methods such as gradient analysis, ordination programs, and cluster analysis result in plant association (e.g., constancy, cover) tables that can be analyzed. Spatial analysis is conducted using tools such as terrain derivatives and LiDAR. References for classification analysis include those by Mueller-Dombois and Ellenberg (1974), Gauch (1982), Ludwig and Reynolds (1988), Kent and Coker (1992), Jongman and others (1995), and Peck (2010).

(3) Define Differentiating Characteristics

(i) Differentiating characteristics of ESs are determined either by synthesizing existing information or by more objective analyses of abiotic and biotic data collected during the development process of the ES concepts. The central concepts and range of variation for the ESs are described (i.e., the range of soil and plant community properties). Characteristics include a summary of the soil properties or soil map unit components to which the site is provisionally correlated, site characteristics (i.e., slope, aspect, landform, elevation, and climate), and vegetation composition of associated plant communities. This step is based on more than one integrated plot sample. It represents a modal concept and does not include entire data ranges.

(ii) When developing ecological site concepts, use the following criteria to differentiate one ecological site from another:
- Significant differences in species or ecologically significant species groups in the reference plant community
- Significant differences in the relative proportion of species or species groups in the reference plant community
- Significant differences in the total annual production of the reference plant community
- Differences in soil factors that determine plant production and composition, hydrology of a site, or the ecological processes of the water cycle, nutrient cycle, and energy flow
- Overriding concerns about management, because ESs are management constructs. These differentiations must be supported by quantitative evidence related to ecosystem services

(4) Field Test of ES Concepts

Test the differentiating characteristics in the field to validate the ES concepts. The differentiation process is complete when the ES concept works well in the field by a variety
of end users. Final soil-ES correlation and field review by soil scientists and vegetation specialists may occur during this step.

(5) Data Collection – High-Intensity Sampling

(i) High-intensity sampling provides additional detailed information for a few modal sites after the ES concepts are established (sec. 631.52 of this handbook). Modal sites adequately represent the central concepts of ES properties.

(ii) The sample sites must be uniform in vegetation, soils, and landform and large enough to include the complete vegetation plot and soil pit. Obvious ecotones or areas that are not uniform are not suitable for sampling. Soil and vegetation specialists jointly conduct the detailed characterization. Intensive soil characterizations are combined with high-intensity measurements of vegetation. The number of vegetation and soil characterizations needed to represent the concept of a reference state may vary, but the minimum number of characterizations is included in the project plan. Minimum sampling criteria for alternative states and plant communities is also defined in the work plan. The characterizations must represent the geographic extent, environmental range, disturbance regimes, and temporal variability (e.g., within year, yearly, decadal) of the ES.

(iii) The resulting values and associated ranges derived from high-intensity sampling data provide quantitative benchmarks for documentation of states and plant communities in ES products. See part 632 of this handbook for required state and plant community data.

(6) Type Location Data

After a number of sample sites, areas, or plots have been observed and concepts of states are firmly established, several areas may be chosen as modal. The modal areas provide quantitative values for communicating state concepts. For each ES, a minimum of three reference type locations must be described at the high-intensity sampling level. More than three may be needed to ensure that the ES concepts and range of variability have been characterized. If a type location of the reference state no longer exists or cannot be found, another typical plant community from an alternative state is used to meet minimum sampling requirements.

(7) Management Interpretations

Management interpretations are based on the vegetation, soil, and environmental characteristics of the ES that are relevant to land use and resource management decisions. Interpretations may be based on vegetation attributes, soil properties, successional relationships among plant communities, or expected response to disturbance regimes or management actions. Additional information may be obtained by monitoring or observing vegetation, soil properties, wildlife habitat, and response of animals to management or disturbance. This information may be incorporated into the ES product to validate and quantify assumptions about ecosystem properties and dynamics associated with STMs.

(8) Correlation

Correlation ensures consistency in the identification, delineation, description, and interpretation of ESs. Interdisciplinary and interagency input and a formal review and quality control is required. The correlation process is described in part 630, section 630.45, of this handbook.
Part 631 – Development of Ecological Site Concepts and Descriptions

Subpart C – Ecological Site Identification and Labeling Protocol

631.20 Purpose

A. Ecological site (ES) names are not required for linking, analyzing, and delivering information digitally; however, the names are invaluable for communicating concepts and principles while working with land managers and planners. ES names must be consistent and informative. The names are based on concepts defined in this handbook (pt. 631, subpt. A). Each ES within a major land resource area (MLRA) or land resource unit (LRU) must have a unique ID and name, which includes a short common name and a plant community name.

B. The ES common name is based on applicable abiotic site characteristics. It may include a vegetation component based on the ES reference plant community. It must use the minimum number of descriptors necessary to adequately characterize and differentiate one ES from another within an MLRA or LRU. The ES common name must be short, so it can be understood easily by the general public and communicated to land managers during the conservation planning process. Specific plant names must not be used in the ES common name; they are included in the ES plant community name. All descriptors must have a single definition, as found in references in this subpart or as provided in part 631, section 631.41, of this handbook.

C. The ES plant community name describes the reference plant community. It may include as many as three strata (tree, shrub, and herb) and as many as two plant species for each stratum, as applicable. The scientific plant name is followed by the common name. Names in the USDA PLANTS database must be used.

631.21 Ecological Site Common Name

Each ES common name within an LRU or MLRA must be unique. It is based on at least one abiotic site characteristic that typifies the ES concept and is in one of the categories of abiotic characteristics described in this section. It should include as few descriptors as possible that characterize and differentiate an ES. A landscape, landform, or landform position typically is used as a primary descriptor. Additional descriptors are used to differentiate ESs on the same landform or in similar landscape positions. The descriptors are defined in the order in which they commonly occur in legacy and current databases. A vegetation component (sec. 631.21(6) of this handbook) based on the reference plant community may be included as the last descriptor in the common name if it is needed to differentiate an ES. Naming terms must be concatenated to form the ES common name. Examples of ES names and flowcharts outlining the naming process are in section 631.21 of this handbook.

(1) Soil characteristic descriptors used to differentiate similar ESs (as many as three, if needed). For example, an ES in an area of shallow clayey soils on an escarpment might be named "Shallow Clayey Escarpment" and an ES in an area of deep clayey soils on an alluvial flat might be named "Deep Clayey Alluvial Flat." These specific soil characteristics are described in Title 430, National Soil Survey Handbook, Part 618 (430-NSSH-618) (USDA, 2018) and chapter 3 of the Soil Survey Manual (SSM) (Soil Science Division Staff, 2017). The terms in these references are used for consistency. For the following soil characteristics, examples and relevant NSSH and SSM references are given in parentheses.

(i) Soil depth (e.g., shallow, deep) (SSM, Ch. 3, Root-Restricting Depth)
(ii) Rock fragment classes (e.g., cobbly, bouldery, gravelly, stony) (430-NSSH-618-A-618.31; SSM, Table 3-2)
(iii) Taxonomic temperature regime (e.g., mesic, frigid, thermic) (430-NSSH-618-A-618.62) or taxonomic family temperature class (frigid, isofrigid, isomesic, mesic) (430-NSSH-618-A-618.67)
(iv) Soil chemical properties (SSM, Ch. 3, Selected Chemical Properties)
   • Reaction (e.g., alkaline, acidic, reaction class terms)
   • Salinity and sodicity (e.g., saline, sodic)
(v) Soil moisture status (e.g., dry, moist, wet) (SSM, Ch. 3, Soil Water, Internal Soil Water State) or water table hydrology (e.g., seasonally wet, permanently wet, perched water table)
(vi) Drainage class—subaqueous, very poorly drained, poorly drained, somewhat poorly drained, moderately well drained, well drained, somewhat excessively drained, excessively drained (430-NSSH-618-A-618.18; SSM, Ch. 3, Soil Water, Natural Drainage Classes)

(2) Soil texture and parent material terms used to differentiate ESs.
(i) Commonly, family level soil texture groups (e.g., sandy, loamy, clayey) are used rather than fine-earth texture classes (e.g., clay loam, sandy clay, silty clay loam). For fine-earth textures classes, the surface texture generally is used rather than a subsurface texture. It may be necessary, however, to use subsurface textures to differentiate sites that have a similar surface texture.
(ii) For nonmineral, fragmental, or cemented soil material, use a generalized term in lieu of texture.
(iii) A compositional texture modifier may be used with the fine-earth soil texture group to provide more information about the material. A modifier and general soil texture group may be used as a single term.
(iv) Soil parent material (if needed, use only one) (SSM, Ch. 2, Parent Material).
   • Kind of geologic material (e.g., limestone, sandstone, shale, gneiss, schist, slate, chert, basalt, glacial till, mixed)
   • Kind of transported soil parent material (e.g., alluvium, loess, colluvium, glacial or volcanic material)
   • Kind of organic accumulation (e.g., woody, herbaceous, grassy, mossy)

(3) Other ES descriptors (if needed, use as many as two).
(i) Flooding frequency class (e.g., rarely flooded, frequently flooded, or very frequently flooded) (modified from 430-NSSH-618-A-618.30).
(ii) Wetland class, according to the hydrogeomorphic classification of wetlands (e.g., riverine, fringe, depressional, slope) (Brinson, 1980).
(iii) Stream type or fluvial term for geomorphic channels, using appropriate descriptions for channels in the ES (e.g., Rosgen Classification, Channel Evolution Model Stage).
(iv) Slope class/complexity (e.g., nearly level, undulating, rolling, hilly, steep, very steep) (SSM, Ch. 2, Consistently Describing Landscapes, Landforms, and Geomorphology, Surface Morphometry, Table 2-3).
(v) Slope shape (e.g., concave, convex, linear) (SSM, Ch. 2, Consistently Describing Landscapes, Landforms, and Geomorphology, Surface Morphometry, Fig. 2-14).
(vi) Aspect (e.g., exposed, protected, north, south). Aspect is especially applicable in mountainous or hilly areas.

