This amendment transmits new or revised material for:

Part/Section	Description
Cover Page	Revised graphic.
Tables of Contents	Revised tables of content to reflect changes.
Part 535.4	Changed part title from Foresters Within NRCS to Forestry Within NRCS to agree with companion part in the NFH
Part 536.01	Changed CMS to RMS and added subparts (a) and (b).
Part 536.03	Revised to include specific reference in the NFH.
Part 537.10	Revised ESIS statement to reflect new section on ecological site concepts
Part 537.22	Revised rating classes for Road Suitability (Natural Surface), Mechanical Site Preparation (Surface), and Mechanical Site Preparation (Deep) to correspond to soil survey pre-written material.
Part 537.30	Added material on ecological site concepts
Part 537.31	Revised to reflect new material added to Part 537.30
Part 537.32	Added material to reflect relationship between ecological site development and soil survey activities.
Part 537.33	Renumbered and revised to reflect the two new worksheets in the NFH used to record forest and windbreak plot data.
Exhibits 537-1	Revised to add curve number for *Abies lasiocarpa* (subalpine fir)
Exhibits 537-7 and 537-8	Revised water table criteria.
Exhibits 537-9 and 537-10	Revised rating class headings in exhibits to reflect the revised ratings classes in part 537.22. Revised water table criteria
Exhibit 537-11	Revised restriction hardness and water table criteria.
Exhibit 537-12	Revised water table criteria.
Exhibit 537-14	Revised to add inadvertently omitted criteria.
Exhibit 537-15	Revised various soil rating criteria in the Conservation Tree/Shrub Group criteria table, revised Exhibit Notes/Definitions to modify Growing Season definition and correct exhibit number, and added Exhibit Conservation Tree/Shrub Group Descriptions.
Part 538.25	Removed part 538.25 to delete reference to STEMS software which is no longer available for use. Remaining parts renumbered accordingly.
Subject Index	Revised subject index to reflect changes.

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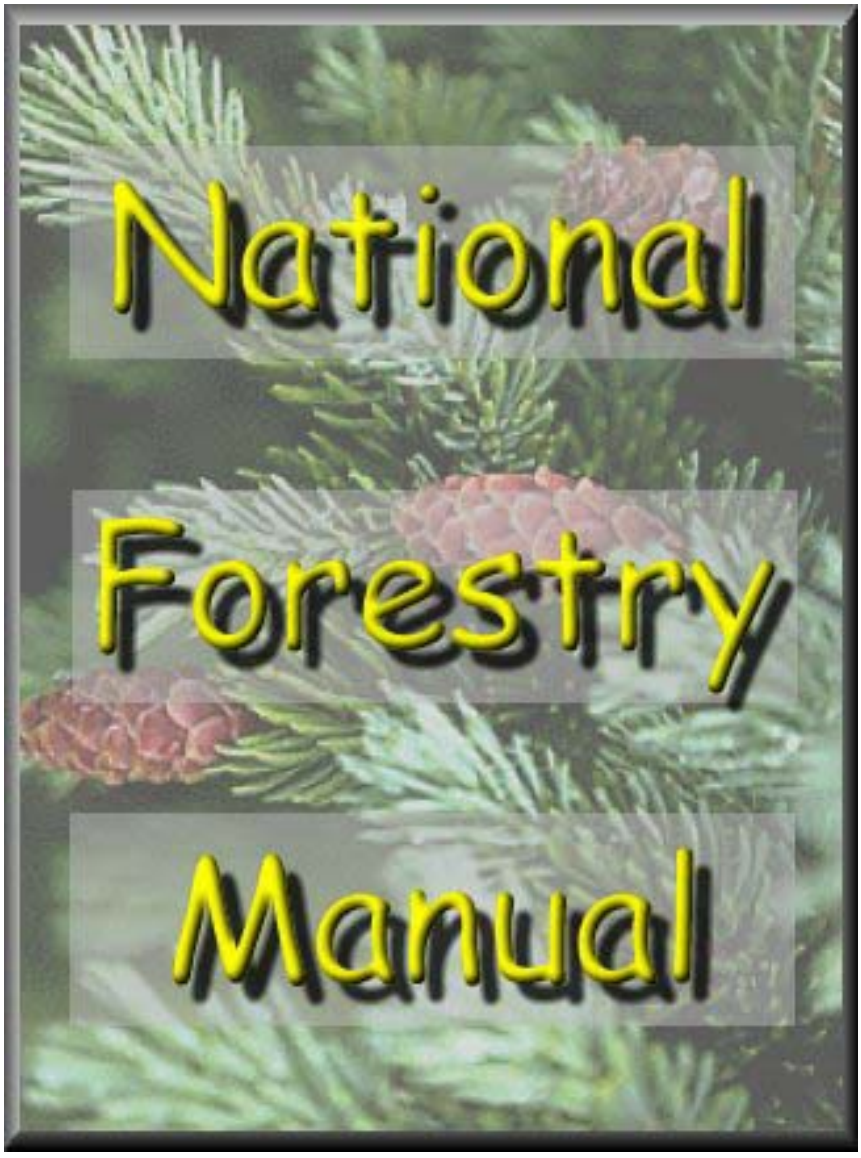

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Part 535.4 – Forestry Within NRCS

535.40 General

This section describes forestry positions in NRCS, steps in career development, training guidelines, and sources of technical materials and information.

535.41 Forestry Positions

(a) National Level

The NRCS will have foresters at national headquarters, national centers and institutes to represent NRCS nationally and provide national leadership on NRCS forestry-related activities.

(b) State Level

State Conservationists will have a state staff forester or a designated staff forestry specialist. This position has technical responsibility for conservation forestry matters for NRCS programs within the state.

(c) Area and Field Levels

Where needed, State Conservationists will have area and field foresters or designated forestry specialists. Area-wide and field foresters provide assistance on forestry-related operations within their administrative area.

535.42 Career Development

Foresters at all levels will pursue continuing education to maintain technical expertise. Foresters will encourage qualified employees to consider forestry positions within the NRCS.

535.43 Performance Benchmarks

The training guidelines for soil conservationists and foresters are contained in GM-360, Part 410. Additional guidelines are contained in Exhibit 535-4.

535.44 Technology Transfer

(a) Acquiring and Maintaining Technical Materials

Foresters acquire or maintain access to technical materials for the administrative area they serve.

(b) Disseminating Technical Information

Foresters will issue technical information at the area, state, or national level. This may include original information, research notes or papers, or excerpts of such material. Foresters are encouraged to submit articles for publication or presentation at professional meetings. Information will have an appropriate technical review and include crediting of information source(s).

(c) Training

Foresters will receive and provide training necessary to maintain technical competency at all administrative levels. Training includes but is not limited to National Employee Development Courses, workshops, conferences, and university courses.

535.45 Technical Guides

State staff foresters develop and review Field Office Technical Guide materials and ensure materials are technically correct, comprehensive, and useful to other agencies. NRCS policy on preparing and maintaining technical guides is contained in Title 450-GM, Part 401.

Part 536 – CONSERVATION PLANNING

CONTENTS

Part 536.0 - General

536.00 Introduction

This part describes planning policy with owners and users of forestland and agricultural producers using agroforestry technology.

536.01 Planning Policies

(a) General

General Manual 180, Part 409 - Planning Policy establishes NRCS policy that guides NRCS employees as they provide assistance to clients for planning and implementing resource conservation plans.

The NRCS National Planning Procedures Handbook provides guidance on the "how to" of the planning process as related to the planning policy established by the General Manual

The National Forestry Manual provides NRCS policy for forestland resource conservation planning (forestry and agroforestry).

The General Manual 450, Part 401- Technical Guides establishes NRCS Field Office Technical Guide policy. The local Field Office Technical Guide contains the technical information needed to assist clients in the development and application of conservation plans. It contains general resource information about the field office area, soil and site information, quality criteria to be met in the Resource Management Systems (RMS's), guidance documents depicting the resource management planning thought process, practice standards for all practices applicable to the local field office area, and examples of the Conservation Effects Decision Making Process.

(b) Forestry Planning Policy

The success of the forestry phase of the conservation program depends on the landowner considering forestland a part of the total operating unit. To give forested areas the same consideration and attention that is given to any other land use, the land owner or operator needs a plan that provides:

- A system for managing the forest that is consistent with and coordinated with other farm or ranch operations.
- An annual or periodic income in accordance with owner's objectives.
- Other values such as erosion control, recreation, wildlife habitat, forage production, and environmental enhancement.

(c) Providing Forestry Planning Assistance

When agreements have been developed (see Exhibit 535-1), NRCS personnel are authorized to provide forestry services beyond the normal assistance in conservation planning. Besides giving assistance on erosion control measures, properly trained personnel may provide cooperative assistance on the following:

- servicing cost-shared forestry practice referrals
- limited tree marking
- common insect and disease control methods
- location of logging roads.

Estimating timber volume should be avoided. Nevertheless, there may be occasions when volume estimates are needed to establish cutting cycles for planning purposes. Also, estimating tree volume on a few individual trees for demonstration activities is acceptable.

NRCS supports and encourages prescribed burning on rangeland, pastureland, forest land, hayland, Conservation Reserve Program (CRP) land, and wildlife land to meet specific resource management objectives. The NRCS policy on prescribed burning on grazing lands is in appendix A of this handbook. The national standard for prescribed burning is in the National Handbook of Conservation Practices. In states where prescribed burning on forestland is an acceptable practice, NRCS involvement is limited to planning assistance.

536.02 Objectives

NRCS assists people to make informed management decisions regarding their natural resources. Management considerations normally include information on the current and desired conditions of the soil, water, air, plant, and animal resources. Information is also provided on human resources and values such as; recreation potential, cultural values, economic viability, and aesthetic values.

536.03 Planning Procedures

Refer to the National Forestry Handbook, Part 636.1 for detailed forestry and agroforestry planning procedures.

PART 537 – SOIL-RELATED FORESTRY AND AGROFORESTRY INTERPRETATION

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Part 537.4 - Exhibits

Part 537.1 - Data Collection, Analyses, and Interpretation

537.10 General

Certain data must be collected, analyses made, and evaluations performed to accurately describe the behavior and limitations of soil components for the purposes of forestry and agroforestry. Interpretations associated with each soil component are: (1) developed from the raw field data and subsequent analyses, (2) inferred from historical data, maps or anecdotal information, or (3) derived from criteria based on soil characteristics, soil-moisture relationships, and other associated attributes.

Certain interpretations are highly dependent on the analyses of field data, e.g., Trees to Manage; Forest Productivity; Forest Understory, Ground Cover and Structure, etc. NRCS foresters are to avoid making such interpretations without adequate and properly collected data.

Other interpretations are inferred from historical data and maps, e.g., Historic Climax Plant Community or from expert criteria or rating guides, e.g., Conservation Tree/Shrub Suitability Groups. These interpretations are usually not field data dependent and can be derived from available reference materials or criteria. As such, they are approximations or expectations of an individual soil component's behavior and limitations.

537.11 Organization of Interpretations

Forestry and agroforestry interpretations are organized into two subparts:

(a) Part 537.2 - National Soil Information System (NASIS) Interpretations

This subpart presents the policy, definitions and requirements for basic forestry and agroforestry interpretations normally published in soil survey map unit descriptions and tables.

(b) Part 537.3 - Ecological Site Information System (ESIS) Interpretations

This subpart presents a discussion of ecological site concepts and the policy, definitions and requirements for (1) the collection of forestry and agroforestry plot data and (2) the development of forestland ecological site descriptions.

(iii) Ratings do not assess:

- Clean tillage and other similar activities that disturb up to nearly 100 percent of the area and change the character of the soil.
- Histosols.
- Individual precipitation or storm events.
- The impact of gully erosion.
- Sediment production/delivery ratio or streambank or streambed erosion for water courses on the site.
- Ground disturbing activities on the amount of surface or subsurface water runoff.

(3) Ratings

Slight—Erosion is unlikely under ordinary climatic conditions.
Moderate—Some erosion is likely; control measures may be needed.
Severe—Erosion is very likely; control measures for vegetation re-establishment on bare areas and structural measures are advised.
Very Severe—Significant erosion is expected; loss of soil productivity and off-site damages are likely; control measures are costly and generally impractical.

(4) Soil Rating Criteria

See Exhibit 537-3.

(c) Soil Rutting Hazard

(1) Description

Ratings indicate the hazard or risk of ruts in the uppermost soil surface layers by operation of forest equipment. Soil displacement and puddling (soil deformation and compaction) may occur simultaneously with rutting.

(2) Considerations

(i) Ratings assess:

- The operation of equipment on forest sites (3-10 passes) when the soil moisture is near field capacity.
- The use of standard rubber-tired vehicles (non-flotation tires).
- Year-long water tables ≤30cm.
- Soil displacement and puddling that may affect aesthetics, groundwater hydrology, and productivity of the site.

(ii) Ratings assume:

- Rutting depths usually range from 5 to 60cm and depends, in part, on the weight of equipment (including carried or pulled loads) and shape and size of wheels.
- Lack of organic/vegetation surface cover.
- Condition occurs on soil with slopes and other characteristics that allow use of ground-based equipment.

(iii) Ratings do not assess:

- Impacts of rutting on sloping sites that may channel surface water and effect hydrology.
- Frozen soil within 60cm of the surface.

(3) Ratings

Slight—Little or no rutting.
Moderate—Ruts are likely.
Severe—Ruts readily.

(4) Soil Rating Criteria

See Exhibit 537-4.

(d) Road Suitability (Natural Surface)

(1) Description

Suitability for using the natural surface of the soil component for roads by trucks for the transport of logs and other wood products from the site.

(2) Considerations

(i) Ratings assess:

- The efficient and safe transport of forest products from the site.
- The landscape in its natural setting.
- Frequency and duration of flooding, ponding, and depth and duration of water table.
- The use of trucks (1/2-ton to log-transport capability).
- Activities that disturb 100 percent of the soil surface area with rutting, puddling or displacement up to a depth of 45cm.

(ii) Ratings assume:

- Vegetation and debris are cleared from an area sufficient in width for the road before use begins.
- Using the natural setting of the soil without cut and fill construction.
- Slopes are less than 20 percent gradient.

- Use occurs during customary periods of such activity for the local area.

- Roads are generally less than 1.6km in length with up to a 6m wide running surface.

(iii) Ratings do no assess:

- Non-soil obstacles, e.g., slash.
- Frozen or snow-covered soils.

(3) Ratings

Well Suited—Little or no restrictions to natural road suitability.
Moderately Suited—One or more restrictions reduce site suitability.
Poorly Suited—One or more restrictions generally make the use of the site for a natural road very difficult or unsafe.

(4) Soil Rating Criteria

See Exhibit 537-5.

(e) Log Landing Suitability

(1) Description

The suitability of the soil at the forest site to serve as a log landing.

