

# ECOLOGICAL SITE DATABASE - BASIC SITE INFORMATION FOR RESOURCE ANALYSIS AND DECISION MAKING

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## ABSTRACT

The USDA Natural Resource Conservation Service (NRCS) describes and interprets range, native pasture, grazable forest, pasture, and hayland with ecological site descriptions and forage suitability groups. Ecological sites have evolved from agency range and woodland site descriptions, and have integrated alternate and more recent concepts with the traditional succession-retrogression model for site classification and interpretation. Ecological site interpretations are based on vegetation sampling by weight and composition, and other field data collection. Sample data is recorded and managed in the Ecological Site Information System (ESIS) and is analyzed to identify and develop site and suitability group descriptions. ESIS provides data that facilitates resource inventory, analysis, and planning using the agency field office computing system (FOCS), in particular, grazing land decision support software (GLA).

## KEYWORDS

Ecological site, site classification, natural resource database, decision support, information system

## INTRODUCTION

NRCS has assisted land owners and managers for the last 60 years with grazing land management. Until recently, the decision making process for rangelands used range site descriptions and analysis of range condition and trend, based on successional theory advanced by Clements (1916), first applied by Sampson (1923), and institutionalized in the Soil Conservation Service (now NRCS) by Dyksterhuis (1949). With the recommendations by the National Research Council (1994), which incorporates alternate and emergent ecological views of Gleason (1926), Ellison (1949), Holling (1973), Wissel (1984), Westoby et al (1989), Laycock (1991), Friedel (1991) and others, NRCS has drafted a new National Range and Pasture Handbook (USDA-NRCS, 1996) that prescribes ecological site descriptions, the rating of rangeland trend, rangeland health, and determining a rangeland similarity index.

NRCS ecological sites for forestland and native/naturalized pasture contain many of the same elements as those for rangelands, but also have some alignment with habitat types described by the U.S. Forest Service after Daubenmire (1968). For several years, NRCS has maintained pasture or forage suitability groups, which provide a basis for management of forage resources on cultivated land.

NRCS data collection for plant community and soil site correlation began in the late 1940's. In the late 1960's, three major databases began to emerge, (1) a national soils data system, which supported the progressive soil survey, (2) a national range data system for support and development of range site guides, and (3) a national data system to support the development of woodland site guides. As computers and database management systems became more accessible, the data needed for models and decision support software grew steadily. The agency now sponsors four strategic natural resource databases. They are the National Soil Information System (NASIS), the NRCS component of the United Climate Access Network (UCAN), National Plant Database (PLANTS), and the Ecological Site Information System (ESIS). These systems catalog, analyze, correlate, and interpret discrete site data and deliver interpretive data to agency field offices for resource inventory, analysis, and planning.

## THE ECOLOGICAL SITE DATABASE (ESIS)

The Ecological Site Database (ESIS) contains ecological site descriptions for rangeland, forestland, and native/naturalized pasture, and forage suitability groups for cultivated agricultural land.

Development of ecological site descriptions begins with the collection of data from sample points in areas of apparent physiographic and floristic similarity. With a variety of approved sampling methods, data is collected on plant composition, biomass, hydrologic characteristics, and other parameters from which to circumscribe an ecological site and derive interpretations. This field data is recorded and managed in ESIS.

Rangeland ecological sites contain the following data: site number, full name, major land resource area (MLRA), physiographic features, climatic features, associated soil components, interpretive plant community, major plant species by weight and percentage, ground cover and structure, median and range of annual production, plant growth curves for major species or species groups, major plant community types that can occur on the site, ecological dynamics, major animal species that occupy or use site, ecological site values, relationship to other sites, and interpretations for livestock grazing, wildlife, watersheds, threatened and endangered species, recreation, and wood products.

Two major new features of rangeland ecological sites are the major plant community types (stable states) and ecological dynamics entities. The site descriptions are to identify thresholds and list the known causes of change from one stable community to another; differences in the function of the water cycle, mineral cycle, and energy flows among communities; and recovery mechanisms within and between community types.

Forestland ecological sites are very similar to rangeland sites except that ecological dynamics are characterized by linear successional stages ranging from herbaceous, shrub-herbaceous, sapling, immature forestland, mature forestland, and over-mature forestland. Multiple, reticulate states and transitions for now are excluded from the dataset. Ecological sites for native and naturalized pasture follow the format of forestland site descriptions, except the tree overstory portion of the description may be omitted.

Forage suitability groups contain the following information: group number; full name; MLRA; climatic features; soil suitability group description; associated soil mapping units; adapted forage species list and growth curves with adjustments for aspect, salinity, heaving potential, and pH; soils limitations; management considerations; management dynamics; and relationship to other groups. Management dynamics for forage suitability groups describe how various management practices may influence the composition of the species in the forage mixture, and explains how the forage planting can be sustained during its intended life.

## INTEGRATION OF ESIS WITH OTHER NATURAL RESOURCE DATABASES

Essentially, the primary key in the ESIS database is the site identifier. There are foreign keys to other database entities. Plant species data in site descriptions is keyed by a unique plant symbol, which is the cornerstone of the NRCS National Plant Database. This provides

linkages to taxonomic information, synonymy, common names, morphological and physiological attributes, and conservation uses. Plant symbols are used in the Interagency Taxonomic Information System (ITIS), a collaborative effort of several federal agencies and botanical institutions.

ESIS data also is correlated with the NRCS National Soils Information System (NASIS), which manages all data associated with the National Cooperative Soil Survey. Geospatially, ecological sites and suitability groups are aggregations of soil map units and their components, and are modeled as such in the tabular ESIS database. Soil map units and components provide links to a wealth of soils information useful for natural resource analysis and planning.

Climatic features of ecological sites reference climate stations, a primary linkage to detailed historic climate data managed in databases of the United Climate Access Network (UCAN), including temperature, precipitation, wind, snowfall, and solar radiation in 15-minute, hourly, daily, monthly, and annual increments.

#### USE OF SITE INFORMATION IN NATURAL RESOURCE DECISION SUPPORT SYSTEMS

Data recorded, analyzed, and developed in ESIS feeds software applications in the NRCS Field Office Computing System (FOCS). FOCS is deployed in 2800 county field offices and is the primary automated tool for conducting agency business, including technical assistance on grazing lands.

The principal decision support tool that uses ecological site and forage suitability information is the Grazing Land Applications (GLA) package (Ekblad, 1993). With this software range conservationists can match site descriptions to the individual response units of the management units in a grazing operation, analyze the potential forage and nutritional resources, and balance with livestock and wildlife herd requirements. GLA provides up to 28 reports, including a complete forage inventory, herd inventories, forage balance, record of condition and trend, grazing systems of up to 30 pastures with a daily grazing schedule, and economic analysis.

Ecological site descriptions also will provide the benchmark for calculating rangeland similarity index, rangeland health, and other assessments. Rangeland similarity index essentially is range condition, but without the value judgment of condition class. Rangeland health is to be expressed in terms of soil stability, nutrient cycling, energy flows, and recovery mechanisms, but potential methods for deriving a health rating are being evaluated, and have not been implemented.

Ecological site descriptions provide interpretations for agency conservation planning in forestlands. Forage suitability groups provide a valuable reference for developing grazing plans for pastures and cultivated forages on cropland.

Site data must be an integral part of a comprehensive, integrated natural resource information system that facilitates multi-objective, multi-resource decision making (Carlson, 1993). In the near future, ecological sites and suitability groups will be represented in geospatial databases, opening the door for more effective data manipulation, analysis, and presentation.

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