(4) Landscape, landform, or hillslope description (if needed, use only one). Refer to 430-NSSH-629-A-629.2; 430-NSSH-629-B-629.10; and Field Book for Describing and
Sampling Soils (Schoeneberger et al., 2012). Note that some terms, but not all, apply to both landscapes and landforms.

(i) Landscape terms (e.g., uplands, breaks, basins, lowlands, mountains, plateaus).
(ii) Landform terms (e.g., hills, canyons, basin floors, plateaus, cliffs, terraces, ridges, depressions, flood plains, moraines).
(iii) Hillslope position terms (e.g., summits, shoulders, backslopes, footslopes, toeslopes).

(5) Geographical/climate zones (if needed, use only one) (e.g., elevation zones, precipitation zones, precipitation-evaporation zones, temperature zones). Current data will be used when establishing these zones.

(6) General type of vegetation representing the reference plant community (if needed, use only one) (e.g., woodland, savanna, grassland, tall grass prairie, mixed hardwood forest, deciduous forest) (National Vegetation Classification System, Federal Geographic Data Committee, 2011).

631.22 Ecological Site Biotic Name

An ES biotic name includes—

(1) Scientific and common plant names as in USDA PLANTS database.
(2) Plant names for as many as three strata (tree, shrub, and herb).
(3) As many as two relevant dominant or ecologically significant indicator plant species for each stratum representing the reference plant community.
(4) Plant species in the same stratum or growth form separated by a hyphen (-) and those in different strata separated by a slash (/). Plant species in the uppermost stratum are listed first, and those in lower strata follow, successively. The order of plant species names within a stratum or growth form generally reflects decreasing levels of dominance, constancy, or another diagnostic.

631.23 Ecological Site ID Alphanumeric Coding

A. The 12-character coding scheme for ecological sites includes alternating alpha and numeric characters that represent the land resource region (LRR), MLRA, LRU, and ecological site identification number. The code—

(1) Represents the ecological site relationship within the land hierarchy.
(2) Provides flexibility for expanding and contracting subdivisions.
(3) Retains current and familiar symbols.
(4) Is intuitive and easily discernable at a glance.

B. Example—GX070A02B001

(1) GX=LRR. Generally, an LRR is represented by an uppercase alpha character and an uppercase X. If an LRR is subdivided; however, a lowercase alpha character replaces the X (e.g., DX is replaced with Da, Db, etc.). Note that some of the Alaska LRRs were subdivided and represented by an uppercase alpha character and a number (e.g., X1, X2, W1, W2). For ecological site coding, these should be changed to the standard uppercase alpha character and lowercase alpha character (e.g., Xa, Xb, Wa, Wb).
(2) 070A=MLRA. MLRAs are represented by three numeric characters or three numeric characters and an uppercase alpha character. If an MLRA does not have an alpha character, an X is inserted as a placeholder (e.g., 035X, 002X, 143X). If two or more MLRAs are combined (e.g., MLRAs 38 and 39), the numerical characters of one of the MLRAs is chosen (e.g., 039X). If MLRAs are subdivided, the new subdivisions would
start with the D modifier (e.g., MLRAs 43A, 43B, and 43C in Montana might be subdivided into six MLRAs. The MLRAs would be 043D, 043E, 043F, 043G, 043H, and 043I. This scheme allows for keeping track of old and new MLRAs.

(3) \(02\) = LRU. Every LRU is represented by two numeric characters, which allows for an MLRA to be subdivided into 99 LRUs. If the MLRA has no LRU subdivisions, it is represented as 01, meaning the MLRA and LRU are the same polygon. If an MLRA has subdivisions, they are represented as 01, 02, 03, and so on.

(4) \(B\) = LRU subset. Every LRU subset is represented by one uppercase alpha character, which allows for the LRU to be subdivided into 26 subset polygons. If there are no LRU subsets, an \(X\) is inserted.

(5) \(001\) = Ecological site identification (ESID). Every ESID is represented by three numeric characters, which allows for 999 ecological sites within a LRU subset.

**631.24 State or Plant Community Name**

A. An ES consists of one or more states. One state is defined as the reference state. If multiple plant communities are in the reference state, one plant community is designated the reference plant community. Each state and plant community is assigned a name identical to one in the STM diagram. Refer to part 631, subpart A, of this handbook for guidance on developing an STM. Common plant names or land types may be added to further differentiate alternative states (e.g., eroded grassland, cheatgrass-invaded shrub steppe).

B. Plant community names are based on representative plant species, plant groups, or growth forms. If possible, the plant communities should be cross-walked to vegetation types in the National Vegetation Classification System, Version 2 (Federal Geographic Data Committee, 2008).

(1) Plant community names include both the scientific and common plant names of the relevant dominant or ecologically significant indicator species that represent each plant community. In the STM diagrams, only the common or scientific plant names for each plant community are given, not both. The relevant dominant or ecologically significant indicator species used to name a plant community must be included in a tabular plant species summary of the plant community.

(2) Names in the USDA PLANTS database are used. Plant species within the same stratum or growth form are separated by a hyphen (-), and those in different strata are separated by a slash (/). Plant species in the uppermost stratum are listed first, and those in lower strata follow, successively. As many as three strata can be listed, and two plant species in each stratum can be listed. The order of plant species within a stratum or growth form generally reflects decreasing levels of dominance, constancy, or another diagnostic value.

(3) Example Plant Community Names

(i) *Pascopyrum smithii*- *Nassella viridula* (western wheatgrass-green needlegrass).

(ii) *Abies concolor*- *Pinus jeffreyi*/*Arctostaphylos patula*- *Chrysolepis sempervirens* (white fir-Jeffrey pine/greenleaf manzanita-bush chinquapin)

(iii) *Juniperus virginiana*/*Bromus inermis*/*Carex scoparia* (eastern redcedar/smooth brome-bromeedge)

**631.25 Labeling State-and-Transition Model (STM) Diagrams**

A. Diagrams will be labeled with a header that includes the ES common name and ID to ensure that it is included in the correct ecological site description (ESD) (e.g., Loamy Upland, NX123X01X001).
B. Bold-outlined exterior boxes represent a state. Within a state, plant community dynamics are represented by boxes and arrows; graphs of driving variables, response variables, or response surfaces; or another medium that best reflects the dynamics and conveys them to the intended audience.

C. All states are identified by a number (1, 2, 3...), and the state name in the STM is identical to the state name in the ESD. Reference states are assigned the number 1.

D. Transitions from one state to another are identified by an arrow and a sequential number and letter combination. The label begins with a “T” and is followed by a number that represents the state of origin and a sequential capital letter for each departure point from the state. For example, T1A is a transition that originates from state 1 and is the first labeled departure, T1B is the second transition from state 1, and so on.

E. When using boxes and arrows to describe dynamics within a state, all plant communities are identified by a decimal number (1.1, 1.2, 1.3...). The first value (left of decimal) represents the state, and the second value (right of decimal) identifies the plant community within the state.

F. Either common or scientific plant names are used in the plant community names, not both.

G. Arrows are labeled with the number of the originating plant community followed by a capital letter (e.g., 1.1A). A separate sequential letter is assigned to each arrow departing from a single plant community. For example, 1.1A indicates that the action, or arrow, originated from plant community 1.1. The A indicates that it is the first arrow from that plant community. A second arrow from the same plant community is labeled 1.1B.