(2) Considerations

(i) Ratings assess:

- Efficient and effective use of equipment for the temporary storage and handling of logs.
- The use of grappel hooks, skidders, trucks, loaders, cable yarders, and other similar equipment.
- Activities that disturb 100 percent of the soil surface area with rutting, puddling or displacement up to a depth of 45cm.
- The landscape in its natural setting.
- Frequency and duration of flooding, ponding, and depth and duration of water table.

(ii) Ratings assume:

- Vegetation and debris are cleared from an area sufficient in size for the road or landing before use begins.
- One-half acre or less in size.

(iii) Ratings do not assess:

- Non-soil obstacles, e.g., slash.
- Frozen or snow-covered soil.

(3) Ratings

Well Suited—Little or no restrictions to road or log landing suitability.
Moderately Suited—One or more restrictions reduce site suitability.
Poorly suited—One or more restrictions generally make the use of the site for a landing very difficult or unsafe.

(4) Soil Rating Criteria

See Exhibit 537-6

(f) Construction Limitations for Haul Roads and Log Landings

(1) Description

Ratings reflect limitations for constructing haul roads and log landings.

(2) Considerations

(i) Ratings assess:

- Earth moving activities to meet standards and specifications for haul roads and log landings.
- Excavating, removal and shaping of native soil materials to develop haul roads and log landings for forest harvesting and other management activities.
- Cuts and fills less than 3m in depth.
- The use of bladed crawler tractors, excavators, graders, and other primary construction equipment.
- Year-round water tables, year-round ponding, and permafrost.
- Frequency and duration of flooding.

(ii) Ratings assume:

- Construction activities occur during customary periods of such work for the local area.
- Roads are up to 1.6km in length with up to a 6m wide running surface.

(iii) Ratings do not assess:

- Snow-covered soils.

(3) Ratings

Slight—Little or no limitations to construction activities.
Moderate—One or more limitations that cause some difficulty.
Severe—One or more limitations that make road or log landing construction very difficult or more costly.

(4) Soil Rating Criteria

See Exhibit 537-7.

(g) Harvest Equipment Operability

(1) Description
The suitability for operating harvesting equipment.

(2) Considerations
(i) Ratings assess:
- The off-road transport or harvest of logs and/or wood products by ground-based wheeled or tracked equipment.
- The use of standard rubber-tire skidders and bulldozers used for ground-based harvesting and transport.
- Activities that disturb from 35 to 75 percent of the surface area with rutting, puddling, or displacement up to a depth of 45cm.
- Year-round water tables and year-round ponding.

(ii) Ratings assume:
- Activities occur during customary periods of such work for the local area.

(iii) Ratings do not assess:
- Non-soil obstacles, e.g., slash.
- Frozen or snow-covered soils.

(3) Ratings
Well Suited—Little or no restrictions to equipment operability.
Moderately Suited—One or more restrictions reduce the effective and safe use of equipment.
Poorly suited—One or more restrictions make the use of equipment impractical or unsafe.

(4) Soil Rating Criteria
See Exhibit 537-8

(h) Mechanical Site Preparation (Surface)

(1) Description
Ratings indicate the suitability of using surface-altering soil tillage equipment.

(2) Considerations
(i) Ratings assess:
- Activities that include modifying the soil surface to prepare the site for planting or seeding.
- Activities that treat up to 50 to 75 percent of the site to 30cm in depth.
- Features and characteristics from the surface to 30cm in depth.
- The use of brush rakes, chisels, disks, and other similar types of implements pulled by bulldozers or tractors (D6/D7, 150 h.p. tractor or equivalent).
- Year-round water tables and year-round ponding.

(ii) Ratings assume:
- Activities for such work occur during customary periods for the local area.

(iii) Ratings do not assess:
- Non-soil obstacles, e.g., slash.
- Human-caused compacted layers from harvesting or other site activities (only natural restrictive layers are considered).
- Frozen or snow-covered soils.

(3) Ratings
Well Suited—Little or no restrictions to surface mechanical site preparation.
Poorly Suited—One or more restrictions reduce the effective and safe use of equipment.
Unsuited—One or more restrictions generally prevent the effective and safe use of equipment.

(4) Soil Rating Criteria
See.

(i) Mechanical Site Preparation (Deep)

(1) Description
Ratings indicate the suitability of using deep soil tillage equipment.

(2) Considerations
(i) Ratings assess:
- Activities that include subsoiling, ripping and other subsurface soil disturbance across the slope.
- Activities that treat up to 50 to 75 percent of the site to 90cm in depth to break up restrictive or compacted layers and increase infiltration for plant growth.
- Features and characteristics from the surface to 90cm in depth..

- The use of rippers, subsoilers, and other implements pulled by bulldozers (D8 or equivalent) that till at a depth greater than 30cm.
- Year-round water tables and year-round ponding.

(ii) Ratings assume:

- Activities occur during customary periods of such work for the local area.

(iii) Ratings do not assess:

- Non-soil obstacles, e.g., slash
- Human-caused compacted layers from harvesting or other site activities (only natural restrictive layers are considered).
- Frozen or snow-covered soils.

(3) Ratings

Well Suited—Little or no restrictions to deep mechanical site preparation.
Poorly Suited—One or more restrictions reduce the effective and safe use of equipment.
Unsuited—One or more restrictions generally prevent a sufficient level of deep mechanical site preparation.

(4) Soil Rating Criteria

See Exhibit 537-10.

(j) Hand Planting Suitability

(1) Description

Ratings indicate the expected difficulty of hand planting.

(2) Considerations

(i) Ratings assess:

- Activities that include the proper placement of the root systems of tree and shrub seedlings to a depth of up to 30cm.
- The use of bareroot stock, tublings, containerized stock, and cuttings.
- The use of spades, dibbles, planting bars or other similar planting tools.
- Year-round water tables and year-round ponding.

(ii) Ratings assume:

- Necessary site preparation is completed before hand planting.
- Planting activities occur during customary periods of such work for the local area.

(iii) Ratings do not assess:

- Non-soil obstacles, e.g., slash.
- Human-held powered equipment such as power augers.
- Human-caused compacted layers from harvesting or other site activities (only natural restrictive layers are considered).
- Frozen or snow-covered soils.

(3) Ratings

Well Suited—Little or no restrictions to hand planting; planting rates are not affected.
Moderately Suited—One or more restrictions that impede planting and reduce planting rates.
Poorly suited—One or more restrictions that severely impede planting and reduce planting rates.
Unsuited—Site factors and features prevent the proper planting of seedlings.

(4) Soil Rating Criteria

See Exhibit 537-11.

(k) Mechanical Planting Suitability

(1) Description

The difficulty of planting tree or shrub seedlings using a mechanical planter.

(2) Considerations

(i) Ratings assess:

- Activities that include the proper placement of the root systems of tree and shrub seedlings to a depth of up to 30cm.
- The use of bareroot stock, tublings, containerized stock, and cuttings.
- Year-round water tables and year-round ponding.
- The use of mechanical planters that create narrow furrows or trenches to a depth of 30cm and are operated on the contour or cross-slope.
- The use of mechanical planters on a 3-point hitch with coulter, shank or trench "shoe," and packing wheel pulled by sufficiently powered equipment.

(ii) Ratings assume:

- Planting activities occur during customary periods of such work for the local area.
- Necessary site preparation is completed before mechanical planting.

Part 537.3 – Ecological Site Information System (ESIS) Interpretations

537.30 Forestland Ecological Sites

(a) Definition

Forestland landscapes are divided into ecological sites for the purposes of inventory, evaluation, and management. An ecological site is a distinctive kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation.

An ecological site is the product of all the environmental factors responsible for its development, and it has a set of key characteristics that are included in the ecological site description. Ecological sites have characteristic soils that have developed over time throughout the soil development process. The factors of soil development are parent material, climate, living organisms, topography or landscape position, and time.

An ecological site has a characteristic hydrology, particularly infiltration and runoff, that has developed over time. The development of the hydrology is influenced by development of the soil and plant community.

An ecological site has evolved a characteristic plant community and amount of vegetation. The development of the vegetation, the soil, and the hydrology are all interrelated. Each is influenced by the others and influences the development of the others. The plant community on an ecological site is typified by an association of species that differs from that of other ecological sites in the kind and/or proportion of species, or in total production.

An ecological site evolved with a characteristic fire regime. Fire frequency and intensity contributed to the characteristic plant community of the site.

Soils with like properties that produce and support a characteristic native plant community are grouped into the same ecological site.

An ecological site is recognized and described on the basis of the characteristics that differentiate it from other sites in its ability to produce and support a characteristic plant community.

(b) Succession and Retrogression

Succession is the process of soil and plant community development on an ecological site. Retrogression is the change in vegetation away from the historic climax plant community due to mismanagement or severe natural climatic events.

Succession occurs over time and is a result of interactions of climate, soil development, plant growth, and natural disturbances and conditions existing on the ecological site. Plant succession is defined as the progressive replacement of plant communities on an ecological site that leads to development of the historic climax plant community.

Primary succession is the formation process that begins on substrates having never previously supported any vegetation (lava flows, volcanic ash deposits, etc.). Secondary succession occurs on previously formed soil from which the vegetation has been partially or completely removed.

In some locations, primary succession was never completed before the site was disturbed by human intervention. An example is the historic lakebed of Lake Bonneville in the Great Basin area of Utah, Nevada, and Idaho.

Ecological site development, along with associated climatic conditions and normal disturbances (fire, flooding, etc.) produces a plant community in dynamic equilibrium with these conditions This plant community is referred to as the historic climax plant community. Vegetation dynamics on an ecological site includes succession and retrogression. The pathway of secondary succession is often not simply a reversal of disturbances and/or stressors responsible for retrogression and may not follow the same pathway as primary succession.

(c) Historic Climax Plant Communities

The historic climax plant community for a site in North America is the plant community that existed at the time of European immigration and settlement. It is the plant community that had developed as a result of all site forming factors and was best adapted to the unique combination of environmental factors associated with the site. The historic climax plant community was in dynamic equilibrium with its environment. It is the plant

community that was able to avoid displacement by the suite of disturbances and disturbance patterns (magnitude and frequency) that naturally occurred within the area occupied by the site. Natural disturbances, such as drought, fire, and insects were inherent in the development and maintenance of these plant communities. The effects of these disturbances are part of the range of characteristics of the site that contribute to that dynamic equilibrium. Fluctuations in plant community structure and function caused by the effects of these natural disturbances establish the boundaries of dynamic equilibrium. They are accounted for as part of the range of characteristics for an ecological site. Some sites may have a small range of variation, while others have a large range. Plant communities that are subjected to abnormal disturbances and physical site deterioration or that are protected from natural influences, such as fire, for long periods seldom typify the historic climax plant community.

(d) State and Transition Models

State and transition models will be utilized to describe vegetation dynamics and management interactions associated with each ecological site. State and transition models provide a method to organize and communicate complex vegetation management information.

A state is a recognizable, relatively stable and resilient complex whose attributes include its physical environment (abiotic components) and communities of living organisms (biotic component, inclusive of soil biota). The biotic and abiotic components are inseparably interrelated and interact upon each other to produce a sustained equilibrium. Each state has its own characteristics, benefits, and values depending upon the intended use, products, and environmental effects desired from the site.

Two important attributes of a state are stability and resilience. Stability refers to the capability of the state to absorb disturbance and stresses and retain its ecological structure. Resilience refers to the amount of disturbance or stress a state can endure and still regain its original function after the disturbances and stresses are removed.

States are relatively stable and resistant to changes produced by disturbances or stressors up to a certain threshold point. A threshold is the boundary between two states. Once a threshold is crossed, returning to the previous state is not possible on a practical time scale without significant inputs. Significant inputs are associated with accelerating practices. Accelerating practices are those that supplement vegetation management, such as tree planting, site preparation, and timber stand improvement. Once a threshold is crossed there is a disruptive de-coupling of the biotic and abiotic components of the system and a new state is not developed until a new, unique equilibrium of these components is established, producing a stable system.

Transition is the trajectory of system change between states, triggered by natural events, management actions, or both, that will not cease before the establishment of a new state. Prior to crossing a threshold, a transition is reversible and represents an opportunity to reverse or arrest the change. Some transitions may occur very quickly and others over long periods of time. In either case, the system does not stop halfway through a transition. Even though a transition between two states can occur in either direction, they generally are not just the opposite of each other and usually follow different paths.

States are not static. They encompass a certain amount of variation due to climatic events, management actions, or both. Dynamics within a state do not represent a state change since a threshold is not crossed. In order to organize information for management decision making purposes, it may be desirable at times to describe these different expressions of dynamics within the states. These different assemblages within states will be referred to as communities and the cause of change between these communities as community pathways. See Figure 537 - 1 for an example of a state and transition model diagram for an ecological site.

The state and transition discussion in each ecological site description will describe and illustrate:

- Common states that can occur on the site
- Transitions that exist between states
- Conditions that must prevail for management opportunities to exercise the option to make favorable transitions
- Conditions under which management must avoid unfavorable transitions in order to prevent degradation

The first state described in an ecological site description is the historic climax plant community or naturalized plant community. From this state, a “road map” to other states can be developed. Each transition is to be identified separately and described, incorporating as much information as is known concerning the triggers and drivers of change and any known probabilities

associated with the transitions. Communities and community pathways within states may be described as needed.

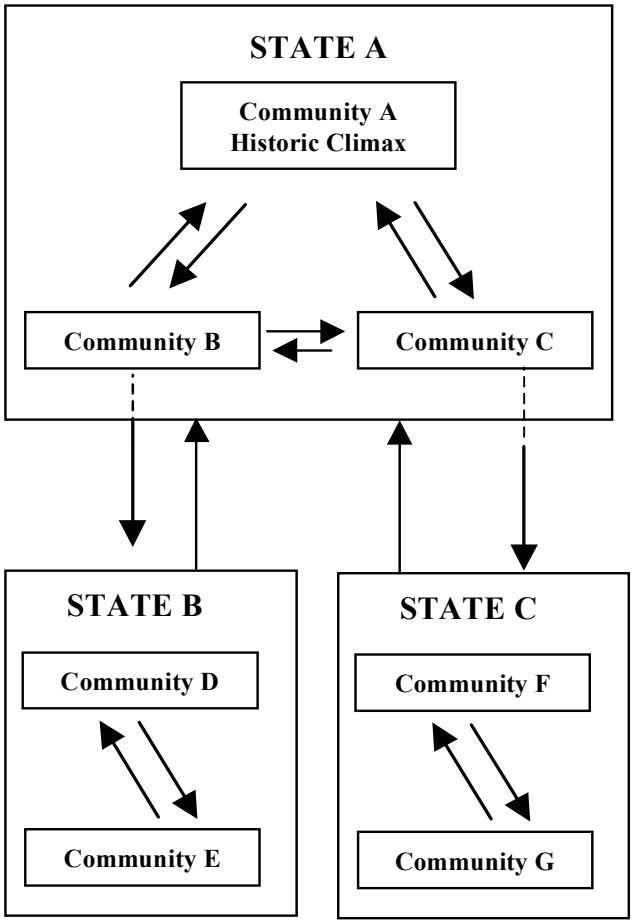


Figure 537 - 1 State and transition diagram example

(e) Naturalized Plant Communities

Ecological site descriptions are to be developed for all identified sites on forestland. In some parts of the country, however, the historic climax plant community has been destroyed, and it is impossible to reconstruct that plant community with any degree of reliability. In these regions, site descriptions will be developed using the naturalized plant communities for the site. The use of this option for ecological site descriptions is limited to those parts of the country where the historic climax plant community has been destroyed and cannot be reconstructed with any degree of reliability. An example of the areas in the United States where this may be used is the state of Hawaii, the Caribbean Area, and the annual grasslands of California. Approval to describe additional forestland ecological regions in this way must be obtained from the national program leader for forest ecology.

