ECOLOGICAL SITE DESCRIPTIONS

INTRODUCTION

An ecological site is a distinctive type of land with specific physical characteristics that differ from other land types in its ability to produce a characteristic kind and amount of vegetation – plant community. These key characteristics are included in the ecological site description. An ecological site description relates a unique vegetative assembly of plants with underlying soil resources on the landscape.

The key characteristics of ecological sites are included in the site description. Ecological sites have characteristic hydrology, soils, plant communities, fire regime and herbivory that have developed over time. Most ecological sites evolved with a characteristic kind of herbivory: kinds, numbers of herbivores, seasons of use, and intensity of use. Herbivory directly influences the vegetation and soil, both of which influence the hydrology. Each of these interacts with each other and is further influenced by broader environmental factors such as climate and geology. The site is therefore the product of the interaction of the environmental factors and the site characteristics.

Ecological site descriptions (ESD) contain information about:

- Climatic features,
- Physiographic features,
- Soils and associated hydrologic features,
- Plant communities that occur on the site,
- Plant community dynamics,
- Annual production estimates,
- Distribution of production throughout the year,
- Plant growth curves,
- Associated wildlife communities,
- Associated and similar ecological sites, and
- Interpretations for use and management of the site.

A ‘state and transition’ model, as information is available, describes the ecology of the site. A 'state' is a stable and resilient complex of both the physical environment and the

biotic communities. A state is capable of absorbing disturbance or stress, defined by the model as 'community pathways.' The pathways and the communities they shape are dynamic. The boundary of a state is defined as a 'threshold.' If a particular disturbance or stress crosses this threshold, a change in state occurs. This process represents a 'transition.' A return to the previous state is not dynamic on a practical time scale without significant inputs or accelerating practices.

Landscapes are divided into ecological sites for the purposes of inventory, evaluation, and management. For instance, forestland ecological sites consist of soil components having the same or nearly the same historic climax plant community, approximately equal productivity of tree and understory vegetation, and similar physical site characteristics.

SOILS

HYDROLOGY

An ecological site has 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.

DIFFERENTIATING ECOLOGICAL SITES

Soil is the basis for determining, correlating, and differentiating one ecological site from another. Soils with similar properties that produce and support a characteristic native plant community and that respond similarly to management are grouped into the same ecological site. Five factors influence soil development. They are:

- Parent material,
- Climate,
- Flora and fauna (presence and types of living organisms),
- Topography (landscape position), and
- Time.

Anthropomorphic influences may also affect soil development and soil properties over shorter time frames than the five factors cited above. These factors lead to soil development or degradation through the processes of loss, addition, translocation, and transformation.

Soils with similar 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.

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

- Significant differences in the species or species groups that are characteristic of the plant community.
- Significant differences in the relative proportion of species or species groups in the characteristic 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, various mineral cycles, and energy flow.
- Differences in the kind, proportion, and production of the overstory and understory plants due to differences in soil, topography, climate, and other environment factors, or the response of vegetation to management.

ECOLOGICAL SITES AND CONSERVATION PLANNING

Ecological sites are used in conservation planning for forestland and woodland as reference points for the evaluation of forest health and as assessment tools. They are also a critical interpretation for the soil survey program, and are necessary for conservation and program planning. The ecological description explains the ecological processes that are occurring and the plant communities that can be found. The NRCS planner must understand how an ecological site or association of sites responds to disturbance or other treatments.

Information in the ESD is to be used for completing forestland inventory and evaluation and for suggestions to solve identified resource concerns for Resource Management System (RMS) planning. In addition to or as a substitute for the ESD, planners should consult with New York State-Department of Environmental Conservation Foresters or forestry publications, public information guides from the State University of New York-College of Environmental Science and Forestry, Cornell Cooperative Extension service publications, local information, and soil survey information.

As with all information contained in the FOTG, the information in Ecological Site Descriptions is not absolute. It is intended for use as a guide for planners and

decisionmakers to assist in the resolution of identified resource concerns leading to resource sustainability.

The National Forestry Manual (http://nsscnt.nssc.nrcs.usda.gov/nfm) and the National Range and Pasture Handbook (http://www.ftw.nrcs.usda.gov/glti/NRPH.html) also contain guidance and may be accessed at .

Official soil/site correlation information is found in the National Soil Information System (NASIS). Forestland ecological site descriptions may be viewed or printed from the Plants Database on the Internet at http://plants.usda.gov/esis. From the ESIS page link to Ecological Site Description (ESD); select a state (required) and Major Land Resource Area (MLRA) (optional step) before entering the ESD system.