H. A simple legend may be developed, but it must be kept separate from the STM diagram and labeled with the ES name and ID to ensure that it correlates to the correct ES. Legends should briefly describe actions represented by arrows and specific actions or triggers of change. Arrows in the diagram will not include acronyms representing conservation practices, best management actions, or triggers, etc. Detailed descriptions of these are included in applicable transition or community pathway narratives.
631.30 Purpose

A. Ecological site (ES) names will be based on concepts defined in this handbook (part 631, subpart A). Each ES within a major land resource area (MLRA) or land resource unit (LRU) must have a unique ID and name. The ES name includes a short common name and a plant community name.

B. The ES common name is based on applicable abiotic site characteristics and may include a vegetation component based on the ES reference community phase. The ES common name must use the minimum number of descriptors necessary to adequately characterize and differentiate one ES from another within an MLRA or a LRU. The ES common name should be short, so it can be easily understood by the general public and communicated to land managers through the conservation planning process. Specific plant names are not acceptable for the ES common name; they are included in the ES plant community name. All descriptors must have a single definition, as found in references in this part or as provided in part 631, subpart F, section 631.51.

C. The ES plant community name describes the ES reference community phase and may be composed of as many as three strata (tree, shrub, and herb) and as many as two plant species names for each stratum, as applicable. The scientific plant names will be followed by the common names, and plant names in the USDA PLANTS database will be used.

631.31 Ecological Site Common Name

A. Each ES common name within a LRU or an MLRA must be unique. It will be based on at least one abiotic site characteristic category, as given in A through E of this part, but include as few descriptors as possible to characterize and differentiate each ES. A landform, landscape, or hillslope typically should be used as a primary descriptor. Additional descriptors are used to differentiate ESs on the same landform, landscape, or hillslope. The descriptors are defined in the order in which they commonly occur in legacy and current databases. A vegetation component (part 631, subpart D, section 631.31G) based on the reference community phase of the ES may be added as the last descriptor in the common name, if needed to differentiate an ES. Naming terms will be concatenated to form the ES common name. Examples of ES names are given in part 631, subpart H, section 631.82, and flowcharts outlining the naming process are given in part 631, subpart H, section 631.83.

B. Soil Characteristic Descriptors That Differentiate Similar ESs (as Many as Three, if Needed).—For example, a Clayey Upland ES on shallow soils is named “Shallow Clayey Upland” and a Clayey Upland ES on deep soils might be named “Clayey Upland.” These terms are specific to soil characteristics as described in chapter 3 of the Soil Survey Manual (SSM) and Title 430, National Soil Survey Handbook (NSSH), Part 618, and are used for consistency. In the following, relevant NSSH and SSM references are given in parentheses.

(1) Soil depth (e.g., shallow, deep) (SSM, Chapter 3, root restricting depth)
(2) Rock fragment classes (e.g., cobbly, bouldery, gravelly, stony) (430-NSSH, Part 618, Subpart A, Section 618.9; SSM, Table 3-11)
(3) Soil temperature regime (e.g., mesic, frigid, thermic) (430-NSSH, Part 618, Subpart A, Section 618.63, “Taxonomic family temperature class”)
(4) Soil chemical properties (SSM, Chapter 3, selected chemical properties)
   (i) Reaction class (e.g., alkaline, acidic, standard soil reaction class)
   (ii) Salinity and sodicity (e.g. saline, sodic).
(5) Soil moisture status (e.g., dry, moist, wet) (SSM, Chapter 3; soil water, internal classes) or water table hydrology (e.g., seasonally wet, permanently wet, perched water table).
(6) Drainage class—subaqueous, very poorly drained, poorly drained, somewhat poorly drained, well drained, moderately well drained, excessively well drained (430-NSSH, Part 618, Subpart A, Section 618.16; SSM, Chapter 3, natural drainage classes).

C. Soil Texture or Parent Material Origin Terms to Differentiate ESs

(1) Soil texture terms (part 631, subpart H, section 631.84) (e.g., sandy, loamy, clayey, silty, specific soil texture classes). Commonly, general broad groups or classes of texture rather than specific texture classes are used. Surface texture rather than subsurface texture generally will be used to define a texture name, but it may be necessary to account for subsurface texture differences to differentiate sites that have the same surface texture.
(2) For nonmineral, fragmental, or cemented soil material, use a generalized term in lieu of texture (part 631, subpart H, section 631.84).
(3) General soil texture groups may be modified with generalized compositional modifier terms to provide information about the nature of the material. Both a modifier and a general texture group may be used as a single term (part 631, subpart H, section 631.84).
(4) Soil parent material (use only one, if needed) (SSM, chapter 3, parent material).
   (i) Geologic material, kind, or origin (e.g., limestone, sandstone, shale, gneiss, schist, slate, chert, basalt, mixed geology)
   (ii) Soil deposits and parent material moved by water, wind, glaciers, or gravity (e.g., alluvium, colluvium, volcanic ash, lava, loess)
   (iii) Organic material accumulations (e.g., sedimentary peat, moss peat, woody peat)

D. Other ES Descriptors (as Many as Two, if Needed)

(1) Flooding frequency class—nonflooded, rarely flooded, frequently flooded, or very frequently flooded (modified from 430-NSSH, Part 618, Subpart A, Section 618.26)
(2) Wetland class, according to the hydrogeomorphic classification of wetlands (e.g., riverine, fringe, depressional, slope) (Brinson, 1980)
(3) Stream type or fluvial term for geomorphic channels, using appropriate channel descriptions that occur on the ES (e.g., Rosgen Classification, Channel Evolution Model Stage)
(4) Slope class/complexity (e.g., nearly level, hilly, steep, very steep, undulating) (SSM, chapter 3, soil slope, table 3-1)
(5) Slope shape; e.g., concave, convex, or linear (SSM, Chapter 3, soil slope, figure 3-2)
(6) Aspect (e.g., exposed, protected, north, south) (especially applicable in mountainous/hilly areas)

E. Landscape, landform, or hillslope description (only one, if needed). Refer to 430-NSSH, Part 629, Subpart A, Section 629.02; 430-NSSH, Part 629, Subpart B, Exhibit 629-1; and Field Book for Describing and Sampling Soils (Schoeneberger and others, 2002). Note that some terms, but not all, apply to both landscapes and landforms.

   (1) Landscape terms (e.g., upland, breaks, basins, lowlands, mountains, plateaus)
   (2) Landform terms (e.g., hills, canyons, basin floors, plateaus, cliffs, terraces, ridges, depressions, flood plains, moraines)
   (3) Hillslope position terms (e.g., backslopes, summits, footslopes, shoulders)

F. Geographical or climate zones (only one, if needed) (e.g., elevation zones, precipitation zones, precipitation-evaporation zones, temperature zones). When establishing these zones, current data will be used.
G. General type of vegetation representing the reference community phase (only one) (e.g., woodland, savannah, grassland, tall grass prairie, mixed hardwood forest, deciduous forest) (National Vegetation Classification System, Federal Geographic Data Committee, 2011).

631.32 Ecological Site Plant Community Name

An ES plant community name will be based on—

1. Scientific and common plant names as in USDA PLANTS database.
2. Plant names for as many as three strata can be used (tree, shrub, and herbaceous). Each stratum can have two relevant dominant or ecologically significant indicator plant species representing the reference community phase.
3. Among the plant species chosen for the name, those in the same stratum or growth form are separated by a hyphen (-) and those in different strata are separated by a slash (/). Plant species in the uppermost stratum are listed first, and those in lower strata follow, successively. The order of plant species names within a stratum or growth form generally reflects decreasing levels of dominance, constancy, or another diagnostic value.

631.33 Ecological Site ID Alphanumeric Coding

Ecological sites will be assigned an eight-character alphanumeric ID as follows:

1. The first element of the ID is a three-digit number and a single capital letter that designates the MLRA (default is “X” for MLRAs that do not include a letter). Examples are 102A and 112X. Leading zeros will be used for MLRAs that have less than three digits (e.g., 002).
2. The second element is a single capital letter (A to Z) that designates the LRU (default is “Y” if an LRU is not identified or used).
3. The final element is a unique three-digit number, assigned in ascending numerical order (001 to 999).
4. Only one ID is given to an ES in an LRU or MLRA. In some cases, an ES and soil map unit components in an ES cross LRU or MLRA boundaries. In these cases, the LRU or MLRA that has the most acres of a given ES will be used for the ID.
5. Example ES ID Alphanumeric Coding
   (i) 123XY001—MLRA 123, X (no MLRA letter), Y (no LRU), 001 (unique site number)
   (ii) 004CA010—MLRA 004, C (MLRA letter), A (LRU letter), 010 (unique site number)

631.34 State or Community Phase Name

A. An ES may consist of one or more states. One state will be defined as the reference state. If there are multiple community phases in the reference state, one phase will be designated the reference community phase. Each state and community phase will be assigned a name that matches the STM diagram. Refer to part 631, subpart A, for guidance on developing a STM. Names for alternative states will reflect the dominant process that caused the transition, such as eroded state or invaded state, etc. Common plant names or land types may be added to further differentiate alternative states, such as eroded grassland or cheatgrass-invaded shrub steppe.