(f) Permanence and Change of Ecological Site Potential

Retrogression can occur on an ecological site resulting in a number of different states depending on the type of disturbances, the sequence of disturbances, climatic variations, and other variables. Some states that are considered vegetative expressions of degraded historic climax plant communities are stable and can persist for many years without evidence of secondary succession. This persistence may extend beyond practical timeframes for use and management planning. As long as the physical environment supporting these states remains similar to those required by the historic climax plant community, change to another ecological site is not recognized. The ecological potential for the site is not considered to have been altered merely because the present state is stable and can persist for many years.

Severe physical deterioration can permanently alter the potential of an ecological site to support the original plant community. Examples include permanently lowering the water table, severe surface drainage caused by gullying, and severe soil erosion by water or wind. When the ecological site's potential has significantly changed, it is no longer considered the same site. A change to another ecological site is then recognized, and a new site description may need to be developed on the basis of its altered potential.

Some ecological sites have been planted or seeded to introduced species. The introduced species may become well established or naturalized to the site. They may dominate the site, or they may continue to occupy part of the site even when secondary succession has restored the plant community to near historic climax conditions. In these cases a change in ecological site is not recognized because the edaphic and climatic potential for the site has not been altered.

(g) Determining Characteristic States

Where possible, the historic climax plant community for each ecological site is to be determined. Where it is not possible to determine the historic climax plant community, the naturalized plant community will be described. In addition to the historic climax plant community or naturalized plant community, other known states occurring on the site are to be included in the ecological site description.

The description of each state should be considered as an approximation subject to modification as additional knowledge is gained. Every effort should be made to examine plant communities within the ecological site's area of occurrence during different seasons and in different years. This is necessary to adequately describe the vegetation dynamics within a site.

Characteristics of a state obtained from a single source or site are not conclusive for describing the state. In evaluating plant information, consideration must be given to many factors including:

- Effects of fire or lack of fire
- Impacts of grazing or browsing animals
- Impacts of insects or diseases
- Soil erosion or deposition by wind or water
- Drought or unusually wet years
- Variations in hydrology and storm events
- Introduced plant species

The following methods are used in determining the characteristic states of an ecological site:

- Identification and evaluation of reference sites with similar plant communities and associated soils. When describing the historic climax plant community, the reference sites should not have been subjected to abnormal disturbances (or the lack of normal disturbance). The productivity and the species composition of the plant community should be evaluated.
- Evaluation and comparison of the same ecological sites occurring in different areas, but that have experienced different levels of disturbance and management. Further comparison should be made with areas that are not disturbed. Projecting the response of plant species to given disturbances and relating the present day occurrence of species on a site to past disturbances (type and extent of disturbance, frequency, and magnitude) provides a basis for approximating certain vegetative characteristics of the plant community.
- Evaluation and interpretation of research data dealing with the ecology, management, and soils of plant communities.
- Review of historical accounts, survey and military records, and botanical literature of the area.

The Ecological Site Inventory (ESI) database can provide useful data in identifying plant communities. This database can be accessed on the internet at:

http://plants.usda.gov/esis

(h) Differentiation Between Ecological Sites

The following criteria are used to differentiate one ecological site from another:

- Significant differences in the species or species groups that are in the historic climax plant community.
- Significant differences in the relative proportion of species or species groups in the historic climax plant community.
- Significant differences in the total annual production of the historic climax plant community.
- Soil factors that determine plant production and composition, the hydrology of the site, and the functioning of the ecological processes of the water cycle, mineral cycles, and energy flow.

Contrasting conditions in the soil characteristics, climate, topography, and other environmental factors known to be associated with a specific ecological site can be used as a means of identifying the site when the historic climax plant community is absent.

Generally, one species or a group of species dominates a site. Dominant status does not vary from place to place or from year to year. Because of their stability in the historic climax plant community, dominant species can often be used to distinguish sites and to differentiate one site from another. When dominant species are in equal proportion, species in minor proportions can be used to distinguish sites.

In evaluating the significance of kinds, proportion, and production of species or species groups that are dominant in a historic climax plant community, and given different soil characteristics, the relative proportion of species may indicate whether one or more ecological sites are involved. For example, in one area the historic climax plant community may consist of 60 percent green ash and 10 water oak, and in another area it may consist of 60 percent water oak and 10 percent green ash. Thus, two ecological sites are recognized. Even though the production and species are similar, the proportion's difference distinguish them as separate sites.

In identifying an ecological site, consideration must be given to its environment as a whole, as well as to the individual components. The effect of any single environmental factor can vary, depending on the influence of other factors. For example, an additional 2 inches of annual rainfall may be highly important in a section of the country that has an arid climate, but of minor

significance in a humid climate. Similarly, a difference in site index of 10 feet may be of minor importance on ecological sites capable of producing site indices of 250 feet. This difference, however, is highly significant on sites capable of producing site indices of only 60 feet. Similar variations in degree of significance apply to most factors of the environment. Consequently, in identifying an ecological site, consideration must be given to its environment as a whole, as well as to the individual components.

Where changes in soils, aspect, topography, or moisture conditions are abrupt, ecological site boundaries are distinct. Boundaries are broader and less distinct where plant communities change gradually along broad environmental gradients of relatively uniform soils and topography. Making distinctions between ecological sites along a continuum is difficult. Thus, the need for site differentiation may not be readily apparent until the cumulative impact of soil and climatic differences on vegetation is examined over a broad area. Although some plant communities may appear to be along a continuum, distinctive plant communities can be identified and described. Of necessity, boundaries between ecological sites along a continuum of closely related soils and a gradually changing climate are somewhat arbitrary.

At times, normally less frequently occurring plants may increase on a site, or the site may be invaded by plants not formerly found in the historic climax plant community. The presence or absence of these plants may fluctuate greatly because of differences in microenvironment, weather conditions, or human actions. Consequently, using them for site identification can be misleading, so they should not be used to differentiate sites. Site differentiation, characterization, and determination are based on the plant community that develops along with the soils. A study of several locations over several years is needed to differentiate and characterize a site.

(i) Native and Naturalized Pasture

Forestland ecological site descriptions will be developed for land previously managed as native and naturalized pasture where they occurred on forest soil.

If forestland ecological site descriptions have not been developed, or if they do not adequately serve the purpose, native and naturalized pasture forage suitability groups will be developed as the basic interpretive or suitability grouping for native and naturalized pasture. Native and naturalized pasture forage suitability groups consist of one or more soils capable of producing similar kinds and amounts of herbaceous natural vegetation. These soils generally are also capable of producing similar kinds and amounts of overstory trees.

Forestland ecological site descriptions used for native and naturalized pasture must have details about the herbaceous native and naturalized plant community, its production potential, and other pertinent features. The natural tree overstory part of the description will be omitted only if not known. The state forester and state grazing lands specialist, working as a team, have the responsibility of identifying and describing forestland ecological sites with native and naturalized pasture. Assistance from soil scientists and biologists will be requested as needed.

(j) Correlating Ecological Sites

Soil-ecological site correlation establishes the relationship between soil components and ecological sites. Ecological sites are correlated on the basis of soils and the resulting differences in species composition, proportion of species, and total production of the historic climax plant community. Sometimes it is necessary to extrapolate data on the composition and production of a plant community on one soil to describe the plant community on a similar soil for which no data are available. The separation of two distinct soil taxonomic units does not necessarily delineate two ecological sites. Likewise, some soil taxonomic units occur over broad environmental gradients and may support more than one distinctive historic climax plant community. Changes may be brought about by other influences, such as an increase or decrease in average annual precipitation.

Ecological sites are to be correlated between states. Only one Site ID should be given to a single site that occurs in adjacent states within the same MLRA.

The following procedures for soil-ecological site correlation are compatible with the procedures detailed in the National Soil Survey Handbook, Part 627.09.

(1) Responsibilities of State Conservationists

- Maintaining all ecological site inventory data and descriptions within their state
- Proposing and developing new sites
- Consulting with administrators of cooperating agencies for correlating all sites within their states
- Designating which state is responsible for maintaining and updating the ecological site

descriptions when a site occurs in more than one state

(2) Responsibilities of Field Personnel of All Cooperating Agencies

- Collecting the necessary documentation for each site
- Proposing draft descriptions for consideration and approval by the appropriate technical specialist of the agency responsible for the survey

(3) Guidelines for Internal Consistency of Soil-Ecological Site Correlation

- Portray each individual feature with the narrowest feasible range of characteristics that accurately describes the site. For example, portray elevation in relation to aspect. Exclude exceptions that result from unique combinations of features in the described range of characteristics. Discuss the exception in the narrative
- Check that all combinations of features are compatible with the range of characteristics that are described for each individual feature. Coordinate the soil moisture and temperature with the climatic features described. Review the compatibility of listed plant species and the soil properties listed under soil features. Check for other apparent inconsistencies.

(4) Guidelines for Correlation Between Sites

- Make and document comparisons of site descriptions when proposing new sites, reviewing existing sites, or correlating between survey areas, major land resource areas, or states.
- Compare all sites that have two or more major species in common and all sites that have the same soil family, groups of similar families, or other taxa.

537.31 Ecological Site Descriptions

An ecological site description is prepared for each ecological site identified. Descriptions should clearly present the features that characterize the site. They are to address all the resources of the site that are important for identifying, evaluating, planning, developing, managing, and monitoring forestland resources. Descriptions are developed as part of the Ecological Site Information System (ESIS) using the ecological site description format. ESIS is the official repository for all data associated with forestland ecological site descriptions. The state office is responsible for entry and maintenance of site descriptions in this database. Refer to the National Forestry Handbook, Part 637 for detailed instructions on entering data into the ESIS database. The ESIS database can be accessed on the internet at http://plants.usda.gov/esis.

The data comprising a forestland ecological site description is presented in four major categories:

- Site Characteristics
- Plant Communities
- Site Interpretations
- Supporting Information

The following describes the data presented within each of these four sections.

(a) Site Characteristics

The Site Characteristics category identifies the site and describes the physiographic, climate, soil, and water features associated with the site.

(1) Site Type

The subdivision into which forestland and rangeland are divided for study, evaluation, and management. Ecological site descriptions provide the basic data for planning the use, development, rehabilitation, and management of ecological sites.

Forestland ecological sites and rangeland ecological sites are separated based on the historic climax plant community. Where it is not possible to determine the historic climax plant community, the naturalized plant community will be used to differentiate forestland from rangeland ecological sites.

A site type of "forestland" is assigned and described where a 25% overstory canopy of trees, as determined by crown perimeter-vertical projection, dominated this historic vegetation. A tree is defined as a woody-stemmed plant that can grow to 4 meters in height at maturity on the site being described.

A site type of "rangeland" is assigned where overstory tree production was not significant in the climax vegetation. Refer to the National Range and Pasture Handbook for details on developing ecological site descriptions for "rangeland" ecological types.

To determine site type in juniper and pinyon plant communities in the western United States use the criteria contained in the publication *Inventorying, Classifying, and Correlating Juniper and Pinyon Communities to*

Soils in Western United States published September 1997 by the Grazing Lands Technology Institute, NRCS, USDA.

(2) Site Name

Descriptive text used to differentiate one forestland ecological site from another. Forestland ecological sites are named to help users recognize the different forestland sites in their locality.

Forestland ecological sites are named using the scientific names of the vegetation comprising the historic climax plant community. Where it is not possible to determine the historic climax plant community, the sites will be named using the scientific names of the vegetation comprising the naturalized plant community, or other plant communities that comprise the known steady states of vegetation.

The source for scientific names shall be the National Plants Database. The ecological site name shall consist of one or two overstory tree species, one or two understory shrubs and one or two herbaceous species. If more than one species of overstory trees, understory shrubs, or herbaceous species is named, each shall be separated by a "-". The major groupings (trees, shrubs, and herbaceous) shall be separated by a "/".

Example:

Quercus nigra-Quercus phellos/Ilex decidua/Panicum anceps-Carex

Refer to the National Range and Pasture Handbook for details on naming rangeland ecological sites.

Because the interpretive plant community may be either the historic climax plant community or, where applicable, the naturalized plant community**, the first sentence in the interpretive plant community narrative should clearly state whether the interpretive plant community described is the historic climax or the naturalized plant community**.

(3) Site ID

A unique identifier assigned to each named ecological site.

The Site ID consists of five parts:

- The first part of the ecological site id is a letter "F" if the ecological site type is forestland or the letter "R" if the ecological site type is rangeland.
- The second part is a three-digit number and a one-digit letter designating the Major Land Resource Area (MLRA). If the MLRA is only two numbers and no letters, a zero is inserted in the first space followed by the two numbers. The letters A, B, C, etc. following the MLRA represent the MLRA subdivision. An X in the fourth space denotes that there is no MLRA subdivision.
- The third part is a single letter designating the Land Resource Unit (LRU), where applicable. A Y is inserted when LRU's are not used.
- The fourth part is a three digit number representing the individual ecological site number as assigned by the state. The number 0 is placed in front of all state-assigned site numbers less than 100.
- The fifth part is the two-letter state postal code of the state developing the site description.

Examples:

F133BY083AR (forestland ecological site)

R070CY003NM (rangeland ecological site)

(4) Representative Physiographic Features

This section contains a narrative description of the physiographic features representative of the site and the data relative to the following physiographic features.

(i) Landform

Descriptive name(s) representative of the surface features of the site. Up to three landform feature names may be listed. The landform feature name(s) listed are those associated with the soil component(s) comprising the site as recorded in NASIS.

(ii) Elevation

The minimum and maximum elevation, in feet, representative of the site. The representative values should correspond to those recorded in NASIS for the soil components comprising the site.

(iii) Slope

The minimum and maximum slope percent representative of the site. The representative values should correspond to those recorded in NASIS for the soil components comprising the site.

(iv) Water Table Depth

The minimum and maximum depth to the water table, in inches, representative of the site. The representative values should correspond to those recorded in NASIS for the soil components comprising the site.

(v) Flooding
The minimum and maximum values for flooding frequency and duration representative of the site. The representative values should correspond to those recorded in NASIS for the soil components comprising the site.