HISTORIC CLIMAX PLANT COMMUNITIES

The historic climax plant community for a site in North America is the plant community that existed before European immigration and settlement - the plant community that had developed on the site as a result of all of the site forming factors. This plant community 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 steady state plant community that was able to avoid displacement by the suite of disturbances and disturbance patterns that naturally occurred within the area occupied by the site. Natural disturbances, such as drought, fire, grazing of native fauna, and insects, were inherent in the development and maintenance of the native plant communities. 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 vegetation and may exist in a steady state that is different from the historic climax plant community.

The historic climax plant community of an ecological site is not a precise assemblage of species for which the proportions are the same from place to place or from year to year. Generally, one species or a group of species dominants a site. Dominant status does not vary from place to place or year to year. Because of their stability in the 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.

At times, normally less frequently occurring plants may increase on a site, or plants not formerly found in the climax community may invade the site. The presence or abundance 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 determinations are based on the plant community that developed along with the soils. A study of several locations over several years is needed to differentiate and characterize a site.

Where changes in soils, aspect, topography, or moisture conditions are abrupt, plant community boundaries are distinct. Boundaries are broader and less distinct where plant communities change gradually along broad environmental gradients of relatively uniform soils and topography. Although some plant communities may appear to be along a continuum, distinctive plant communities can be identified and described. These communities occur with predictable regularity and are associated with concurrent differences in soil, topography, hydrology, or climate that can also be recognized.

ECOLOGICAL SITE DESCRIPTION (ESD) APPLICATION - OVERVIEW

The Ecological Site Description (ESD) application provides the capability to produce automated ecological site descriptions from information stored in the site's database. The ESD is the official repository for all data associated with the development of forestland and rangeland ecological site descriptions by the Natural Resources Conservation Service. The site is located at: http://plants.usda.gov/esis/index.html. NRCS offices in New York will utilize this site to develop ESDs that are site specific.

The data comprising an ESD is presented in four major categories:

- Site Characteristics -- Identifies the site and describes the physiographic, climate, soil, and water features associated with the site.
- Plant Communities -- Describes the ecological dynamics and the common plant communities comprising the various vegetation states of the site. The different plant communities produced by an ecological site are called vegetation states. The processes that cause a shift from one state to another are called transition pathways.
- Site Interpretations -- Interpretive information pertinent to the use and management of the site and its related resources.
- Supporting Information -- Information useful in assessing the quality of the site description and its relationship to other ecological sites.

Most new ecological site descriptions in New York will be written in conjunction with ongoing soil surveys. Guidance for developing and using these ecological site

descriptions with landowners during the planning process is found in the 1997 NRCS Range and Pasture Handbook found at: . http://www.ftw.nrcs.usda.gov/glti/NRPH.html .

DATA USE

The collection of plot data is an important activity conducted by the Natural Resources Conservation Service. 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, for obtaining data for hydrologic models, for studies of treatment effects, and for many other purposes.

INTERPRETATIONS

Ecological Site Descriptions include a section on the interpretations for the use and management for the site. The information includes:

Grazing- the information necessary to develop the initial stocking rates along with forage preferences for both livestock and wildlife. It also includes a description of wildlife-livestock interactions and competition. Uses of vegetation by the kind and class of livestock is listed as well as potential management problems that may exist such as poisonous plants, topographical limitations, physical barriers, etc.

Plant Preference by Animal Kind (forestland/woodland)) – a listing of plant preferences by various animals. For each animal, the preference rating is listed for various plant species. Additionally preference ratings may be listed for the different plant parts (leaf, flower, bud, etc.) of each of the identified species.

Forest Site Productivity – the minimum and maximum, and representative annual productivity and site index of the major tree species. The annual productivity per acre in cubic feet at the culmination of the mean annual increment (CMAI) is listed for each species when available.

Animal Community/Wildlife – a list and/or description of the animal communities associated with the site. It may also include information about the type of forage and cover the site affords specific animals, management implications, impacts, etc.

Hydrology Functions – a narrative description that includes such information as storm events, rainfall distribution, landscape position, flooding potential and/or ponding susceptibility, erosion potentials, concentrated flow characteristics, etc.

Recreational Uses – a narrative description of the potential recreational uses that the site can support or which may influence the management of the site. This can include plant species that have special aesthetic values, landscape values, viewsheds etc.

Wood Products – 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 the result of producing these wood products.