B. Community phases will be named based on representative plant species. If alternative naming conventions are used, the community phases that are supported by data should be crosswalked to vegetation types in the National Vegetation Classification System, Version 2 (Federal Geographic Data Committee, 2008).

1. Community phase names will include both scientific and common plant names of the relevant dominant or ecologically significant indicator species that represent each community phase.
STM diagrams, however, will display only the common plant name or the scientific plant name for each community phase, not both. The relevant dominant or ecologically significant indicator species used to name a community phase must be included in tabular plant species summaries of the community phase and include at least one plant species from the dominant stratum of the plant community.

(2) Names in the USDA PLANTS database will be used. Plant species within the same stratum or growth form are separated by a hyphen (-), and those in different strata are separated by a slash (/). Plant species in the uppermost stratum are listed first, and those in lower strata follow, successively. As many as three strata and two plant species in each can be listed. The order of plant species within a stratum or growth form generally reflects decreasing levels of dominance, constancy, or another diagnostic value.

(3) Example Community Phase Names

(i) *Pascopyrum smithii*- *Nassella viridula* (Western wheatgrass-green needlegrass)

(ii) *Abies concolor*- *Pinus jeffreyi*/ *Arctostaphylos patula*- *Chrysolepis sempervirens* (white fir-Jeffrey pine-greenleaf manzanita-bush chinquapin)

(iii) *Juniperus virginiana*- *Bromus inermis*- *Carex scoparia* (Eastern redcedar-smooth brome-broomsedge)

631.35 Labeling in State-and-Transition Model (STM) Diagrams

Formatting, labeling, naming, and numbering STMs will be completed as follows (see part 631, subpart H, section 631.85):

(1) Diagrams will be labeled with a header that includes the ES common name and ID to ensure that it matches the correct ES (e.g., Loamy Upland, 123XY001).

(2) Bold-outlined exterior boxes will represent a state, and interior boxes will represent community phases within the state. Bold lines represent thresholds.

(3) All states will be identified with the integer number (1, 2, 3...), and the state name in the STM will match the state name for the ES. Reference states will be assigned the number “1.”

(4) All community phases will be identified by a decimal number (1.1, 1.2, 1.3...). The first value represents the state, and the second value (decimal) identifies the community phase within the state.

(5) Either common or scientific plant names will be used in the community phase names, not both.

(6) Arrows between community phase pathways identify feedback mechanisms. Arrows are labeled with the number of the originating community phase followed by a capital letter (e.g., 1.1A). A separate sequential letter will be assigned to each arrow departing from any one community phase.

Example: The symbol “1.1A” indicates that the action, or arrow, originated from community phase 1.1. The letter A indicates that it is the first arrow from that community phase. A second arrow from the same community phase is labeled 1.1B.

(7) Transitions from one state to another are identified by an arrow and a sequential number-letter combination. The label includes a “T,” a number that represents the state of origin departed from, and a sequential capital letter for each departure point from the state. For example, T1A is a transition that originates from state 1 and is the first labeled departure. A second transition from state 1 would be labeled T1B.

(8) Restorations, or management actions that lead to re-establishment of a state that has undergone transition, are identified with an arrow and a sequential number-letter combination. The label includes an “R,” a number that represents the state of origin, and a sequential capital letter for each departure point from the state. For example, R2A is a
restoration that originates from state 2 and is the pathway to the reference state or the state closest to the reference to which a restoration can be made. A second restoration arrow from state 2 would be labeled R2B.

(9) A simple legend may be developed, but it must be kept separate from the STM diagram and labeled with the ES name and ID to ensure that it matches the correct ES. Legends should briefly describe actions represented by arrows and specific actions and triggers of change. Arrows in the diagram may not include acronyms representing conservation practices, best management actions, triggers, etc. Detailed descriptions of these will be included in applicable restoration, transition, or community pathway narratives.


Part 631 – Ecological Site Concept and Description Development

Subpart E – Ecological Site Keys

631.40 Purpose

A. An ecological site (ES) key is an important tool for accurate identification of ESs and for differentiating one ES from another. It is developed along with site concepts to assist in ES classification. As ES concepts are tested and accepted and ESs are correlated to soil map unit components, the ES key is finalized. The ES key must be kept current as concepts are changed. The key also aids in ES data organization and analyses.

B. An ES key is based on specific soil, topography, climate, hydrologic, and other abiotic characteristics that differentiate ESs and facilitate identification of individual ESs across the landscape. Since an ES may have a variety of states and community phases, plant species will not be used in an ES key. In certain cases, indicator or dominant plant species that are persistent features of an ES can be footnoted as typical for the site and used on a local basis to aid in ES site identification. These species are not part of an ES key, however, because they may not be present or may have been removed. The ES key is based on abiotic factors because these factors are relatively stable and unlikely to change as a result of management. Ideally, ES concepts are developed for an entire major land resource area (MLRA) or a subunit, such as a land resource unit (LRU); therefore, similar or associated ESs can easily be keyed, using appropriate abiotic factors. The ES key should be developed for the MLRA or subunit in most instances; however, some MLRAs may be very similar and therefore one ES key could be developed that covers more than one MLRA or subunit. An ES key can be crosswalked to ecological sections or subsections if the National Hierarchical Framework of Ecological Units developed by the Forest Service is used.

631.41 Abiotic Factors Used in Ecological Site Keys

Examples of abiotic factors used in ES keys to differentiate one ES from another:

1. Soil (soil properties such as texture, restricting layers, depth, water table, pH, salinity, and parent material, etc.)
2. Topography (landform, slope, aspect, slope position, elevation, etc.) (part 631, subpart H, section 631.86)
3. Hydrology (groundwater, runoff, flooding, ponding, frequency, duration, timing, etc.)
4. Climate (precipitation, temperature, growing season, etc.)

631.42 Ecological Site Key Types

A. Depending on landscape complexity, an ES key may be constructed using a dichotomous format (true-false, yes-no, agree-disagree, wet-dry, etc.), flow chart, or matrix or by using diagnostic characteristics. Part 631, subpart H, sections 631.87 and 631.88 illustrate various formats that may be used to develop an ES key. ES keys are based on ES concepts that have been tested, confirmed, and at least preliminarily correlated to soils.

B. An ES key can be developed using specialized classification terminology or commonly understood terminology (part 631, subpart H, section 631.87). Specialized terminology could include soil properties, topographic factors, and other abiotic factors used by specialists for identification and differentiation of ESs. This kind of key typically is developed for an MLRA or smaller area.
C. An ES key developed with common terms may be used by personnel and the general public to identify ESs in the field. This kind of ES key may be developed for an entire state or for multiple MLRAs.
Part 631 – Ecological Site Concept and Description Development

Subpart F – Contents of Ecological Site Descriptions

631.50 Purpose and Background Information

A. This subpart describes each element of an ecological site description (ESD) and includes the requirements for each. An ESD represents the modal concept for an ecological site (ES). The modal concept does not include the extremes or total range of values that may exist for any given element. The modal concept is developed using a variety of data and information sources (part 631, subpart A, section 631.2C).

B. Sources used to support the ESD and shown in the appropriate ESD section may include site specific experimental data and other experimental data, models, specific references, general ecological research and literature, expert opinion and experience, inventory or monitoring data, historical documentation, and other pertinent data or information. See part 631, subpart F, section 631.58C, for details on inventory data references; part 631, subpart F, section 631.58G for documenting other kinds of data and information used to support information in an ESD; and part 631, subpart F, section 631.56D(2) for citation documentation for community phases.

631.51 General Information Section

A. Ecological Site Name

(1) See part 631, subpart D, for guidance on ES naming conventions. The ES name includes a descriptive abiotic common name and a biotic plant community name that includes both the scientific and common plant species names.

(2) The following is an example of an ES name using the naming convention detailed in part 631, subpart D:

Clay Loam Upland 13-17” p.z. (precipitation zone)

Artemisia tridentata ssp. wyomingensis/Pascopyrum smithii-Bouteloua gracilis (Wyoming big sagebrush/western wheatgrass-blue grama)

B. Ecological Site ID

ESs will be assigned an eight-character alphanumeric ID (e.g., 123XY987) as per guidance in part 631, subpart D.

C. Hierarchical Framework Relationships

List the name (and code, if applicable) of the higher land or ecological group geographic framework element. Approved spatial classification systems include the major land resource area (MLRA) and land resource unit (LRU) concept (NRCS, 2006) and the ecological subregion, section, and subsection concept (McNab and others, 2007) of the National Hierarchical Framework of Ecological Units (Cleland and others, 1997). An additional option is the Level-III and Level-IV ecoregions system (Omernik, 1987, and EPA, 2011). If this system is used, a crosswalk to one of the other approved systems is required.