(vi) Ponding
The minimum and maximum values for ponding frequency, duration, and depth representative of the site. The representative values should correspond to those recorded in NASIS for the soil components comprising the site.

(vii) Runoff Class
The minimum and maximum values of the runoff potential class representative of the site. The representative values should correspond to those recorded in NASIS for the soil components comprising the site.

(viii) Aspect
The direction toward which the surface of the soil faces, expressed as a cardinal direction - North, South, East, West, Northeast, Northwest, Southeast, and Southwest. Up to three cardinal directions may be entered. The aspect of a site is normally of importance only on sites with slopes of 15% or greater.

(5) Representative Climatic Features
This section contains a narrative description of the climatic features representative of the site and the data relative to the following climatic features.

(i) Frost-free Period
The representative minimum and maximum number of days when no frost occurs. Frost may occur even when the official temperature is above freezing as the ground can be colder than where the thermometer is located.

(ii) Freeze-free Period
The representative minimum and maximum number of days when the temperature is a above 32 degrees F.

(iii) Mean Annual Precipitation
The representative minimum and maximum average precipitation the site receives annually, in inches.

(iv) Monthly Precipitation and Temperature
The representative monthly average minimum and maximum precipitation (in inches) and temperature (in degrees Fahrenheit) on the site.

(v) Climate Stations
The unique identifier(s) and name(s) of the climate stations from which the climate data was derived. The period of record (i.e. 1954-1994) for each climate station should also be recorded.

(6) Influencing Water Features
This section contains a narrative description of the influencing water features representative of the site and the data relative to the following water features.

(i) Wetland Description
A listing of the wetland system(s) and associated subsystem(s) and class(es) representative of the site, based on the Cowardin wetland classification system.

(ii) Stream Types
A listing of the stream code(s) and associated narrative(s) describing the various stream type(s) representative of the site, based on the Rosgen classification system (applicable only when the Cowardin wetland system is classified as riverine).

(7) Representative Soil Features
This section contains a narrative description of the soil features representative of the site and the data relative to the following soil features.

(i) Predominant Parent Materials
The kind and origin of the parent material predominant on the site. These values should correspond to those recorded in NASIS for the soil components comprising the site.

(ii) Surface Texture
The representative texture class(es) and texture modifier within a specified depth of the soil surface. Up to three surface textures may be recorded. The depth should be recorded in the narrative for representative soils features. These values should correspond to those recorded in NASIS for the soil components comprising the site.

(iii) Subsurface Texture Group
A general term used to denote the predominant texture group in the soil horizons within a specified depth of the soil surface. The soil texture classes assigned to each group are: Sandy - cos, s, fs, vfs, lcos, ls, lfs, lvfs; Loamy - cosl, sl, fsl, vfsl, l, si, cl, scl, sicl; and Clayey - sc, sic, c. These values should correspond to those recorded in NASIS for the soil components comprising the site. The depth should be recorded in the narrative for representative soils features.

(iv) Surface Fragments <=3"

The representative percent of the ground covered by fragments less than or equal to 3" in size on the site. These values should correspond to those recorded in NASIS for the soil components comprising the site.

(v) Surface Fragments >3"
The representative percent of the ground covered by fragments greater than 3" in size on the site. These values should correspond to those recorded in NASIS for the soil components comprising the site.

(vi) Subsurface Rock Fragments <=3"
The representative percent by volume of the rock fragments less than or equal to 3" in size in the soil horizons to a specified depth These values should correspond to those recorded in NASIS for the soil components comprising the site. The depth should be recorded in the narrative for representative soils features.

(vii) Subsurface Rock Fragments >3"
The representative percent by volume of the rock fragments greater than 3" in size in the soil horizons to a specified depth. These values should correspond to those recorded in NASIS for the soil components comprising the site. The depth should be recorded in the narrative for representative soils features.

(viii) Drainage Class
The range of drainage classes representative of the site. This value should correspond to that recorded in NASIS for the soil components comprising the site.

(ix) Permeability Class
The range of permeability classes representative of the site. This value should correspond to that recorded in NASIS for the soil components comprising the site.

(x) Soil Depth
The representative minimum and maximum depth of the soil to the first restrictive layer, in inches. These values should correspond to those recorded in NASIS for the soil components comprising the site.

(xi) Electrical Conductivity
The representative minimum and maximum values for the electrical conductivity of the soil within 40 inches of the soil surface or to the first restrictive layer, in millimhos per centimeter. These values should correspond to those recorded in NASIS for the soil components comprising the site.

(xii) Sodium Adsorption Ratio
The representative minimum and maximum values for the sodium adsorption ration of the soil within 40 inches of the soil surface or to the first restrictive layer. These values should correspond to those recorded in NASIS for the soil components comprising the site.

(xiii) Soil Reaction (1:1 Water)
The representative minimum and maximum values for the pH of the soil as measured by the 1:1 water method within 40 inches of the soil surface or to the first restrictive layer. The 1:1 water method is general used for all soils except Histosols. These values should correspond to those recorded in NASIS for the soil components comprising the site.

(xiv) Soil Reaction (0.01M CaC12)
The representative minimum and maximum values for the pH of the soil as measured by the 0.01M calcium chloride method within 40 inches of the soil surface or to the first restrictive layer. The 0.01M calcium chloride method is general used for soils with organic horizons. These values should correspond to those recorded in NASIS for the soil components comprising the site.

(xv) Available Water Capacity
The representative minimum and maximum values for the total available water capacity within 40 inches of the soil surface or to the first restrictive layer, in inches. These values should correspond to those recorded in NASIS for the soil components comprising the site.

(xvi) Calcium Carbonate Equivalent
The representative minimum and maximum values for the percent calcium carbonate equivalent within 40 inches of the soil surface or to the first restrictive layer. These values should correspond to those recorded in NASIS for the soil components comprising the site.

(xvii) Soil Survey Associations
A listing of the soil the soil map unit symbols, soil map unit names, and soil components/phases in specified soil surveys that are associated with the site. The soil map unit symbols, soil map unit names, and soil

components/phases should correspond to those recorded in NASIS for the specified soil surveys listed.

(b) Plant Communities

Included in this category are:

- Description of the ecological dynamics of the site
- State and Transition Model diagram
- Description of the common states that occur on the site and the transitions between the states. If needed, describe the communities and community pathways within the state
- Ground cover and structure
- Overstory and understory composition and production
- Photos of each state or community

(1) Ecological Dynamics of the Site

A narrative and graphical representation (state and transition model) describing the states and transitions between the states. The narrative may include, but is not limited to a discussion of:

- The known causes of plant community changes and the patterns of succession shifts or change.
- The effects that variations in non-management type events (weather, wind, fire, flood, etc.) may have on the dynamics of the site.
- The effects that management activities (grazing, fire, silvicultural, etc.) may have on the dynamics of the site.

(2) Plant Community Narrative

This section provides a narrative description of the interpretive plant community and other common plant communities comprising the various vegetation states of the site.

The narrative should describe the structure, appearance, and function of each of the common plant communities. Include the assumptions made of how the site developed (fire, cultural activities, etc.).

Because the interpretive plant community may be either the historic climax plant community or, where applicable, the naturalized plant community**, the first sentence in the interpretive plant community narrative should clearly state whether the interpretive plant community described is the historic climax or the naturalized plant community**.

(3) Ground Cover and Structure

This section lists the percent ground cover by height class (feet) for various cover types -- tree, shrub/vine, grass/grasslike, forb, lichen, moss, microbiotic crusts, coarse fragment, bareground, and litter. The percent ground cover for living cover is the percent of the ground covered by live foliar vegetation looking from the vertical view, in order of plant layer stratification (See Figure 537 - 2). The total percentage can exceed 100%.

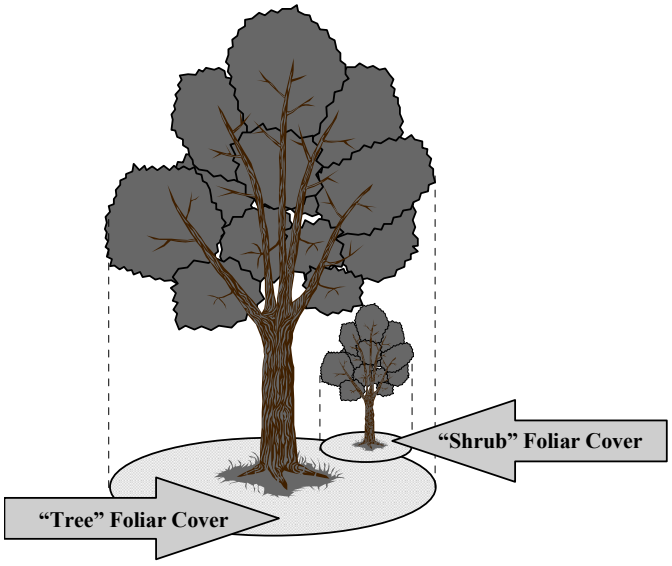
(4) Forest Overstory and Understory Composition

This section contains a narrative description and the percent composition by frequency of the overstory species. The total percent composition must equal 100%.

(5) Forest Understory

This section contains a narrative and the typical annual production of understory species under a minimum, maximum and representative canopy cover. Understory species are those 4.5 feet in height or less. The annual production is recorded in percent of composition and pounds of air-dry weight per acre.

Figure 537 - 2 Vegetation foliar cover



(6) Typical Site Photo

If available, a photograph of a typical site may be included for each state or community.

(c) Site Interpretations

This category contains interpretive information pertinent to the use and management of the site and its related resources.

(1) Forest Site Productivity

This section lists the minimum and maximum site index and annual productivity of the major tree species. The annual productivity per acre per year in cubic feet at culmination of mean annual increment (CMAI) is listed for each identified species. Annual productivity per acre per year in other common units of measurement, (boardfoot-doyle, i.e.), may also be listed for one or more of the identified species.

These values should correspond to those recorded in NASIS for the corresponding soil components and tree species.

(2) Animal Community

This section contains a narrative description of the animal communities associated with the site. The narrative should include information about the type of forage and cover the site affords specific animals, management implications, impacts, etc.

(3) Plant Preference by Animal Kind

This section contains a listing of plant preferences by various animals. For each animal, preference rating is listed for various plant species during each month of the year. Additionally, preference ratings may be listed for the different plant parts (leaf, flower, etc.) of each identified plant species.

(4) Hydrology Functions

This section contains a narrative description of the hydrology of the site. The narrative should include such information as climatic patterns (storm events, rainfall distribution, etc.), landscape position, flooding and/or ponding susceptibility, erosion potentials, concentrated flow characteristics, etc.

(5) Recreational Uses

This section contains a narrative description of the potential recreational uses that the site can support or which may influence the management of the site.

List special concerns that will maintain the recreational potentials or site conditions that may limit its potential. Also, list plant species that have special aesthetic values, uses, and landscape value.

(6) Wood Products

This section contains a narrative description of the kinds of wood products the site is capable of producing and any potential impact that may influence the management of the site as a result of producing these products.

(7) Other Products

This section contains a narrative description of potential uses of other products produced on the site. These may include such things as landscape plants, biomass, mushrooms, berries, ferns, nuts, etc.

(8) Other Information

This section contains a narrative description of other pertinent, interpretive, and descriptive information relative to the site.

(d) Supporting Information

This category contains information useful in assessing the quality of the site description and its relationship to other ecological sites.

(1) Associated Sites

This section contains information about other forestland ecological sites that are commonly located in conjunction with the site. This information includes the site name and site id of each associated site and a narrative describing similarities and differences to the site being described.

(2) Similar Sites

This section contains information about other sites that resemble or can be confused with the site. This information includes the site name and site id of each similar site and a narrative describing the similarities to the site being described.

(3) State Correlation

This section contains a listing of other state(s) using the site description of the site being described.

(4) Inventory Data References

This section contains a narrative description of how data about the interpretive plant community was obtained and a listing of the site inventory plots supporting the site

description. This list records the data source and sample id of each inventory plot used in the development of the site description.

(5) Type Locality
This section contains information about the physical location of sites that typify the site being described. The latitude and longitude of each typifying site will be recorded. The township, range, section, and a general description of the location may also be recorded.

(6) Relationship to Other Established Classifications
This section contains a listing of other classification systems that describe sites similar to the site being described.

(7) Other References
This section contains a list of references used in the development of the site or references that aid in understanding the ecological dynamics of the site.

(8) Site Description Approval
This section contains the name, title, affiliation and date of the individuals that developed/revised and approved the site description.

(e) Revising Ecological Site Descriptions

Analysis and interpretation of new information about the soil, vegetation, and other on-site environmental factors may reveal a need to revise or update ecological site descriptions. Because the collection of such information through resource inventories and monitoring is a continuous process, site descriptions should be periodically reviewed for needed revision. It is especially important that site descriptions be reviewed when new data on composition, production, or response to disturbance become available. Documented production and composition data, along with related soil, climate, and physiographic data, will be the basis of the site description revisions or new site descriptions.

(f) Developing New Site Descriptions

A new site description should be prepared when data analysis or new information reveals that a different or new ecological site exists. Generally, enough land area must be identified to be of importance in the management or study of the site before a new site will be developed and described.

A new ecological site may be differentiated from an existing site when sufficient erosion or other action has occurred to significantly alter the site's potential.

537.32 Ecological Sites and Soil Surveys

NRCS policy dictates mapping of soils and the publication of soil surveys that contain essential information for use in conservation and resource planning activities. These surveys must meet the requirements of the National Cooperative Soil Survey program (see National Soil Survey Handbook, part 606).

The National Soil Survey Handbook, parts 622 and 627, establishes responsibility for planning soil surveys. Soil scientists and forestry discipline specialists work together to map soils and ecological sites in forestland areas. Essential activities include development of soil survey work plans, determination of composition of soil mapping units, preparation of map legends, determination of mapping intensity, and necessary field reviews.

(a) Using Soil Surveys to Identify Ecological Sites

Where Order II soil surveys are completed and ecological site interpretations have been made, boundaries of ecological sites can generally be determined directly from the soil map.

Order III mapping describes individual soil and plant components at association or complex levels. This requires that mapping unit descriptions be developed that describe each association component and assign locations and percentages to each. Individual ecological sites must be described at a level equivalent to the individual components of the Order III soils map.

Each ecological site will be assigned a unique number that distinguishes it from all other ecological sites. This unique 10-character number will be correlated to each soil series or taxonomic unit that occurs within the ecological site. This number and site name will be input into NASIS or other applicable soils data base.

537.33 Ecological Site Inventory

Vegetation sampling is an important activity conducted by Natural Resources Conservation Service (NRCS).

The data are used to develop inventories for planning, to monitor ecological change, to provide data to make management decisions, for the development of ecological site descriptions, and for many other purposes. An inventory is defined as the collection, assemblage, interpretation, and analysis of natural resource data for planning or other purposes. Inventories are regularly completed to determine the present status of variables important to NRCS and decisionmakers. Production and composition by species are used by NRCS in characterizing ecological sites.