Other Products – a narrative description of potential uses of other products produced on the site. Examples include such things as biomass, landscape plants, mushrooms, berries, ferns, nuts, etc.

Other Information – a narrative description of other pertinent, interpretative, and descriptive information that may be relative other information

ECOLOGICAL SITE TYPES - FORESTLAND

DEFINITION

Forestland 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, or other plant communities that comprise the known steady states of vegetation are 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. Forestland site types characterized most of New York's ecological sites.

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. An association of species that differs from that of other ecological sites in the kind and/or proportion of species, or in total production typifies the plant community on an ecological site.

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.

SUCCESSION

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.

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.

RETROGRESSION

When an ecological site has reached natural potential with all its key characteristics and subsequently becomes degraded, either through mismanagement or severe natural climatic event, the plant community shifts away from the historic climax plant community. This transition away from the HCPC is called retrogression. This site may then produce a plant community similar to an earlier seral stage, or it may produce a different plant community dominated by other species. The change in the composition of the plant community is a reflection of the change in the site conditions.

STATES AND TRANSITION PATHWAYS

A *state* is the general description of the ecological site's characteristics. As the characteristics change there is a transition to a new state. The different plant communities produced by an ecological site are called vegetation states. The processes that cause a shift from one state to another are called transition pathways. The state and transition discussion in each ecological site description will describe and illustrate:

- the common states that can occur on the site,
- the transition pathways that exist between and among the states,
- the conditions that must prevail for management opportunities to exercise the option to make transitions, and
- the conditions under which management must avoid transition attempts in order to prevent degradation.

Two important attributes of a state are resistance and resilience. Resistance 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 change caused by disturbances up to a threshold point. A threshold is the boundary between two states such that one or more of the ecological processes has been irreversibly changed and must be actively restored before return to a previous state is possible. Additional thresholds may occur along the

irreversible portion of a transition causing a change in the trajectory toward another state. Once a threshold is crossed, a the equilibrium among one or more of the primary ecological processes is disrupted. This will be expressed through changes in the vegetative community and eventually the soil resource. A new stable state is formed when the system reestablishes equilibrium among its primary ecological processes.

The first vegetation state described in an ecological site description is the historic climax plant community, where it can be determined. From this state, a "road map" to other states can be developed. These other states are those that are known to occur on the site and the transitions that lead to and from each state. Each alternative state and transition should be described incorporating as much about the characteristics of each state and transition as possible, including changes in soil properties and hydrology, if known.

Some states shift to another state relatively easily and in a short time. Others may be more resistant to change and are long-lived. When states are resistant to change, they are called steady states. These steady state plant communities change only as a result of a natural event that is beyond the normal range of events or as a result of human actions. An example of a natural event beyond the normal range of events would be a severe long-term drought or a long period of above average precipitation. In addition, the HCPC can shift to a different steady state.