D. Ecological Site Concept

(1) See part 6312, subpart A, section 631.2, for guidance on defining the ES concept. Describe microclimate, geology, topography (elevation, slope, aspect, and landform position), hydrology, and soil characteristics. Collectively, these factors determine soil temperature,
moisture, and nutrient regimes that affect vegetation patterns and ecological processes associated with a particular ES. These controlling factors become the basis for defining the physical characteristics of an ES and predicting the recurring pattern of an ES across the landscape.

(2) Summarize the overall ES concept and how it is differentiated from that of other ESs. The information includes that which specifically characterizes the ES from another (i.e., what was used as the basis for ES delineation) and the literature and research data used to support reference state and community phase descriptions.

631.52 Physiographic Features Section

Describe the physiographic features of the ES, such as landscape position, landform, geology (lithology and stratigraphy), aspect, site elevation, slope, water table, flooding, ponding, and runoff potential. Use standard physiographic terminology and definitions from Title 430, National Soil Survey Handbook (USDA, 1996) and Field Book for Describing and Sampling Soils (Schoeneberger and others, 2012). Document the capability of the site to generate runoff or receive runoff from other sites, or both.

631.53 Climatic Features Section

Describe the climatic features that typify the ES and relate to its potential, and characterize the dynamics of the ES, including storm intensity, frequency of catastrophic storm events, and drought cycles. Climatic features include frost-free period, freeze-free period, mean annual precipitation, monthly moisture and temperature distribution, and location of climate stations. If climate data are available, include information (averages and ranges) from throughout the entire area of extent for the ES. Many ESs occur in areas for which appropriate climate station data are not available. Climate data may be extrapolated using climate models (e.g., PRISM). Distinguish between information that is supported by weather station data and information that is extrapolated from existing weather station data (e.g., PRISM data). Include a link to local weather stations. Indicate how close the weather station is to the representative ecological site, and describe any microclimate concerns because of the location of the weather station.

631.54 Influencing Water Features Section

Describe water features of the ES or adjacent wetland or riparian water regimes that influence the vegetation or management of the site and make the site distinctive from other ESs. Example water features include subsurface waterflow, seasonal groundwater levels, overland flow, streams, springs, wetland, and depressions. Use terminology associated with Wetland Classification (Cowardin and others, 1979), Rosgen Stream Classification (Rosgen, 1996), or another established water- or hydrology-related classification system.

631.55 Representative Soil Features Section

A. Describe inherent soil properties that make an ES distinctive from others. Differentiate between inherent, attainable, and actual values for the selected properties, as appropriate. Give special attention to properties that significantly affect plant-soil-water relationships and hydrology. Representative soil features include parent material, surface and subsurface texture, surface and subsurface fragments, drainage class, hydrologic conductivity (permeability class), depth to diagnostic horizons, soil depth, electrical conductivity, sodium adsorption ratio, calcium carbonate equivalent, soil reaction (pH), and available water capacity.
B. Describe the soil and hydrologic indicators that characterize the reference community phase. For example, describe the extent of rills and gullies, extent of runoff patterns across the soil surface during overland flow, amount and pattern of pedestals and terraces caused by wind or water, size and frequency of wind-scoured areas, susceptibility of the site to compaction, expected nature of the surface organic layer, and expected physical and chemical crusts. For land classified as rangeland, describe the hydrologic rangeland health indicators.

C. A list of soil map unit components that are correlated to the ES may be included.

631.56 States and Community Phase Section

A. Ecological Dynamics of the Ecological Site

Describe the general ecological dynamics of the ES. Describe states based on growth form, lifeform, or functional group. If appropriate, identify successional or seral stages. Describe the changes that are expected as a result of variation in weather or climate and the possible effect on the dynamics of the ES. Identify the disturbances and the frequency and intensity of the disturbances affecting site development (fire regime, fire dependent or not, native herbivory, and other disturbances). Other general information regarding the dynamics of the site should be described, such as human management impacts. Identify assumptions used in describing ecological dynamics. Cite scientific literature and experts consulted in the “Other References” section of the ESD.

B. State-and-Transition Diagram

(1) Include a diagram of the state-and-transition model (STM) for the ES. It should include states, community phases, community pathways, transitions, and restoration pathways. Label all parts of the STM. See part 631, subpart A, for further guidance on components of STMs and part 631, subpart D, for guidance on labeling STMs.

(2) The assumptions, methods, and supporting data or literature used in defining alternative states should be documented, peer reviewed, and further developed, if needed. These include careful description of the properties of reference and alternative states, description of the ecological mechanisms causing transitions and precluding recovery of the reference state or other states, identification of evidence sources and assumptions, and level of confidence in portions of the STM as a result of the evidence.

C. Photographs

One or more photographs will be included for each state and community phase described in an STM. Landscape photographs are desirable. Consider including other photographs that capture unique properties of the ES, such as vegetative structure and soil surface. Photographs should convey characteristics of the natural landscape setting and should not include people, livestock, or vehicles, etc. If reference to scale is important, include a tool such as a range pole in the photograph.

D. Reference State

(1) Narratives—Describe the reference community phase and state identified in the STM diagram. Document whether the community phases are supported by empirical data or are provisional communities. Describe the rationale for separating community phases based on ecological processes. At a minimum, describe the dynamics of the community phase and the causes or triggers of community pathways and transitions. Identify and describe the thresholds between the reference state and other states. Provide information on the water cycle, nutrient cycle, and energy flow and an evaluation of the function of these ecological processes. Explain causes for shifts or changes and how they will affect ecological functions.
Describe changes in hydrologic and erosion characteristics of the ES as a result of shifts. Include descriptions of elements such as amount and distribution of expected litter, patterns of plant mortality, and expected or measured changes in dynamic soil properties.

(2) Supporting Community Phase Documentation.—For the reference community phase and all other community phases supported by empirical data, document the number and type of plots and the methods used to gather data. For community phases not supported by quantitative data, document the source of information (e.g., historical data, local expertise, photographs, notes) used as the basis for describing the phase. If possible, identify the sampling site locations used to describe the community phases.

(3) Community Phase Composition.—For the reference community phase and all other data-supported community phases, a detailed plant species list will be incorporated into plant association or constancy cover tables. For community phases that are dominantly tree species, understory plants will be included. Both common and scientific names and plant symbols will be included for all species. Scientific names and symbols will be obtained from the USDA PLANTS database (USDA, 1995). If plant groups are used, they must identify whether individual species within the group have a production limitation or whether a single species is not limited and can account for most of the production of the plant group. Numerous items must be considered when placing plant species into functional groups for the purpose of ESD development, including kind, structure, and size of plant; rooting structure; lifecycle; production; niche; and photosynthetic pathway.

Examples of plant groups include cool-season grasses, warm-season tall grasses, warm-season mid-grasses, annual grasses, perennial forbs, biennial forbs, annual forbs, shrubs, deciduous trees, evergreen trees, and cacti. Professionals describing sites may identify additional attributes and relationships to define useful groupings. For example, two or more groups of warm-season mid-grasses may be described because different niches exist, such as structure, elevation, and climatic adaptations, which in turn may result in differences in production.

(4) Species Productivity.—The type of species production data to collect for defining and describing an ES will be determined at the project planning level, based on the species that occur in the community phase.

(i) For the reference community phase and all other data-supported community phases that are *dominantly herbaceous or shrub species*, show the low to high range of production by species (designating the range of variability for each species across the extent of the community phase). It should be expressed in pounds per acre of air-dry weight. If an estimate of tree species production is desirable and feasible, site productivity is expressed as site index and culmination of the mean annual increment (CMAI).

(ii) For the reference community phase and all other data-supported community phases that are *dominantly tree species*, show the range of site productivity expressed as site index and CMAI. If an estimate of understory production is desirable and feasible, show the low to high range of understory production by species (designating the range of variability for each species across the extent of the community phase). It should be expressed in pounds per acre of air-dry weight. If desired (likely for carbon sequestration), the total biomass of trees may also be estimated.

(iii) For the reference community phase and all other data-supported community phases that are *not dominantly herbaceous, shrub, or tree species* (e.g., mosses, lichens, bare ground, open water, rocks), the type of production data needed to define and describe the ES will be determined during project planning.

(5) Total Annual Production

(i) For the reference community phase and all other data-supported community phases that are *dominantly herbaceous or shrub species*, show the total annual production by growth
form, expressed in pounds per acre of air-dry weight, and the fluctuations expected
during favorable, normal, and unfavorable years (weather variability, primarily a result of
timing, amount of precipitation, and temperature). If an estimate of total production for
primary tree species is desirable and feasible, site productivity is expressed as site index
and CMAI.