(a) Forest Plot Inventory

The ESI Forest Plot Field Worksheet is used to record forest plot inventory information. Refer to the National Forestry Handbook, Part 637 for detailed instructions on the collection of forest plot data, completion of the ESI Forest Plot Field Worksheet, and use of the Ecological Site Inventory database.

(1) Minimum Forest Plots

Table 537-1 lists the minimum number of plots required for major species for each wood-producing soil component identified within a soil survey area.

Table 537- 1 Minimum plots by soil component extent

Soil Component Extent	Acreage (thousands)	No. of plots (National Comparison)
Small	<10	3
Moderate	10 - 100	5
Large	>100	8

(2) Class-determining and Local Phases

Some soil components have class-determining and/or local phases based on productivity or species composition. In such cases, the minimum standards apply for each phase. Existing conditions on certain soil components and/or phases, such as recent harvesting, may preclude obtaining sufficient data. In addition, some species do not have established site index curves. These cases are exempt from the minimum plot standards.

(3) Comparison Data

Data from other soil surveys for a particular soil component or phase may be used to determine site index values if: (1) a minimum of 3 verification plots is taken, or (2) the data source is footnoted.

(4) Measurement Integrity

For all plots on a soil component or phase, the variance of site index values for the indicator species should not exceed a standard deviation value of 10. If the standard deviation of the plots taken is greater than 10, then: (1) increase the number of plots, or (2) determine if a class-determining phase of the soil component or a new soil component is warranted.

(5) Documentation

Site index information published in soil surveys, ecological site descriptions, special reports, and other documents used by the public will list the mean site index for the soil component or phase for its entire geographic extent or for the specific soil survey area. Where the site index displayed does not meet standards of sampling and analysis, clearly note that the standards of sampling and analyses are not met.

(b) Conservation Tree/Shrub Plot Inventory

The ESI Windbreak Plot Field Worksheet is used to record plot data for conservation tree/shrub interpretations.

Refer to the National Forestry Handbook, Part 637 for detailed instructions on collection of conservation tree/shrub plot data, completion of the ESI Windbreak Plot Field Worksheet, and use of the Ecological Site Inventory application to record plot data.

(c) Ecological Site Inventory (ESI) Application

The Ecological Site Inventory (ESI) application provides the capability to enter, edit, and retrieve range, forestry, and agroforestry plot data. ESI is the official repository for all plot data collected via the ESI Forest

Plot Field Worksheet, the ESI Windbreak Plot Field Worksheet, and the Production and Composition Record For Native Grazing Lands (ECS-417).

Refer to the National Forestry Handbook, Part 637 for detailed instructions on the completion of the ESI Forest and Windbreak Plot Field Worksheets, and use of the Ecological Site Inventory database.

Refer to the National Range and Pasture Handbook for detailed instructions on the collection of range plot data.

Part 537-4 - Exhibits

Exhibit 537-1 National Register of Site Index Curves

Scientific Name Common Name NSPNS	Curve Number Age Base Reference	Area of Use	Age Correction Factor								
Abies amabilis Pacific silver fir ABAM	05 100TA Hoyer, Herman 1989	Entire Range	Not Needed								
Abies balsamea balsam fir ABBA	010 50TA Gevorkiantz 1956a	Northeast	**SI** **Years**	30 15	40 13	50 11	60 9	70 8			
	011 50TA Carmean, Hahn 1981	Lake States	**SI** **Years**	20 15	30 13	40 11					
	020 50TA Lloyd 1970a	Northeast	**SI** **Years**	30 15	40 13	50 11	60 9	70 8			
Abies concolor white fir ABCO	030 50TA Schumacher 1926	Entire Range	**SI** **Years**	30 16	40 14	50 12	60 10	70 8	80 6	90 5	
	031 50BH Cochran 1979a	East of Cascades in OR and WA	Not Needed								
	032 50BH Dolph 1987	West of Sierra Nevada Range									
	035 50BH SCS 1988a	East of Cascades in OR and WA									
	605 300TA Dunning 1942	California	**SI** **Years**	71-84 12	85-98 10	99-112 8	113+ 6				
Abies fraseri Fraser fir ABFR	020 50TA Lloyd 1970a	Entire Range	**SI** **Years**	30 15	40 13	50 11	60 9	70 8			

Scientific Name Common Name NSPNS	Curve Number Age Base Reference	Area of Use	Age Correction Factor								
Abies grandis grand fir ABGR	031 50BH Cochran 1979a	East of Cascades in OR and WA	Not Needed								
	570 50TA Haig 1932	Entire Range	**SI** **Years**	40 9	50 8	60 7	70 7	80 6	90 6		
Abies lasiocarpa *subalpine fir* *ABLA*	412 100BH Alexander 1967		Not Needed								
Abies magnifica California red fir ABMA	050 50TA Schumacher 1928		**SI** **Years**	30 16	40 14	50 12	60 10	70 8	80 6		
	055 50BH Dolph 1991	WA, OR	Not Needed								
	605 300TA Dunning 1942	California	**SI** **Years**	71-84 12	85-98 10	99-112 8	113+ 6				
Abies pocera noble fir ABPR	060 100BH Herman, Curtis, DeMars 1978	Entire Range	Not Needed								
Acer nigrum black maple ACNI5	070 50TA Lloyd 1971a		**SI** **Years**	50 5	60 4	70 3					
Acer rubrum red maple ACRU	094 50TA Lloyd 1971b	Entire Range	**SI** **Years**	50 5	60 4	70 3					
	095 50TA Carmean 1978	WI, MI	All Sites - 4 years								
Acer saccharinum silver maple ACSA2	070 50TA Lloyd, 1971a	Entire Range	**SI** **Years**	50 5	60 4	70 3					

Exhibit 537-7 Soil Rating Criteria for Construction Limitations for Haul Roads and Log Landings

FACTOR	SLIGHT	MODERATE	SEVERE	FEATURE	IMPACT
Slope %	<15%	15-30%	>30%	Slope	Reduced efficiency
Soil Slippage Potential	Low	Medium	High	Landslides	Road or landing failure; increased costs
Flooding **Frequency** (months) None, Rare Occasional Frequent/Very Frequent	 1-2 1-2 0	 -- 3-5 1-2	 -- 6-12 3-12	Flooding	Road damage; increased costs
Texture Texture modifier "permanently frozen" or texture in-lieu-of "consolidated permafrost"	--	--	True	Permafrost	Increased costs
Plasticity Index Greatest value for any layer thicker than 15cm and: within 30cm on <15% slopes or within 90cm on 15-30% slopes or within 150cm on >30% slopes	<30	≥30	--	Stickiness	Reduced efficiency, increased construction costs
Particle Size Separates Percent retained on #200 sieve for layers ≥15cm thick and: within 30cm on <15% slopes, within 90cm on 15-30% slopes, or within 150cm on >30% slopes	<85%	≥85%	--	Sandiness	Increased construction costs

Unified Classification Group Layers ≥15cm thick and: within 30cm on <15% slopes or within 90cm on 15-30% slopes or within 150cm on >30% slopes	--	CL, CH, CL-ML, ML, MH	OL, OH, PT	Low strength	Increased construction costs
Texture (depth to Layer) **Very or Extremely Stony** <15% slopes 15-30% slopes **Very or Extremely Bouldery** <15% slopes 15-30% slopes	 >50cm to ≤75cm >75cm >100cm >150cm	 ≤50cm ≤75cm ≥50cm to ≤100cm ≥75cm to <150cm	 -- -- <50cm <75cm	Stoniness	Reduced efficiency; equipment damage; increased costs
Rock Fragments Percent surface cover ≥250cm in size	<3%	3-15%	>15%	Stoniness	Obstruction
Restrictive Layer Depth to bedrock lithic or any restriction with hardness of indurated <15% slopes 5-30% slopes	 >100cm >150cm	 ≥50cm to ≤100cm ≥75cm to <150cm	 <50cm <75cm	Restrictive layer	Reduced efficiency; increased construction costs
Water Table Minimum depth to wet layer for 12 months of the year	>60cm	60cm to 30cm	<30cm	Wetness	Reduced efficiency
Ponding Number of months with occasional or frequent ponding	--	--	12		

Exhibit 537-8 Soil Rating Criteria for Harvest Equipment Operability

FACTOR	WELL SUITED	MODERATELY SUITED	POORLY SUITED	FEATURE	IMPACT
Slope %	<20%	20-35%	>35%	Slope	Reduced efficiency; unsafe operation
Rock Fragments **Percent Surface Cover** ≥75mm to <250mm in size ≥250 to <600cm in size ≥600cm in size	<15% <3% <0.1%	15-50% 3-15% 0.1-3%	>50% >15% >3%	Stoniness	Obstruction
Plasticity Index Highest value for uppermost thickest mineral horizon in the upper 15cm	<30	≥30	--	Stickiness	Reduced efficiency
Particle Size Separates Percent retained on #200 sieve for layers ≥7cm thick in the upper 15cm	<85%	≥85%	--	Too sandy	Reduced efficiency
Unified Classification Group ≥7cm thickness in the upper 15cm	--	CL, CH, CL-ML, ML, MH	OL, OH, PT	Low strength	Reduced efficiency
Water Table Minimum depth to wet layer for 12 months of the year	>60cm	60cm to 30cm	<30cm	Wetness	Reduced efficiency
Ponding Number of months with occasional or frequent ponding	--	--	12		

(190-V-NFM, 1998)

Exhibit 537-9 Soil Rating Criteria for Mechanical Site Preparation (Surface)

FACTOR	WELL SUITED	POORLY SUITED	UNSUITED	FEATURE	IMPACT
Slope %	<15%	15-35%	>35%	Slope	Reduced efficiency
Restriction Hardness (depth to layer) **Strongly or Very Strongly Cemented** **Indurated**	 >30cm --	 <30cm --	 -- <30cm	Restrictive layer	Reduced efficiency
Plasticity Index Greatest value for any layer within 30cm of the surface	<30	≥30	--	Stickiness	Reduced efficiency
Rock Fragments **Within 30cm of Surface** (greatest value for any layer by volume) >75mm in size 2mm to 75mm in size **Percent Surface Cover** ≥75mm to <250mm in size ≥250mm to <600mm in size ≥600mm in size	 <15% <35% <15% <3% <0.1%	 15-60% ≥35% 15-50% 3-15% 0.1-3%	 > 60% -- >50% >15% >3%	Stoniness	Obstruction
Water Table Minimum depth to wet layer for 12 months of the year	≥30cm	<30cm	--	Wetness	Reduced efficiency
Ponding Number of months with occasional or frequent ponding	--	--	12		

Exhibit 537-10 Soil Rating Criteria for Mechanical Site Preparation (Deep)

FACTOR	WELL SUITED	POORLY SUITED	UNSUITED	FEATURE	IMPACT
Slope %	<15%	15-35%	>35%	Slope	Reduced efficiency
Restriction Hardness (depth to layer) **Very Strongly Cemented** ≥10 and ≤20cm Thick Layer >20cm Thick Layer **Indurated**	 -- -- >90cm	 <90cm -- 50cm to 90cm	 -- <90cm <50cm	Restrictive layer	Reduced efficiency
Rock Fragments **Within 90cm of surface** (greatest value for any layer by volume) >75mm in size **Percent Surface Cover** >250cm in size	 <35% <3%	 35-60% 3-15%	 > 60% >15%	Stoniness	Obstruction
Water Table Minimum depth to wet layer for 12 months of the year	--	--	<60cm	Wetness	Reduced efficiency; soil degradation
Ponding Number of months with occasional or frequent ponding	--	--	12		

Exhibit 537-11 Soil Rating Criteria for Hand Planting Suitability

FACTOR	WELL SUITED	MODERATELY SUITED	POORLY SUITED	UNSUITED	FEATURE	IMPACT
Slope	< 35%	35-80%	> 80%	--	Slope	Reduced efficiency
Restriction Hardness (depth to layer) **Moderately Cemented or Bedrock (paralithic)** **Strongly, Very Strongly Cemented, Indurated or Bedrock (lithic)**	>30cm --	20cm to 30cm --	<20cm --	-- <30cm	Restrictive layer	Obstruction
Particle Size Separates Percent retained on #200 sieve for layers ≥7cm thick within 30cm of the surface	--	>85%	--	--	Sandiness	Sloughing
Plasticity Index Greatest value for any layer within 30cm of the surface	<20	20-30	>30	--	Stickiness	Reduced efficiency
Rock Fragments **Within 30cm of the surface** (greatest value for any layer by volume) >75mm in size 2mm to 75mm in size **Percent Surface Cover** >75mm in size	 < 15% <35% <3%	 15-35% 35-75% 3-15%	 36-75% >75% 16-50%	 > 75% -- >50%	Coarse fragments	Obstruction
Water Table Minimum depth to wet layer for 12 months of the year	≥30cm	<30cm	--	--	Wetness	Reduced efficiency
Ponding Number of months with occasional or frequent ponding	--	--	12			

Exhibit 537-12 Soil Rating Criteria for Mechanical Planting Suitability

FACTOR	WELL SUITED	MODERATELY SUITED	POORLY SUITED	UNSUITED	FEATURE	IMPACT
Slope	<5%	5-15%	15-25%	>25	Slope	Reduced efficiency
Restriction Hardness (depth to layer) **Strongly or Very Strongly Cemented** **Indurated**	≥30cm --	<30cm --	-- --	-- <30cm	Restrictive layer	Reduced efficiency
Particle Size Separates Percent retained on #200 sieve for layers ≥7cm thick within 30cm of the surface	--	>85%	--	--	Texture	Sloughing
Plasticity Index Greatest value for any layer within 30cm of the surface	<20	20-30	> 30	--	Stickiness	Reduced efficiency
Rock Fragments **Within 30cm of Surface** (greatest value for any layer by volume) >75mm in size 2mm to 75mm in size **Percent Surface Cover** ≥75mm by size	 < 5% <15% <0.1%	 5-15% 15-35% 0.1-3%	 16-35% 36-60% 3-15%	 > 35% >60% >15%	Stoniness	Obstruction
Water Table Minimum depth to wet layer for 12 months of the year	≥30cm	15cm to 30cm	<15cm	--	Wetness	Reduced efficiency
Ponding Number of months with occasional or frequent ponding	--	--	--	12		