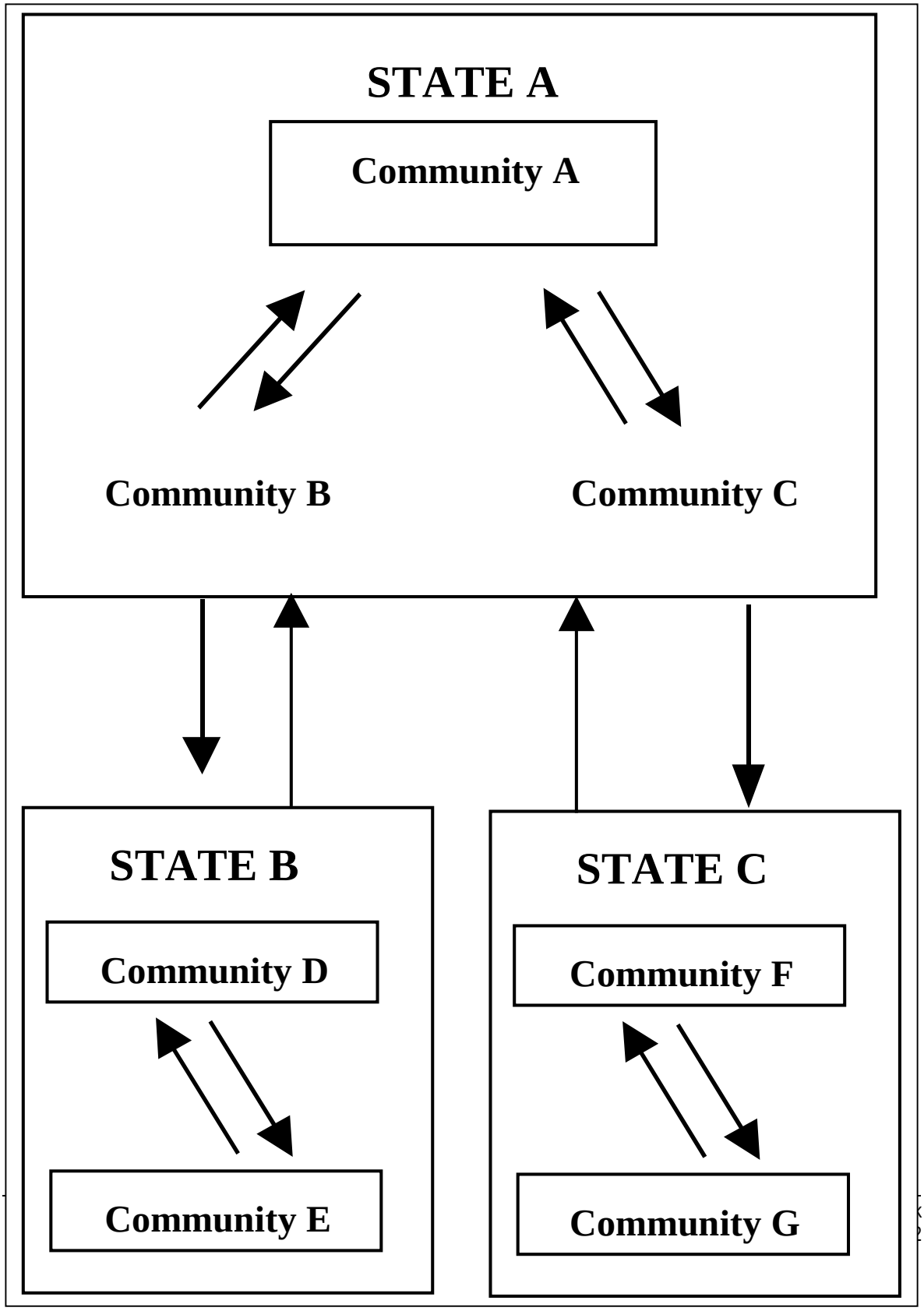
The historic climax plant community is generally one of the vegetation states that can exist on the site; in instances where it is not known or conditions have changed it may no longer be attainable. Each box in a state and transition diagram represents a different plant community that could exist on the site. Generally, only a few vegetation states or plant communities are identified and described for a single site. Each plant community has its own characteristics, benefits, values, advantages, and disadvantages depending upon the intended use, products, and environmental effects desired from the site.

Even though a transition between two states and shifts can occur in either direction, they are usually different pathways or events and generally are not just the opposite of each other. Each transition pathway is identified separately and described. There can also be more than one transition pathway between the same states. In some instances transition can occur in only one direction, while in others transition can occur in both directions. Some transitions are reversible, and others are not. Some transitions occur rapidly and others over long periods. Some transitions result in the crossing of a threshold, and others result in the crossing of more than one threshold. Some pathways may exist, but rarely are followed because of extremely abnormal climatic conditions that would be necessary to allow the transition to occur or because of lack of economic feasibility or the impractical nature of a necessary management action.

Transition is the trajectory of system change between states that will not cease before the establishment of a new state. Natural events, management actions, or both can trigger transitions. Some transitions may occur very quickly and others over a long period of time. Two portions of a transition are recognized: reversible and irreversible. Prior to crossing a threshold, a transition is reversible and represents an opportunity to reverse or arrest the change. Vegetation management practices and, if needed, facilitating practices are used to reverse the transition. Once a threshold is crossed, the transition is irreversible without significant inputs of management resources and energy. Significant inputs are associated with accelerating practices such as brush management and tree planting.

States are not static as 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 vegetative assemblages within states will be referred to as plant communities and the change between these communities as community pathways.

Figure 1 illustrates the different components of a state and transition model diagram for an ecological site. States are represented by the large boxes and are bordered by thresholds. The small boxes represent plant communities with community pathways representing the cause of change between communities. The entire trajectory from one state to another state is considered a transition (i.e., from State A to State B). The portion of the transition contained within the boundary of a state is considered reversible with a minimum of input from management. Once the transition has crossed the threshold it is not reversible without substantial input (accelerating practices). The arrow returning to a previous state (State B to State A) will be utilized to designate types of accelerating practices needed.


STATE A
Community A
Community B
Community C
STATE B
Community D
Community E
STATE C
Community F
Community G