(ii) When the reference community phase or any other data-supported community phase is
dominantly tree species, show total annual production by primary species, expressed as
site index and CMAI. If an estimate of total production for understory is desirable and
feasible, show the total annual production by growth form, expressed in pounds per acre
of air-dry weight, and the fluctuations expected during favorable, normal, and
unfavorable years (climatic variability, primarily a result of precipitation).

(iii) If the reference community phase or other data-supported community phase is not
dominantly herbaceous, shrub, or tree species (e.g., mosses, lichens, bare ground, open
water, rocks), the type of total annual production data needed to define and describe the
ES will be determined during project planning.

Note: Total annual production by growth form should not be confused with species
productivity (part 631, subpart F, section 631.56D(4)), which is annual production and
variability by species throughout the extent of the community phase.

(6) Canopy or Foliar Cover.—For the reference community phase and all other data-supported
community phases, show either canopy or foliar cover, as appropriate to describe the ES.
Identify the type of cover and the data collection method. Methods used to gather data should
be standardized and documented according to guidance in part 631, subpart C. Summarize
and show the range of canopy or foliar cover and constancy by species for each community
phase. Show the canopy cover by height class.

(7) Structure.—Describe both vertical and horizontal structure for the reference community
phase and all other data-supported community phases.

(i) Describe vertical structure by characterizing vertical strata of vegetative cover by growth
form. Define both the height of the respective vertical strata and the type of cover
(canopy or foliar). Vertical strata can also be broken down into three primary strata (tree,
shrub, and herb), which can be broken down even further with groupings such as height
ranges for canopy or foliar cover. Use as needed to describe vertical structure.

(ii) Describe horizontal structure by characterizing vegetation patterns within an ES. For
ESs with little or no vegetation, this section may not be applicable.

• Examples of characterizing vegetation patterns in tree-dominant community phases
  include defined sociability classes, such as grows solitarily or slightly grouped;
tussocks; small or large patches; and large almost pure population stands.

• Examples of characterizing vegetation patterns in herbaceous and shrub-dominant
  community phases include canopy gaps, basal gaps, foliar cover, and clumps, etc.

(8) Ground Surface Cover.—For the reference community phase and all other data-supported
community phases, show ground surface cover. Ground surface cover is the percentage of
the ground surface actually occupied by bare soil, basal vegetation, litter, downed wood,
gravel, rock, or soil biological crust, including mosses and lichens.

(9) Overstory Canopy Cover.—For the reference community phase and all other data-supported
community phases, show the overstory canopy cover if the community phase contains
overstory trees typically more than 5 meters tall. Methods should be standardized and
documented as per guidance in part 631, subpart C.

(10) Understory.—For the reference community phase and all other data-supported community
phases that are dominantly trees with an understory, show the low and high range of the
estimated canopy cover (by percent) for the understory plants that typically reach a height of
less than 5 meters and can be broken down into strata that group understory plants.
Understory can include stands of young trees, such as seedlings and saplings typically less than 5 meters tall, and associated other woody and herbaceous vegetation. Other understory data can include the bottom and top height of live crowns for each understory grouping and high and low values for the hard and soft snags per acre (part 631, subpart C).

(11) Community Phase Growth Curves.—For the reference community phase and all other data-supported community phases that are dominantly herbaceous and shrub species, include a generalized chart or graph showing percent growth by month or season.

E. Alternative States

(1) Narratives.—Describe each alternative community phase and state identified in the STM diagram. Document whether the community phases are supported by empirical data or are provisional communities. Describe the rationale for separating community phases in different states based on ecological processes. At a minimum, describe the dynamics of the community phase and causes or triggers for community pathways and transitions. Identify and describe the thresholds between states. Provide information on the water cycle, nutrient cycle, and energy flow and an evaluation of the function of these ecological processes. Explain causes for shifts or changes and relate how they will affect ecological functions. Describe changes in hydrologic and erosion characteristics of the site as a result of these shifts. Include descriptions of elements such as amount and distribution of expected litter, patterns of plant mortality, and expected or measured changes in dynamic soil properties.

(2) If community phases are data-supported, follow the guidance in part 631, subpart F, sections 631.56D (2)-(11).

631.57 Ecological Site Interpretations

A. Interpretation for uses, products, and management of an ES are described as appropriate. Some interpretations are listed below, but others may be described as needed.

B. Wildlife Habitat

(1) Interpretations needed for wildlife will be identified early in project planning. Wildlife interpretations can be used by planners and managers to help in determining proper manage of targeted wildlife habitat. The State Conservationist’s designee in consultation with the state wildlife committee determines the scope of selected species, species habitats, life history events, geographic scale of the wildlife habitat interpretations, and other State-specific interpretations. At a minimum, habitat for keystone and indicator species will be described. Habitats for obligate species; commercially important species (i.e., hunted); Federal endangered, threatened, proposed, and candidate species; and State and Tribal species of concern should also be considered.

(2) Terrestrial wildlife species rarely complete their entire life history on a single ecological site. Discuss habitat relationships among associated ecological sites and the habitat requirements of wildlife species met by specific sites. Habitat needs for specific life history events, such as nesting, fawning, brood rearing, and thermal cover, that coincide with specific ecological states (e.g., reference state) or community phases will be noted. Identify these events and the time of year that they occur for integration with use and management of a site, such as timber harvesting, livestock grazing, and forage harvesting. If appropriate, identify specific ecological states or community phases that provide critical source or sink habitat or life history requirements for specific species. This information can be used to mitigate impacts by proper timing of management actions and to determine land use that benefits specific species. Identify changes in fauna and habitat quality that will result from changes in ecological state or community phase.
(3) Descriptions must include information on how the timing, intensity, and duration of management actions affect the quantity and quality of essential habitat elements. Both positive and negative impacts at the site level and population impacts at the landscape level must be addressed. For instance, describe how prescribed grazing management can provide localized nesting or fawning cover. At a landscape level, discuss how retention of snags affects populations of cavity nesters. When developing wildlife habitat interpretations, consider areas where land management actions targeting reduction of fuel loads can improve habitat at the landscape level. Careful management to maintain essential habitat elements for keystone species can provide for regeneration of habitats locally and throughout the ecosystem.

(4) To facilitate timely development of wildlife habitat interpretations (WHI) with limited resources, States should consider developing generalized wildlife interpretations for similar ecological sites. This can be done by developing WHIs at a larger geographic scale (e.g., Level III ecoregions, LRUs, MLRAs). Using this approach, WHIs would be developed for all similar ecological sites with a similar dominant plant community (e.g., woodland, shrubland, grassland). The interpretations would then be adapted to each respective ESD. WHIs for ESDs with unique habitat elements and wildlife species should be described independently.

(5) State biologists will approve the WHIs for the ESDs in their State. They may give approval authority to other biologists in the State.

C. Domestic and Feral Animals

General descriptions for use of the site by livestock, domesticated wildlife, and feral animals must also be included. Suitability of the site for grazing, by kind and class of livestock, and potential management problems (poisonous plants, topography, physical barriers, protection from extreme weather, etc.) must be described. Describe interactions between wildlife and livestock and competition for resources. Include forage preferences for livestock and wildlife by plant species or various parts of a plant species for each season of the year. Much of this information is likely more relevant at a higher order of land classification; therefore, if it is contained in a higher order description, a reference to that description is acceptable.

D. Hydrology Functions

Indicate changes in hydrology functions that may occur with shifts in community phases within states and between states. For each community phase, describe the changes in infiltration and runoff expected with specific rainfall events (e.g., 10-year 24-hour storm) as a result of changes in plant species composition, amount and timing of plant growth, and soil surface characteristics. For example, if the composition of a plant community shifts from blue grama to buffalograss, runoff typically is accelerated as a result of a change in plant growth form and root morphology characteristics. Information about water budgets for each community phase should be considered for inclusion. In areas of wetland and on flood plains, drainage, diversions, channel degradation, land leveling, and other actions change the probability, frequency, and duration of surface water and groundwater.

E. Recreational Uses

Indicate the potential recreational uses that the ES can support or that may influence the management of the site. List the plant species that have special aesthetic or landscape value. Consider species affected by management, such as timber or forage harvesting and the timing of harvesting. Much of this information is likely more relevant at a higher order of land classification; therefore, if it is contained in a higher order description, a reference to that description is acceptable.
F. Wood Products

Describe uses or potential uses of wood products from significant species that may influence the management of the ES. Describe management considerations for woody species that have potential commercial value.

G. Other Products

Describe uses or potential uses for other products, such as landscape plants, nuts and berries, mushrooms, mulching material, and biomass used for energy production. Include a clear heading for each use or product. Strongly consider potential effects from overharvesting or removal of products from the ES.