Exhibit 537-14 Soil Rating Criteria For Potential Seedling Mortality

FACTOR	LOW	MODERATE	HIGH	FEATURE	IMPACT
Flooding and/or Ponding Duration	None, Extremely Brief, Very Brief, Brief	Long	Very Long or Long and frequency is frequent	Wetness	Reduced root respiration
Water Table Depth to wet layer	>45cm, Jan-Dec	>15cm to <45cm and not for ≥2 consecutive months, Oct-Feb or for ≥1 months, Mar-Sept	≤15cm for ≥1 month, Jan-Dec OR >15cm to ≤45cm for ≥2 consec-utive months, Oct-Feb or for ≥1 months, Mar-Sept		
CaCO3 Equivalent Greatest value for any layer within 30cm of the surface	--	15-40	>40	High lime	Nutrient imbalance
Soil Reaction Greatest value for any layer within 30cm of the surface	>4.4-7.8	7.9-8.4 OR 3.5-4.4	>8.4-<3.5	Soil reaction	
Electrical Conductivity Greatest value for any layer within 30cm of the surface (mhos/cm)	<4	4-8	>8	Salinity	Reduced moisture supply; toxicity

FACTOR		LOW		MODERATE		HIGH		FEATURE	IMPACT
Available Water Capacity		**Total AWC Within 50cm of the Surface (cm) Slopes >15%**						Low available water	Poor moisture supply
Moisture Class	**Temperature Regime**	**South Aspect (90-270)**	**North Aspect (270-90)**	**South Aspect (90-270)**	**North Aspect (270-90)**	**South Aspect (90-270)**	**North Aspect (270-90)**		
Udic	Any	--	≤2.5	>2.5	--	≤2.5--	--		
Aridic	Frigid or Mesic	--	≥6.5	--	<6.5	<6.5	--		
Xeric or Ustic	Thermic	--	≥7-<10	≥10	<7	<10	--		
	Mesic or Frigid, or Cryic	--	≥5-<9	≥9	<5	<9	--		
		Total AWC Within 50cm of the Surface (cm) Slopes ≤15%						Low available water	Poor moisture supply
Udic	Any	>2.5		≤2.5		--			
Aridic	Frigid or Mesic	--		≥6.5		<6.5			
Xeric or Ustic	Thermic	≥10		≥7-<10		<7			
	Mesic or Frigid, or Cryic	≥9		≥5-<9		<5			

Exhibit 537-15 Conservation Tree/Shrub Group (CTSG) Criteria

GROUP	Soil Depth (cm)	Available Water Capacity (cm)	$CaCO_3$ Equivalent (%, 0-30cm)	pH (0-30cm)	Elec. Cond. (mmhos, 0-30cm)	Depth to Growing Season Water Table (cm)	Saturated Hydraulic Conductivity ($\mu m\ s^{-1}$) (see notes)
1	≥100	≥19.0	≤5	5.6-8.4	≤4	≥90, <150 **OR** ≥150 and frequent or occasional flooding ≥2 months during growing season with a duration of brief, long, or very long	**0-150cm (or 1st restrictive layer)** Min low ≥1.4 Max high ≤142
1A	≥100	≥19.0	≤5	4.5-5.5	≤4		
1H	≥50	≥19.0	--	≤7.8	≤4		Histosol **OR** texture-in-lieu-of is "peat", "muck", or "mucky peat"
1K	≥100	≥19.0	>5, ≤15	6.5-8.4	≤4		**0-150cm (or 1st restrictive layer)** Min low ≥1.4 Max high ≤142
1KK	≥100	≥19.0	>15, ≤40	6.5-8.4	≤4		
1S	≥100	9.5-19.0	≤5	5.6-8.4	≤4		
1SK	≥100	9.5-19.0	>5, ≤15	6.5-8.4	≤4		
1SKK	≥100	9.5-19.0	>15, ≤40	7.9-8.4	≤4		
2	≥100	≥5.0	≤5	5.6-8.4	≤4	≥45, <90 **OR** <90 and temp regime is cryic or pergelic and <1 month wet soil moisture during growing season or temp regime is isofrigid, frigid, or mesic and <2 consecutive and <3 total months wet soil moisture during growing season or any other temp regime and <3 total months wet soil moisture during growing season	--
2A	≥100	≥5.0	≤5	4.5-5.5	≤4		--
2K	≥100	≥5.0	>5, ≤15	6.5-8.4	≤4		--
2KK	≥100	≥5.0	>15, ≤40	6.5-8.4	≤4		--
2H	≥100	≥19.0	--	≤7.8	≤4		Histosol **OR** texture-in-lieu-of is "mucky peat", "muck", or "peat"
3	≥100	≥19.0	≤5	5.6-8.4	≤4	≥150 **AND** frequent or occasional flooding <2 months during growing season with a duration of brief, long, or very long	**0 -150cm (or 1st restrictive layer)** Min low ≥1.4 Max high ≤142 **AND** **Bottom horizon is not sandy or gravelly**
3A	≥100	≥19.0	≤5	4.5-5.5	≤4		

GROUP	Soil Depth (cm)	Available Water Capacity (cm)	$CaCO_3$ Equivalent (%, 0-30cm)	pH (0-30cm)	Elec. Cond. (mmhos, 0-30cm)	Depth to Growing Season Water Table (cm)	Saturated Hydraulic Conductivity ($\mu m\ s^{-1}$) (see notes)
4	≥50	≥12.0	≤5	5.6-8.4	≤4	≥150 **OR** <150cm for <2 months during growing season	**0-50cm, ≥ 20cm thick** Low ≥1.4 High ≤142 **AND** **One or more horizons >15cm thick with a top depth >0** Low ≥0.42, ≤1.43 High <14.3
4A	≥50	≥12.0	≤5	4.5-5.5	≤4		
4K	≥50	≥12.0	>5, ≤15	6.5-8.4	≤4		
4C	≥50	≥9.5	≤5	5.6-8.4	≤4		**Surface horizon to 20cm** Min low ≥1.4 Max high ≤142 and **All horizons with top depth >0** Min low ≥0.42, <1.43 Max high ≤14.3 **OR** **0-150cm (or 1st restrictive layer)** Min low ≥0.42, ≤1.43 Max high ≤14.3
4CA	≥50	≥9.5	≤5	4.5-5.5	≤4		
4CK	≥50	≥9.5	>5, ≤15	6.5-8.4	≤4		
4CC	≥50	≥9.5	≤5	5.6-8.4	≤4		**Surface horizon to 20cm** Min low ≥1.4 Max high ≤142 and **One or more horizons >15cm thick with a top depth >0** High <0.43 and **>100cm to root restrictive layer** **OR** **0-150cm (or 1st restrictive layer)** Max High ≤0.43
5	≥100	9.5-19.0	≤5	5.6-8.4	≤4	≥150 **AND** frequent or occasional flooding <2 months during growing season with a duration of brief, long, or very long	**0-150cm (or 1st restrictive layer)** Min low ≥1.4 Max high ≤142 **AND** **Bottom horizon is not sandy/gravelly**
5A	≥100	9.5-19.0	≤5	4.5-5.5	≤4		
5K	≥100	9.5-19.0	>5, ≤15	6.5-8.4	≤4		
5KK	≥100	9.5-19.0	>15, ≤40	6.5-8.4	≤4		

GROUP	Soil Depth (cm)	Available Water Capacity (cm)	$CaCO_3$ Equivalent (%, 0-30cm)	pH (0-30cm)	Elec. Cond. (mmhos, 0-30cm)	Depth to Growing Season Water Table (cm)	Saturated Hydraulic Conductivity ($\mu m\ s^{-1}$) (see notes)
6	≥50	5.0-9.5	≤5	5.6-8.4	≤4	≥150 **OR** <150cm for <2 months during growing season	**Surface horizon to 20cm** Min low ≥1.4 Max high ≤142 **AND** **Bottom horizon is:** Sandy/gravelly or; High >141 or; Restrictive layer between 50-150cm **AND** **Drainage Class is E, SE, or W**
6A	≥50	5.0-9.5	≤5	4.5-5.5	≤4		
6K	≥50	5.0-9.5	>5, ≤15	6.5-8.4	≤4		
6KK	≥50	5.0-9.5	>15, ≤40	6.5-8.4	≤4		
6D	50-100	≥9.5	≤5	5.6-8.4	≤4		**Surface horizon to 20cm** Min low ≥1.4 Max high ≤43 **AND** **There is a root restrictive layer between 50-150cm**
6DA	50-100	≥9.5	≤5	4.5-5.5	≤4		
6DK	50-100	≥9.5	>5, ≤15	6.5-8.4	≤4		
6G	≥50	≥9.5	≤5	5.6-8.4	≤4		**Surface horizon to 20cm** Min low ≥1.4 Max high ≤142 **AND** **Bottom horizon is sandy/ gravelly or high ≥141** **AND** **Drainage Class is not E**
6GA	≥50	≥9.5	≤5	4.5-5.5	≤4		
6GK	≥50	≥9.5	>5, ≤15	6.5-8.4	≤4		
6GKK	≥50	≥9.5	>15, ≤40	6.5-8.4	≤4		
7	≥100	≥5.0	≤5	5.6-8.4	≤4	≥150 **OR** <150cm for <2 months during growing season	**0-150cm (or 1st restrictive layer)** Min low ≥42 **AND** **All horizons 0-150cm have sandy texture**
7A	≥100	≥5.0	≤5	4.5-5.5	≤4		
8	≥100	≥19.0	>5, ≤15	6.5-8.4	≤4	≥150 **OR** <150cm for <2 months during growing season	**0-150cm (or 1st restrictive layer)** Min low ≥1.4 Max high ≤142
8K	≥100	≥19.0	>15, ≤40	6.5-8.4	≤4		

GROUP	Soil Depth (cm)	Available Water Capacity (cm)	Sodium Adsorption Ratio (0-30cm)	pH (0-30cm)	Elec. Cond. (mmhos, 0-30cm)	Depth to Growing Season Water Table (cm)	Saturated Hydraulic Conductivity ($\mu m\ s^{-1}$) (see notes)
9C	≥50	≥9.5	--	--	4-16	≥150 **OR** <150cm for <2 months during growing season	**Surface horizon to 20cm** Min low ≥1.4 Max high ≤142 and **All horizons with top depth >0** Min low ≥0.42, ≤1.43 Max high ≤14.3 **OR** **0-150cm (or 1st restrictive layer)** Min low ≥0.42, ≤1.43 Max high ≤14.3
9L	≥50	≥9.5	--	--	4-16	≥150 **OR** <150cm for <2 months during growing season	**0-150cm (or 1st restrictive layer)** Min low ≥1.4 Max high ≤43 **OR** **0-20cm** Min low ≥1.4 Max high ≤43 and **20-150cm (or 1st restrictive layer)** Min low ≥0.42 Max high ≤1.43 **OR** **0-50cm** Min low ≥1.4 Max high ≤43 and **50-150cm (or 1st restrictive layer)** Min low ≥0.42 Max high ≤1.43
9N	≥50	≥5.0	>13, <25 any layer	--	0-16		--
9NW	≥50	≥5.0	>13, <25 any layer	--	0-16	≥45, ≤150	--
9W	≥50	≥5.0	--	--	4-16	≥45, ≤150	--
10	Place soil components in CTSG 10 if any of the following conditions exist: • Soil Depth <50cm • Available Water Capacity <5.0cm • CaCO3 Equivalent >40%, 0- 30cm • pH <4.0 or >8.4, 0-30cm • Elec. Cond. >16mmhos, 0-30cm • Sodium Adsorption Ratio ≥25					• Depth to Growing Season Water Table <45cm • Depth to growing season water table is <90cm and: Temperature Regime — Months Wet Cryic or Pergelic ..... >0 Isofrigid, Frigid, or Mesic ..... ≥2 consecutive or ≥3 total Thermic, Hyperthermic, Isothermic, Isohyperthermic, or Isomesic ..... ≥3	

GROUP	Soil Depth (cm)	Available Water Capacity (cm)	Sodium Adsorption Ratio (0-30cm)	pH (0-30cm)	Elec. Cond. (mmhos, 0-30cm)	Depth to Growing Season Water Table (cm)	Saturated Hydraulic Conductivity ($\mu m\ s^{-1}$) (see notes)

Exhibit 537-15 Notes/Definitions

Available Water Capacity—The total potential available water capacity of the soil to the first restriction. Total potential available water capacity is derived by multiplying the available water capacity of each horizon in the soil profile by the horizon thickness and summing the products.

$CaCO_3$ Equivalent—Percent of free lime is by weight per soil unit in the upper 30 centimeters. For automated interpretations using NASIS, the average representative CaCO3 Equivalent value within 30cm of the soil surface is used.

Depth to Growing Season Water Table—Depth to a layer with a moisture status of "wet" during all or part of the growing season. See ***Growing Season***.

Electrical Conductivity—The standard measure, in millimhos per centimeter, of salinity or amount of salts in a soil as determined by the electrolytic conductivity of an extract from saturated soil paste; <2 mmhos/cm indicates little or no salinity; <4 mmhos/cm indicates a very slightly saline soil; 4 to 8 mmhos/cm indicates slightly saline; and greater than 8 mmhos/cm indicates moderately to strongly saline soil. For automated interpretations using NASIS, the maximum representative EC value within 30cm of the soil surface are used.

Group—The symbol identifies groups of similar soil. Characteristics of each group significantly affect the selection and height growth of trees and shrubs. Letters used in a symbol represent key soil characteristics for the group: A = acid, B = basic, C = clay, D = restrictive layer to roots, K and KK = carbonates, G = gravel/sand, H = histosols, L = loamy, N = Natric, S = sandy, and W = wetness.

Growing Season—For automated interpretations using NASIS, the growing season corresponding to a soil component is determined by its taxonomic temperature regime as follows:

Taxonomic Temperature Regime	Growing Season Months
Cryic or pergelic	Jul and Aug
isofrigid, frigid or mesic	May, Jun, Jul, Aug, and Sep
thermic or hyperthermic	Apr, May, Jun, Jul, Aug, Sep, and Oct
isothermic, isohyperthermic, or isomesic	Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, and Nov

Histosols—A soil component is determined to be a Histosol if its taxonomic order is Histosols or if it has a substitute term used in lieu of texture of muck, peat, or mucky peat.

pH—A numerical expression of the relative acidity or alkalinity of a soil sample. The most common laboratory method for measurement of pH is the 1:1 soil-to-water ratio method, however, the 0.01M calcium chloride method is commonly used to measure pH in Histosols. Values less than 4.5 indicate an ultra or extremely acid soil; 4.5 to 5.5 indicates very strongly to strongly acid; 5.6 to 7.8 indicates moderately acid to slightly alkaline; 7.9 to 8.4 indicates moderately alkaline; and greater than 8.4 indicates strongly or very strongly alkaline soil. For automated interpretations using NASIS, the minimum representative pH value within 30cm of the soil surface is used.

Root Restrictive Layer—A nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly reduce the movement of water and air through the soil or that otherwise provides an unfavorable root environment. For automated interpretations using NASIS, the possible restrictive properties are: abrupt textural

change; bedrock (lithic and paralithic); densic material; duripan; fragipan; natric; ortstein; permafrost; petrocalcic; petroferric; petrogypsic; placic; plinthite; salic; strongly contrasting textural stratification; and sulfuric.

Sandy Horizon Texture—The horizon of a soil component is determined to be sandy if the texture class of the horizon is coarse sand (cos), sand (s), fine sand (fs), very fine sand (vfs), loamy course sand (lcos), loamy sand (ls), loamy fine sand (lfs), or loamy very fine sand (lvfs).

Sandy/Gravelly Horizon—The horizon of a soil component is determined to be sandy/gravelly if the percent passing the #10 sieve times the percent passing the #200 sieve divided by 100 is less than or equal to 15 percent.

Saturated Hydraulic Conductivity (K_{sat})—The amount of water that would move downward through a unit area of saturated in-place soil in unit time under unit hydraulic gradient., in micrometers per second.

Sodium Adsorption Ratio (SAR)—A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste, expressed as a percentage. For automated interpretations using NASIS, the maximum representative SAR value within 30cm of the soil surface is used.

Soil Depth—Depth to first restrictive layer measured from the top of the uppermost mineral horizon (or surface for Histosols) to the top of the restrictive layer.

Exhibit 537-15 Conservation Tree/Shrub Group Descriptions

Group 1

Soil depth to a restrictive layer[1] is at least 40 inches (100 cm). The depth to a water table during the growing season[1] is at least 3 feet (90 cm) but less than 5 feet (150 cm). If the soil is frequently or occasional flooded for 2 or more months during the growing season, with a duration of brief, long, or very long, then the depth to a water table during the growing season[1] may exceed 5 feet. The available water capacity[1] is greater than 7.5 inches (19 centimeters). In the upper 12 inches (30 cm) of the soil profile free carbonates do not exceed a concentration of 5 percent calcium carbonate equivalent[1], the range of pH[1] is between 5.6 and 8.4, and electrical conductivity[1] is 4 mmhos/cm or less. For all horizons to a depth of 5 feet (150 cm), or to the first restrictive layer[1], the minimum low Ksat is 0.2 inches/hour (1.4 micrometers per second) or greater and the maximum high Ksat is 20 inches/hour (142 micrometers per second) or less.

Group 1A

Soil criteria is the same as Group 1 except:
- In the upper 12 inches (30 centimeters) of the soil profile the range of pH[1] is between 4.5 and 5.5.

Group 1H

Soil criteria is the same as for Group 1 except:
- Soil depth to a restrictive layer[1] is at least 20 inches (50 cm).
- In the upper 12 inches (30 cm) of the soil profile, free carbonates are not considered and the pH[1] is 7.8 or less.
- The soil taxonomic order is histosol or texture-in-lieu-of is peat, muck, or muck peat.

Group 1K

Soil criteria is the same as Group 1 except:
- In the upper 12 inches (30 cm) of the soil profile free carbonates range between 5 and 15 percent calcium carbonate equivalent[1] and the range of pH[1] is between 6.5 and 8.4.

Group 1KK

Soil criteria is the same as Group 1 except:
- In the upper 12 inches (30 cm) of the soil profile free carbonates range between 15 and 40 percent calcium carbonate equivalent[1] and the range of pH[1] is between 6.5 and 8.4.

Group 1KK

Soil criteria is the same as Group 1 except:
- In the upper 12 inches (30 cm) of the soil profile free carbonates range between 15 and 40 percent calcium carbonate equivalent[1] and the range of pH[1] is between 6.5 and 8.4.

Group 1S

Soil criteria is the same as Group 1 except:
- The available water capacity[1] is between 3.75 and 7.5 inches (9.5 and 19 cm).

Group 1SK

Soil criteria is the same as Group 1 except:
- The available water capacity[1] is between 3.75 and 7.5 inches (9.5 and 19 cm)
- In the upper 12 inches (30 cm) of the soil profile free carbonates range between 5 and 15 percent calcium carbonate equivalent[1] and the range of pH[1] is between 6.5 and 8.4.

Group 1SKK

Soil criteria is the same as Group 1 except:
- The available water capacity[1] is between 3.75 and 7.5 inches (9.5 and 19 cm)
- In the upper 12 inches (30 cm) of the soil profile free carbonates range between 15 and 40 percent calcium carbonate equivalent[1] and the range of pH[1] is between 7.9 and 8.4.

Group 2

Soil depth to a restrictive layer[1] is at least 40 inches (100 cm). The depth to a water table during the growing season[1] is at least 1.5 feet (45 cm) but less than 3 feet (90 cm). The depth to a water table may be less than 3 feet (90 cm) if it is for less than 3 months during the growing season[1]. The available water capacity[1] is greater than 2 inches (5 cm). In the upper 12 inches (30 cm) of the soil profile free carbonates do not exceed a concentration of 5 percent calcium carbonate equivalent[1], the range of pH[1] is between 5.6 and 8.4, and electrical conductivity[1] is 4 mmhos/cm or less.

Group 2A

Soil criteria is the same as Group 2 except:
- In the upper 12 inches (30 cm) of the soil profile the range of pH[1] is between 4.5 and 5.5.

Group 2K

Soil criteria is the same as Group 2 except:
- In the upper 12 inches (30 cm) of the soil profile free carbonates range between 5 and 15 percent calcium carbonate equivalent[1] and the range of pH[1] is between 6.5 and 8.4.

Group 2KK

Soil criteria is the same as Group 2 except:
- In the upper 12 inches (30 cm) of the soil profile free carbonates range between 15 and 40 percent calcium carbonate equivalent[1] and the range of pH[1] is between 6.5 and 8.4.

Group 2H

Soil criteria is the same as for Group 2 except:
- The available water capacity[1] is 7.5 inches (19 cm) or greater.
- In the upper 12 inches (30 cm) of the soil profile free carbonates are not considered and the pH[1] is 7.8 or less.
- The soil taxonomic order is histosol or texture-in-lieu-of is peat, muck, or muck peat.

Group 3

Soil depth to a restrictive layer[1] is at least 40 inches (150 cm). The depth to a water table during the growing season[1] is at least 5 feet (150 cm). If the soil is frequently or occasional flooded with a duration of brief, long, or very long, it must be for less than 2 months during the growing season[1]. The available water capacity[1] is at least 7.5 inches (19 cm). In the upper 12 inches (30 cm) of the soil profile free carbonates do not exceed a concentration of 5 percent calcium carbonate equivalent[1], the range of pH[1] is between 5.6 and 8.4, and electrical conductivity[1] is 4 mmhos/cm or less. For all horizons to a depth of 5 feet (150 cm), or to the first restrictive layer[1], the minimum low Ksat is 1.4 micrometers per second (0.2 inches/hour) or greater and the maximum high Ksat is 142 micrometers per second (20 inches/hour) or less. The bottom horizon is not sandy or gravelly[1].

Group 3A

Soil criteria is the same as Group 3 except:
- In the upper 12 inches (30 cm) of the soil profile the range of pH[1] is between 4.5 and 5.5.

Group 4

Soil depth to a restrictive layer[1] is at least 20 inches (50 cm). The depth to a water table during the growing season[1] is at least 5 feet (150 cm). The depth to a water table may be less than 5 feet (150 cm) if it is for less than 2 months during the growing season[1]. The available water capacity[1] is at least 5 inches (12 cm). In the upper 12 inches (30 cm) of the soil profile free carbonates do not exceed a concentration of 5 percent calcium carbonate equivalent[1], the range of pH[1] is between 5.6 and 8.4, and electrical conductivity[1] is 4 mmhos/cm or less. In the first 20 inches (50 cm) of the soil profile there is at least one layer that is a minimum of 8 inches (20 cm) thick with a low Ksat of 1.4 micrometers per second (0.2 inches/hour) or greater and a high Ksat of 142 micrometers per second (20 inches/hour) or less. Below the first 20 inches (50 cm) of the profile there is at least one layer that is a minimum of 6 inches (15 cm) thick with a low Ksat between 0.42 and 1.43 micrometers per second (0.6 and 0.2 inches/hour) and a high Ksat of 14.3 micrometers per second (2.0 inches/hr) or less.

Group 4A

Soil criteria is the same as Group 4 except:

- In the upper 12 inches (30 cm) of the soil profile the range of pH[1] is between 4.5 and 5.5.

Group 4K

Soil criteria is the same as Group 4 except:

- In the upper 12 inches (30 cm) of the soil profile free carbonates range between 5 and 15 percent calcium carbonate equivalent[1] and the range of pH[1] is between 6.5 and 8.4.

Group 4C

Soil depth to a restrictive layer[1] is at least 20 inches (50 cm). The depth to a water table during the growing season[1] is at least 5 feet (150 cm). The depth to a water table may be less than 5 feet (150 cm) if it is for less than 2 months during the growing season[1]. The available water capacity[1] is at least 3.75 inches (9.5 cm). In the upper 12 inches (30 cm) of the soil profile free carbonates do not exceed a concentration of 5 percent calcium carbonate equivalent[1], the range of pH[1] is between 5.6 and 8.4, and electrical conductivity[1] is 4 mmhos/cm or less. The soil profile falls into one of the following scenarios with respect to Ksat:

1) In the first 8 inches (20 cm) of the soil profile the minimum low Ksat is 1.4 micrometers per second (0.2 inches/hour) or greater and the maximum high Ksat is 142 micrometers per second (20 inches/hour) or less. Below the first 20 inches (50 cm) all horizons have a minimum low Ksat between 0.42 and 1.43 micrometers per second (0.6 and 0.2 inches/hour) and a high Ksat of 14.3 micrometers per second (2.0 inches/hr) or less.
2) All horizons to a depth of 5 feet (150 cm), or the fist restrictive layer[1], have a minimum low Ksat between 0.42 and 1.43 micrometers per second (0.6 and 0.2 inches/hour) and a maximum high Ksat of 14.3 micrometers per second (2.0 inches/hr) or less.

Group 4CA

Soil criteria is the same as Group 4C except:

- In the upper 12 inches (30 cm) of the soil the range of pH[1] is between 4.5 and 5.5.

Group 4CK

Soil criteria is the same as Group 4C except:

- In the upper 12 inches (30 cm) of the soil profile free carbonates range between 5 and 15 percent calcium carbonate equivalent[1] and the range of pH[1] is between 6.5 and 8.4.

Group 4CC

Soil criteria is the same as Group 4C except:

- The soil profile falls into one of the following scenarios with respect to Ksat:
  1. In the surface horizon (within 20cm) the minimum low Ksat is 1.4 micrometers per second (0.2 inches/hour) or greater and the maximum high Ksat is 142 micrometers per second (20 inches/hour) or less. Below the first 8 inches (20 cm) of the profile there is at least one layer that is a minimum of 6 inches (15 cm) thick with a high Ksat less than 0.43 (0.6 inches/hour).
  2. All horizons to a depth of 5 feet (150 cm), or the fist restrictive layer[1], have a maximum high Ksat of 0.43 micrometers per second (0.06 inches/hour) or less.
- There is no root restrictive layer within 100cm of the surface.

Group 5

Soil depth to a restrictive layer[1] is at least 40 inches (100 cm). The depth to a water table during the growing season[1] is at least 5 feet (150 cm). If the soil is frequently or occasional flooded with a duration of brief, long, or very long, it is for less than 2 months during the growing season[1]. The available water capacity[1] is at between 3.75 and 7.5 inches (9.5 and 19 cm). In the upper 12 inches (30 cm) of the soil profile free carbonates do not exceed a concentration of 5 percent calcium carbonate equivalent[1], the range of pH[1] is between 5.6 and 8.4, and electrical conductivity[1] is 4 mmhos/cm or less. For all horizons to a depth of 5 feet (150 cm), or to the first restrictive layer[1], the minimum low Ksat is 1.4 micrometers per second (0.2 inches/hour) or greater and the maximum high Ksat is 142 micrometers per second (20 inches/hour) or less. The bottom horizon is not sandy or gravelly[1].

Group 5A

Soil criteria is the same as Group 5 except:

- In the upper 12 inches (30 cm) of the soil profile the range of pH[1] is between 4.5 and 5.5.

Group 5K

Soil criteria is the same as Group 5 except:

- In the upper 12 inches (30 cm) of the soil profile free carbonates range between 5 and 15 percent calcium carbonate equivalent[1] and the range of pH[1] is between 6.5 and 8.4.

Group 5KK

Soil criteria is the same as Group 5 except:

- In the upper 12 inches (30 cm) of the soil profile free carbonates range between 15 and 40 percent calcium carbonate equivalent[1] and the range of pH[1] is between 6.5 and 8.4.

Group 6

Soil depth to a restrictive layer[1] is at least 20 inches (50 cm). The depth to a water table during the growing season[1] is at least 5 feet (150 cm). The depth to a water table may be less than 5 feet (150 cm) if it is for less than 2 months during the growing season[1]. The available water capacity[1] is between 2 and 3.75 inches (5 and 9.5 cm). In the upper 12 inches (30 cm) of the soil profile free carbonates do not exceed a concentration of 5 percent calcium carbonate equivalent[1], the range of pH[1] is between 5.6 and 8.4, and electrical conductivity[1] is 4 mmhos/cm or less. In the surface horizon (within 20cm) the minimum low Ksat is 1.4 micrometers per second (0.2 inches/hour) or greater and the maximum high Ksat is 142 micrometers per second (20 inches/hour) or less. The bottom horizon is either sandy or gravelly[1] or the high Ksat is greater than 141 micrometers per second (20 inches/hour) or there is a root restrictive layer between 40 and 60 inches (50 and 150 cm). The drainage class for the soil is either excessively, somewhat excessively, or well drained.

Group 6A

Soil criteria is the same as Group 6 except:

- In the upper 12 inches (30 cm) of the soil profile the range of pH[1] is between 4.5 and 5.5.

Group 6K

Soil criteria is the same as Group 6 except:
- In the upper 12 inches (30 cm) of the soil profile free carbonates range between 5 and 15 percent calcium carbonate equivalent[1] and the range of pH[1] is between 6.5 and 8.4.

Group 6KK

Soil criteria is the same as Group 6 except:
- In the upper 12 inches (30 cm) of the soil profile free carbonates range between 15 and 40 percent calcium carbonate equivalent[1] and the range of pH[1] is between 6.5 and 8.4.

Group 6D

Soil depth to a restrictive layer[1] is between 20 and 40 inches (50 and 100 cm). The depth to a water table during the growing season[1] is at least 5 feet (150 cm). The depth to a water table may be less than 5 feet (150 cm) if it is for less than 2 months during the growing season[1]. The available water capacity[1] is at least 3.75 inches (9.5 cm). In the upper 12 inches (30 cm) of the soil profile free carbonates do not exceed a concentration of 5 percent calcium carbonate equivalent[1], the range of pH[1] is between 5.6 and 8.4, and electrical conductivity[1] is 4 mmhos/cm or less. In the surface horizon (within 20cm) the minimum low Ksat is 1.4 micrometers per second (0.2 inches/hour) or greater and the maximum high Ksat is 43 micrometers per second (6 inches/hour) or less. There is a root restrictive layer[1] between 20 and 60 inches (50 and 150 cm).