631.58 Supporting Information

A. Associated Sites

Identify and describe other ESs commonly located adjacent to or in coordination with the ES. Note how they are connected on the landscape.

B. Similar Sites

Identify and describe ESs that resemble or are similar to the ES and can be confused with it. Note the significant differences between the sites.

C. Inventory Data References

List plots and other supporting inventory data for site identification and community phases. Show the data source (i.e., sample methods, historical inventory data, or photographs) and identification of each plot. A compilation of inventory data types is described in part 631, subpart F, section 631.56D(2). Landowner permission is required to list specific locations on non-Federal land.

D. Agency and State Correlation

Enter the agencies and States that have reviewed and approved the ESD.

E. Type Locality

Enter the location of a typical example of the ES. Indicate the township, range, and section or longitude and latitude and the specific location. Landowner permission is required to publish this information for non-Federal land.

F. Relationship to Established Frameworks and Classification Systems

Describe how the ESD spatial unit (e.g., MLRA/LRU or ecoregion section) relates to other established geographic frameworks, such as Level-III and Level-IV ecoregions defined by EPA. Crosswalk each data-supported community phase to the existing vegetation types in the National Vegetation Classification, if published. If applicable, include how the ES relates to existing potential natural vegetation classifications, habitat type classifications, and biophysical setting classifications. This information is particularly important for Federal land where other classification systems and mapping hierarchies are used in multilevel or above-ES-level resource assessments, land and resource management planning, and monitoring.

G. Other References

Show other reference information and data used for the ESD or for understanding ecological dynamics of the site. List specific references for information and data that are not included in part 631, subpart F, section 631.58C. Examples include information such as literature references,
historic information, site specific notes, interviews, local expertise, and all other relevant information and data.

631.59 Rangeland Health Reference and Matrix Sheets

Provide reference state conditions for the 17 indicators included in Interpreting Indicators of Rangeland Health (Pellant and others, 2005) if the reference community phase is classified as rangeland. Describe the range of variability for each indicator as expected for the natural disturbance regime in the reference state.

631.60 Ecological Site Description Signatures

A. Authorship
   Record the names of the original authors and the date signed. Include the names of the authors and the date signed in revisions.

B. Quality Control (QC) Documentation
   The identified QC reviewer signs and dates to affirm that information in the ESD has been reviewed for completeness and technical accuracy.

C. Final Quality Assurance (QA) Review
   The SSR ESS signs and dates the QA review documentation to affirm that the ESD meets standards and is properly entered in the ES database.

D. Ecological Site Description Correlation
   The SSRD signs and dates to assure consistency in ESD identification, delineation, description, and interpretation.

E. Certification
   Record the signatures, titles, and agency affiliations of the STCs and partners and the date signed to affirm that the ESD meets state and partner needs for conservation planning, implementation, monitoring, and assessment.
Part 631 – Ecological Site Concept and Description Development

Subpart G – Data Storage

631.70 Reserved
Part 631 – Ecological Site Concept and Description Development

Subpart H – Exhibits

631.80 Ecological Site Differentiation and Development Process

**Preliminary Stages**
- Establish Local Workgroup (Part 631, subpart B, section 631.11A)
- Define Geographic/Ecological Extent (Part 631, subpart B, section 631.11B)
- Gather Background Information (Part 631, subpart B, section 631.11C)
- Evaluate Existing Data (Part 631, subpart B, section 631.11D)
- Reconnaissance Low-Intensity Traverses (Part 631, subpart B, section 631.11E)
- Develop STMs (Part 631, subpart B, section 631.11F)
- Develop Sampling Strategy (Part 631, subpart B, section 631.11G)
- Select Sampling Methods (Part 631, subpart B, section 631.11H)

**Iterative Stages**
- Data Collection – Medium-Intensity Sampling (Part 631, subpart B, section 631.12B)
- Data Analysis (Part 631, subpart B, section 631.12C)
- Define Differentiating Characteristics (Part 631, subpart B, section 631.12D)
- Field Test of ES Concept (Part 631, subpart B, Section 631.12E)
  - Does site concept work in the field?
    - Yes
    - No
      - Repeat 1 or more steps

**Final Stages**
- Data Collection – High-Intensity Sampling (Part 631, subpart B, section 631.13E(1)-(2))
- Develop Management Interpretations (Part 631, subpart B, section 631.13E(3))
- Correlation (Part 631, subpart B, section 631.13E(4))
- Quality Control/Quality Assurance (Part 640, subpart E)
- Final ESD Correlation (Part 640, subpart E)

**Certify ESD** (Part 640, subpart E)

(430631-H, 1st Ed., January 2014)
631.81 Ecological Site Data Collection Strategy

Focused data collection at reference site concept locations (ideally gathered in the reference community phase)

Fine-tuned data collection narrowed down to the primary site concept locations

Numerous data points to capture full range of site variation

Low intensity inventory (traverse)

Medium intensity inventory (transecting or stratified)

High intensity characterization

- Line-point intercept production
- Dynamic soil properties/indicators
- Monitoring of selected attributes
- Soil pit (1 day and possibly revisits)

-Ocular estimates or step/line-point intercept
-Soil function indicators
-Soil profile properties/mini-pit
(1-2 hours)

-Rapid plant community characterization,
-Soil surface function indicators
-General soil types/soil taxa/ecological sites
(15-30 minutes)

631.82 Example Ecological Site Names

Example 1: Shallow Sandy Upland; *Artemisia tridentata* ssp. *wyomingensis/Pascopyrum smithii-Bouteloua gracilis* (Wyoming big sagebrush/western wheatgrass-blue grama)

Example 2: Siltstone Summit Woodlands; *Quercus alba-Carya ovata/Carex pensylvanica* (white oak-shagbark hickory/Pennsylvania sedge)

Example 3 (using one term from all six categories in part 631, subpart F, section 631.37): Alkaline Clayey Playa Depression Precipitation Zone 4-8”; *Atriplex canescens/Sporobolus airoides-Muhlenbergia asperifolia* (fourwing saltbush/alkali sacaton-scratchgrass muhly)

Example 4: Lava Mountains Low and Intermediate Elevation Zone Forest; *Metrosideros polymorpha-Acacia koa/Cibotium glaucum-Broussaisia arguta/Dryopteris wallichiana* (‘ohi’a lehua-koa/hapu’u-kanawao/alpine woodfern)
631.83 Example Flow Charts for Naming Process

The following examples illustrate processes used to construct an ES common name.

Example 1, Flow Chart for Constructing an Ecological Site Common Name

Example 2, Flow Chart for Constructing an Ecological Site Common Name
### 631.84 Soil Texture Terms Used in Ecological Site Common Names

<table>
<thead>
<tr>
<th>Modifier</th>
<th>Description of modifier</th>
<th>General soil texture group</th>
<th>Texture class or subclass</th>
<th>Term</th>
<th>Description of term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volcanic</td>
<td>Material with andic soil properties (includes hydrous, medial, and ashy)</td>
<td>Sandy</td>
<td>Coarse sand, sand, fine sand, very fine sand, loamy coarse sand, loamy sand, loamy fine sand, and loamy very fine sand</td>
<td>Rock fragment</td>
<td>Any size rock fragments</td>
</tr>
<tr>
<td>Highly organic</td>
<td>Saturated and unsaturated mineral material with high organic material content (includes mucky, peaty, and highly organic texture modifiers)</td>
<td>Loamy*</td>
<td>Coarse sandy loam, sandy loam, fine sandy loam, very fine sandy loam, loam, clay loam, sandy clay loam, silty clay loam, silt loam, and silt</td>
<td>Pararock fragment</td>
<td>Any size pararock fragments</td>
</tr>
<tr>
<td>Luminic</td>
<td>Luminic layers composed of fecal pellets, diatoms, or calcareous mud</td>
<td>Silty*</td>
<td>Silt loam, silt, and silty clay loam</td>
<td>Cemented/consolidated</td>
<td>Solid mass, less than 10 percent loose material (e.g., bedrock)</td>
</tr>
<tr>
<td>Anthropogenic</td>
<td>Contains 15 to less than 90 percent artifactual material</td>
<td>Clayey</td>
<td>Sandy clay, silty clay, and clay</td>
<td>Muck</td>
<td>Highly decomposed organic material (sapric)</td>
</tr>
<tr>
<td>Cemented</td>
<td>Cemented material; does not slake</td>
<td></td>
<td></td>
<td>Peat</td>
<td>Slightly decomposed organic material (fibric)</td>
</tr>
<tr>
<td>Gypserous</td>
<td>Contains 15 to less than 40 percent gypsum by weight</td>
<td></td>
<td></td>
<td>Mucky peat</td>
<td>Moderately decomposed organic material (hemic)</td>
</tr>
<tr>
<td>Permafrost</td>
<td>Permanently frozen</td>
<td></td>
<td></td>
<td>Gypsum material</td>
<td>Coarse or fine gypsic material (more than 40 percent gypsum)</td>
</tr>
</tbody>
</table>
* Terms from pages 2 to 41 in the Field Book for Describing and Sampling Soils, Version 3.0 (adapted from NSSH Part 618, Subpart A, Section 618.67.H.viii). If these terms are used as a modifier for a general texture group, they are considered one term.
** Adapted from SSM Chapter 3, Grouping of Soil Texture Classes.
* Silt loam, silt, and silty clay loam may be in either a loamy or silty general texture group, whichever it behaves most similar to under local conditions.
** These terms are used instead of soil texture terms if general texture groups are not appropriate (e.g., no mineral soil material present). Terms are from pages 2 to 43 in the Field Book for Describing and Sampling Soils, Version 3.0
631.85 Generic State-and-Transition Model Labeling