Group 6DK

Soil criteria is the same as Group 6D except:
- In the upper 12 inches (30 cm) of the soil profile free carbonates range between 5 and 15 percent calcium carbonate equivalent[1] and the range of pH[1] is between 6.5 and 8.4.

Group 6G

Soil depth to a restrictive layer[1] is at least 20 inches (50 cm). The depth to a water table during the growing season[1] is at least 5 feet (150 cm). The depth to a water table may be less than 5 feet (150 cm) if it is for less than 2 months during the growing season[1]. The available water capacity[1] is at least 3.75 in (9.5 cm). In the upper 12 inches (30 cm) of the soil profile free carbonates do not exceed a concentration of 5 percent calcium carbonate equivalent[1], the range of pH[1] is between 5.6 and 8.4, and electrical conductivity[1] is 4 mmhos/cm or less. In the surface horizon (within 20cm) the minimum low Ksat is 1.4 micrometers per second (0.2 inches/hour) or greater and the maximum high Ksat is 142 micrometers per second (20 inches/hour) or less. The bottom horizon is either sandy or gravelly[1] or the high Ksat is greater than 141 micrometers per second (20inches/hour). The drainage class for the soil is something other than excessively drained.

Group 6GA

Soil criteria is the same as Group 6G except:
- In the upper 12 inches (30 cm) of the soil profile the range of pH[1] is between 4.5 and 5.5.

Group 6GK

Soil criteria is the same as Group 6G except:
- In the upper 12 inches (30 cm) of the soil profile free carbonates range between 5 and 15 percent calcium carbonate equivalent[1] and the range of pH[1] is between 6.5 and 8.4.

Group 6GKK

Soil criteria is the same as Group 6G except:
- In the upper 12 inches (30 cm) of the soil profile free carbonates range between 15 and 40 percent calcium carbonate equivalent[1] and the range of pH[1] is between 6.5 and 8.4.

Group 7

Soil depth to a restrictive layer[1] is at least 40 inches (100 cm). The depth to a water table during the growing season[1] is at least 5 feet (150 cm). The depth to a water table may be less than 5 feet (150 cm) if it is for less than 2 months during the growing season[1]. The available water capacity[1] is at least 2 inches (5 cm). In the upper 12 inches (30 cm) of the soil profile free carbonates do not exceed a concentration of 5 percent calcium carbonate equivalent[1], the range of pH[1] is between 5.6 and 8.4, and electrical conductivity[1] is 4 mmhos/cm or less. For all horizons to a depth of 5 feet (150 cm), or to the first restrictive layer[1], the minimum low Ksat is at least 42 micrometers per second (6 inches/hour) and all horizons have a sandy texture[1].

Group 7A

Soil criteria is the same as Group 7 except:
- In the upper 12 inches (30 cm) of the soil profile the range of pH[1] is between 4.5 and 5.5.

Group 8

Soil depth to a restrictive layer[1] is at least 40 inches (100 cm). The depth to a water table during the growing season[1] is at least 5 feet (150 cm). The depth to a water table may be less than 5 feet (150 cm) if it is for less than 2 months during the growing season[1]. The available water capacity[1] is at least 7.5 inches (19 cm). In the upper 12 inches (30 cm) of the soil profile free carbonates range between 5 and 15 percent calcium carbonate equivalent[1], the range of pH[1] is between 6.5 and 8.4, and electrical conductivity[1] is 4 mmhos/cm or less. For all horizons to a depth of 5 feet (150 cm), or to the first restrictive layer[1], the minimum low Ksat is 1.4 micrometers per second (0.2 inches/hour) or greater and the maximum high Ksat is 142 micrometers per second (20 inches/hour) or less.

Group 8K

Soil criteria is the same as Group 8 except:
- In the upper 12 inches (30 cm) of the soil profile free carbonates range between 15 and 40 percent calcium carbonate equivalent[1].

Group 9C

Soil depth to a restrictive layer[1] is at least 20 inches (50 cm). The depth to a water table during the growing season[1] is at least 5 feet (150 cm). The depth to a water table may be less than 5 feet (150 cm) if it is for less than 2 months during the growing season[1]. The available water capacity[1] is at least 3.75 inches (9.5 cm). In the upper 12 inches (30 cm) of the soil profile, the range of electrical conductivity[1] is between 4 and 16 mmhos/cm. The soil profile falls into one of the following scenarios with respect to Ksat:

1) In the first 8 inches (20 cm) of the soil profile the minimum low Ksat is 1.4 micrometers per second (0.2 inches/hour) or greater and the maximum high Ksat is 142 micrometers per second (20 inches/hour) or less. Below the first 8 inches (20 cm) all horizons have a minimum low Ksat between 0.42 and 1.43 micrometers per second (0.6 and 0.2 inches/hour) and a high Ksat of 14.3 micrometers per second (2.0 inches/hr) or less.
2) All horizons to a depth of 5 feet (150 cm), or the fist restrictive layer[1], have a minimum low Ksat between 0.42 and 1.43 micrometers per second (0.6 and 0.2 inches/hour) and a maximum high Ksat of 14.3 micrometers per second (2.0 inches/hr) or less.

Group 9L

Soil depth to a restrictive layer[1] is at least 20 inches (50 cm). The depth to a water table during the growing season[1] is at least 5 feet (150 cm). The depth to a water table may be less than 5 feet (150 cm) if it is for less than 2 months during the growing season[1]. The available water capacity[1] is at least 3.75 inches (9.5 cm). In the upper 12 inches (30 cm) of the soil profile, the range of electrical conductivity[1] is between 4 and 16 mmhos/cm. The soil profile falls into one of the following scenarios with respect to Ksat:

1) All horizons to a depth of 5 feet (150 cm), or the first restrictive layer[1], have a minimum low Ksat of 1.4 micrometers per second (0.2 inches/hour) or greater and a maximum high Ksat of 43 micrometers per second (6.0 inches/hr) or less.

2) In the first 8 inches (20 cm) of the soil profile the minimum low Ksat is 1.4 micrometers per second (0.2 inches/hour) or greater and the maximum high Ksat is 43 micrometers per second (6.0 inches/hour) or less and. Below the first 8 inches (20 cm) all horizons to 5 feet (150 cm), or to the first restrictive layer[1], have a minimum low Ksat of 0.42 micrometers per second (0.6 inches/hour) or greater and a maximum high Ksat of 1.43 micrometers per second (0.2 inches/hr) or less.
3) In the first 20 inches (50 cm) of the soil profile the minimum low Ksat is 1.4 micrometers per second (0.2 inches/hour) or greater and the maximum high Ksat is 43 micrometers per second (6.0 inches/hour) or less. Below the first 20 inches (50 cm) all horizons to 5 feet (150 cm), or to the first restrictive layer[1], have a minimum low Ksat of 0.42 micrometers per second (.06 inches/hour) or greater and a maximum high Ksat of 1.43 micrometers per second (0.2 inches/hr) or less.

Group 9N

Soil depth to a restrictive layer[1] is at least 20 inches (50 cm). The depth to a water table during the growing season[1] is at least 5 feet (150 cm). The depth to a water table may be less than 5 feet (150 cm) if it is for less than 2 months during the growing season[1]. The available water capacity[1] is at least 2 inches (5 cm). In the upper 12 inches (30 cm) of the soil profile the sodium adsorption ratio[1] ranges between 13 and 25 percent, and electrical conductivity[1] is 16 mmhos/cm or less.

Group 9NW

Soil criteria is the same as Group 9N except:
- The depth to a water table during the growing season[1] is between 1.5 and 5 feet (45 and 150 cm).

Group 9W

Soil depth to a restrictive layer[1] is at least 20 inches (50 cm). The depth to a water table during the growing season[1] is between 1.5 and 5 feet (45 and 150 cm). The available water capacity[1] is at least 2 inches (5 cm). In the upper 12 inches (30 cm) of the soil profile electrical conductivity[1] is between 4 and 16 mmhos/cm.

Group 10

Soils have one or more characteristics that are severely imitating to the planting and growth of trees and shrubs: soil depth is less than 20 inches (50 cm); available water capacity is less than 2 inches (5.0 cm); depth to a water table during the growing season[1] is less than 1.5 feet (45 cm) or occurs for longer than 3 months during the growing season[1]; in the upper 12 inches (30 cm) of the soil profile free carbonates are greater than 40 percent calcium carbonate equivalent[1], pH is less than 4.0 or greater than 8.4, electrical conductivity[1] is greater than 16 mmhos/cm, or sodium adsorption ratio[1] is 25 percent or greater. When using NASIS to automate CTSG grouping, soils will be placed in group 10 if: no taxonomic temperature is recorded; the component kind is recorded as “miscellaneous area”; or no data are recorded in the horizon table.

[1]Refer to Exhibit 537-15 Notes/Definitions for definitions and information on how the property is derived when NASIS is used to automate CTSG groupings.

Part 538 - INFORMATION SYSTEMS

CONTENTS

Part 538.2 - Decision Support Systems

538.20 General

Decision support systems are software applications that managers can use to develop and evaluate ecosystem planning alternatives.

These systems analyze the available ecosystem data and produce outputs based on defined rules. The data used by decision support systems for analysis can be internal to the program, supplied by the user, supplied from external sources like PLANTS, NASIS, or ESIS, or any combination of the above.

The quality of the alternatives and evaluations produced by these decision support systems is directly related to the quality of the data supplied and the accuracy and validity of the rules used to analyze the data.

538.21 Vegetative Practice Design (VegSpec)

VegSpec is a decision support system developed to assist land managers in the planning and design of vegetative establishment practices.

VegSpec is a Internet-based application that utilizes soil, plant, and climate data to select plant species that are (1) site-specifically adapted, (2) suitable for the selected practice, and (3) appropriate for the purposes and objectives for which the planting is intended.

The application also employs a set of expert rules and criteria to aid in the design and implementation of a number of vegetative establishment practices.

The ability of this decision support system to determine site-specific adaptability of plant species negates the need for forestland interpretive groups and thus Woodland Suitability Groups (WSG's) are no longer included in the set of nationally supported forestry interpretations.

Vegspec can be accessed from the Plants homepage at: http://plants.usda.gov.

538.22 Grazing Lands Applications (GLA)

GLA is a decision support software package developed for the grazing land planner/operator to aid in the inventory of land units, calculate stocking rates, calculate multiple species stocking rates (livestock and wildlife), determine nutritional requirements for grazing livestock and analyze the economic value of treatment alternatives.

The application includes a Management Evaluation Program, Multi-species Calculator and a Nutritional Balancing Analyzer.

538.23 Northeast Decision Model/Stand Inventory Processor and Simulator (NED/SIPS)

NED/SIPS is a decision support system that provides a means of creating, managing, and analyzing forest inventory records at the stand level. It provides a host of tools to analyze stand inventory data and generates reports describing the vegetation structure, timber value, and economics of the stand.

NES/SIPS was developed at the USDA, USFS Northeastern Forest Experiment Station. The software is in the public domain and is provided "as is", without warranty of any kind. The user assumes all responsibility for the accuracy and suitability of this program for a specific application.

The software is available for download at: http://www.fsl.uvm.edu/ned/product.htm.

538.24 TWIGS

TWIGS 3.0 is a growth and yield simulation program developed as a microcomputer application of STEMS, a mainframe program for use in the North Central United States.

TWIGS variants for several regions of the U.S. are currently available. Lake States TWIGS was developed for use in Minnesota, Michigan, and Wisconsin; the Central States variant is intended for use in Indiana, Illinois, and Missouri; the Northeast variant is for use in Connecticut, Delaware, Kentucky, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, and West Virginia; and Southeast TWIGS is for use in Georgia, South Carolina, and Alabama.

As an individual-tree growth model, TWIGS projects the growth and death of individual trees in the context of a

stand, thus enabling it to grow stands of mixed species and sizes. It is a tool that enables forest managers and planners, even those inexperienced with computers, to use a computer to interactively "manage" and "grow" existing stands.

Designed to look at the "future" of a forest, one stand at a time, TWIGS assists in evaluating the productivity and economic effects of different silvicultural prescriptions.

Information regarding the software can be obtained at: http://www.forsonline.org/.

538.25 The Landscape Management System (LMS)

The Landscape Management System (LMS) is a decision support application designed to assist in landscape level analysis and planning of forest ecosystems by automating the tasks of stand projection, graphical and tabular summarization, stand visualization, and landscape visualization. LMS coordinates the activities of other programs (projection models, visualization tools, etc.) that makeup the overall system.

LMS is comprised of many separate programs that make projections, produce graphical or tabular displays, store inventory information, and connect these diverse programs into a cohesive system.

Various stand and landscape-level tables, charts, and graphs viewed internally within LMS on projected stand information can be exported to other software for further analysis.

LMS was developed at the Silviculture Laboratory, College of Forest Resources, University of Washington, Seattle, WA.

The software is available for download at: http://silvae.cfr.washington.edu/lms/lms.html

538.26 The Stand Visualization System (SVS)

SVS generates graphic images depicting stand conditions represented by a list of individual stand components, e.g., trees, shrubs, and down material

SVS provides the capability to:

- Display stand information represented by a list of individual plant and log components in a realistic, although abstract, fashion.
- Display stand information in a manner that communicates the overall structural diversity present within the stand.
- Differentiate between stand components using different plant forms, colors, or other types of marking.
- Provide overhead, profile and perspective views of a stand.

SVS allow the user to:

- Vary the parameters controlling all views.
- Define plant forms and colors based on species, plant type, and plant position within the canopy.
- Provide tabular and graphical summaries of stand information before and after a silvicultural treatment.
- Display information describing individual stand components as they are selected by the user.
- Design silvicultural treatments by "marking" stand components and specifying a treatment.

SVS was developed at the USDA, USFS Pacific Northwest Research Station. The software is in the public domain and is provided “as is”, without warranty of any kind. The user assumes all responsibility for the accuracy and suitability of this program for a specific application.

The software is available for download at: http://forsys.cfr.washington.edu/svs.html

538.27 UTOOLS

UTOOLS is geographic analysis software developed for watershed-level planning. The system provides a flexible framework for spatial analyses and can be used to address a variety of problems.

Spatial databases created by UTOOLS can serve multiple analysis functions. Some example functions include:

- producing basic acreage summaries
- identifying areas that are of critical interest within the project area
- data validation
- simulating the effects of management alternatives
- providing functions to help organize and reformat data for export to specialized programs to perform complex spatial analyses

UTOOLS is a public domain software package developed at the USDA, USFS Umatilla National Forest and the Pacific Northwest Research Station.

The software is available for download at:
http://forsys.cfr.washington.edu/utools.html

538.28 WBECON

WBECON is a decision support program for analyzing the economic benefits of field windbreaks for crop production.

WBECON is a public domain software package developed jointly by the University of Nebraska and the Prairie Farm Rehabilitation Administration Shelterbelt Centre in Saskatchewan, Canada.

(190-V-NFM, 1998)

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