State 1—Reference State

- Community phase 1.1
  - 1.3A → 1.3B → Community phase 1.2
  - 1.2A → 1.2B → Community phase 1.2

Alternative State 2

- Community phase 2.1
  - 2.2A → 2.1A
- Community phase 2.2

Alternative State 3

- Community phase 3.1
  - 3.2A → 3.1A
- Community phase 3.2

Alternative State 4

- Community phase 4.1

Threshold

Pathway types:
- Community pathway
- Succession/retrogression pathway
- Transition
- Restoration pathway
631.86 Topographic and Soil Features Important for Ecological Site Keys

- **Backslope site 1** (eroded residuum on backslopes)
- **Depressional upland site** (depressions on summits)
- **Backslope site 2** (exposed bedrock and residuum on backslopes)
- **Lowland site** (colluvium on footslopes)

- **Upland site** (residuum on summits and shoulders)
631.87 Dichotomous Ecological Site Key Examples

A. Technical ES Key

I. Flooded (bottom position, flooded from the valleyside or overbank flow)
   A. Soils that have a seasonal or perennial high water table (<3 feet from surface)
      1. Sandy, gravelly, and cobbly soils with redoximorphic feature .......... Wet Sandy Bottom
      2. Loamy to clayey soils with redoximorphic features ......................... Wet Loamy-Clayey Bottoms
   B. Soils that do not have a seasonal or perennial high water table (>3 feet from surface)
      1. Sandy soils .................................................................................. Sandy Bottom
      2. Sandy loam to clay loam soils ...................................................... Loamy Bottom
      3. Clayey soils (vertic) ....................................................................... Clayey Bottom

II. Not flooded (upland position, receives only precipitation)
   A. Slopes less than 15 percent
      1. Soils that are calcareous throughout
         a. Shallow soils (less than 20 inches deep)
            1. Soils that have a lime-cemented hardpan .................. Shallow Limy Hardpan Upland
            2. Soils underlain by limy schist, diorite, or diabase .... Shallow Limy Upland
         b. Soils that are moderately deep or deep (>30 inches)
            1. Soils that have an argillic horizon .............................. Limy Claypan Upland
            2. Soils that do not have an argillic horizon ...................... Limy Upland
   B. Non-Technical ES Key*
      1—Site receives no water except normal precipitation.
      2—More than 12" annual precipitation .............................................. Use upland ES key
      2—Less than 12" annual precipitation ................................................ See number 3
      3—0 to 8" annual precipitation (big sagebrush not present) .............. Use desert ES key
Desert (0 to 8" annual precipitation) ES Key

1—Site is strongly alkaline and/or saline (Black greasewood is indicator species).

2—Surface soil texture is sand to fine sand

3—Surface soil particles are cemented together to form large grains; dune-like in appearance........ Alkali Dunes Desert
3—Surface soil not as above......................................................................................................................... Alkali Sandy Desert

2—Surface soil texture is loam to clay loam.

3—Loam surface soil texture (Sickle saltbush is dominant shrub.)......................................................... Alkali Loam Desert
3—Silt loam surface soil texture (Iodinebush is dominant shrub.)...................................................... Alkali Silt Loam Desert
3—Silty clay loam or finer textured surface soil (Shadscale is dominant shrub.)............................... Alkali Clayey Desert

1—Site is not alkaline and/or saline.

2—Surface soil texture is sand to fine sand.

3—Surface soil particles are cemented together to form large grains; dune-like in appearance............ Dunes Desert
3—Surface soil not as above......................................................................................................................... Sandy Desert

2—Surface soil texture is loam to clay loam or finer.

3—Loam surface soil texture (Sickle saltbush is dominant shrub.)......................................................... Loam Desert
3—Silt loam surface soil texture (Iodinebush is dominant shrub.)...................................................... Silt Loam Desert
3—Silty clay loam or finer textured surface soil (Shadscale is dominant shrub.)............................... Clayey Desert

* Typical indicator or dominant plant species are given in parentheses, but they are not part of the key since they may not be present or may have been removed from the site.
### 631.88 Matrix Ecological Site Key Example

<table>
<thead>
<tr>
<th>Slope position</th>
<th>Surface texture</th>
<th>Subsoil texture</th>
<th>Depth to seasonal high water table</th>
<th>Ecological site name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summits and shoulders</td>
<td>Coarse sand</td>
<td>Coarse sand</td>
<td>&gt;60 inches</td>
<td>Coarse Sand Ridge</td>
</tr>
<tr>
<td>Summits, shoulders, and backslopes</td>
<td>Sandy</td>
<td>Sandy</td>
<td>&gt;60 inches</td>
<td>Sandy Upland</td>
</tr>
<tr>
<td>Summits, shoulders, and backslopes</td>
<td>Sandy</td>
<td>Loamy</td>
<td>&gt;60 inches</td>
<td>Loamy Upland</td>
</tr>
<tr>
<td>Footslopes, concave backslopes, and other water-receiving upland positions</td>
<td>Sandy or loamy</td>
<td>Clayey</td>
<td>12 to 30 inches</td>
<td>Lowland</td>
</tr>
<tr>
<td>Drainageways or flood plains</td>
<td>Mucky loam or loam, or organic material</td>
<td>Sandy or loamy</td>
<td>Surface to a depth of 12 inches</td>
<td>Overflow</td>
</tr>
<tr>
<td>Depressional areas</td>
<td>Fine sandy loam</td>
<td>Sandy clay or sandy clay loam</td>
<td>Surface to a depth of 12 inches</td>
<td>Depressions</td>
</tr>
</tbody>
</table>
Part 632 – Delineation and Mapping, Hierarchies, and Other Vegetation Classification and Stratification Schemes

Subpart A – Related Stratification Schemes

632.0 Reserved
Part 632 – Delineation and Mapping, Hierarchies, and Other Vegetation Classification and Stratification Schemes

Subpart B – Delineation and Mapping of Ecological Sites

632.10 Reserved
Part 632 – Delineation and Mapping, Hierarchies, and Other Vegetation Classification and Stratification Schemes

Subpart C – Benchmark Ecological Sites

632.20 Reserved
Part 632 – Delineation and Mapping, Hierarchies, and Other Vegetation Classification and Stratification Schemes

Subpart D – Ecological Site Relationships with Other Classification and Mapping Hierarchies

632.30 Reserved
Part 633 – Abbreviations, Glossary, and References

Subpart A – Abbreviations

633.0 List of Abbreviations

The following abbreviations apply to the National Ecological Site Handbook:

1. BOA—board of advisors
2. ES—ecological site
3. ESD—ecological site description
4. ESI—ecological site inventory
5. ESS—ecological site specialist
6. FOTG—Field Office Technical Guide
7. LRU—land resource unit
8. MLRA—major land resource area
9. NASIS—National Soil Information System
10. NCSS—National Cooperative Soil Survey
11. NEST—National Ecological Site Team
12. NESH—National Ecological Site Handbook
13. NGLT—National Grazing Lands Team
14. NGO—nongovernmental organization
15. NHQ—National Headquarters
17. NTSC—national technical and support center
18. QA—quality assurance
19. QC—quality control
20. SDQS—soil data quality specialist
21. SQE—soil quality and ecosystems
22. SRC—State resource conservationist
23. SSD—Soil Science Division
24. SSL—soil survey office leader
25. SSO—soil survey office
26. SSO ESS—soil survey office ecological site specialist
27. SSR—soil survey region
28. SSR ESS—soil survey region ecological site specialist
29. SSRD—soil survey regional director
30. SSRO—soil survey regional office
31. SSS—State soil scientist
32. STC—State Conservationist
33. STM—state-and-transition model
34. WHI—wildlife habitat interpretations
Part 633 – Abbreviations, Glossary, and References

Subpart B – Glossary

633.10 Reserved
Part 633 – Abbreviations, Glossary, and References

Subpart C – References

633.20 Reserved