Interpretive Groupings of Soil

622.02 Land Capability Classification

a. **Definition.** Land capability classification is a system of grouping soils primarily on the basis of their capability to produce common cultivated crops and pasture plants without deteriorating over a long period of time.
b. **Classes.** Land capability classification is subdivided into capability class and capability subclass nationally. Some States also assign a capability unit.
c. **Significance.** Land capability classification has value as a grouping of soils. National Resource Inventory information, the Farmland Protection Policy Act, and many field office technical guides have been assembled according to these classes. The system has been adopted in many textbooks and has wide public acceptance. Some State legislation has used the system for various applications. Users should reference Agriculture Handbook No. 210 for a listing of assumptions and broad wording used to define the capability class and capability subclass.
d. **Application.** All map unit components, including miscellaneous areas, are assigned a capability class and subclass. Agriculture Handbook No. 210 provides general guidance, and individual State guides provide assignments of the class and subclass applicable to the State. Land capability units can be used to differentiate subclasses at the discretion of the State. Capability class and subclass are assigned to map unit components in the official soil survey database.

Categories

1. **Capability Class**
    i. **Definition.** Capability class is the broadest category in the land capability classification system. Class codes I (1), II (2), III (3), IV (4), V (5), VI (6), VII (7), and VIII (8) are used to represent both irrigated and nonirrigated land capability classes.
    ii. **Classes and definitions.** The following definitions, from Agriculture Handbook No. 210, have been slightly altered.

    Class I (1) soils have slight limitations that restrict their use.

    Class II (2) soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.

    Class III (3) soils have severe limitations that reduce the choice of plants or require special conservation practices, or both.

    Class IV (4) soils have very severe limitations that restrict the choice of plants or require very careful management, or both.

    Class V (5) soils have little or no hazard of erosion but have other limitations, impractical to remove, that limit their use mainly to pasture, rangeland, forestland, or wildlife habitat.

    Class VI (6) soils have severe limitations that make them generally unsuited to cultivation and that limit their use mainly to pasture, rangeland, forestland, or wildlife habitat.

    Class VII (7) soils have very severe limitations that make them unsuited to cultivation and that restrict their use mainly to rangeland, forestland, or wildlife habitat.

    Class VIII (8) soils and miscellaneous areas have limitations that preclude their use for commercial plant production and limit their use mainly to recreation, wildlife habitat, water supply, or esthetic purposes.

2. **Capability Subclass**
    i. **Definition.** Capability subclass is the second category in the land capability classification system. Class codes e, w, s, and c are used for land capability subclasses.
    ii. **Subclasses and definitions**

Subclass e is made up of soils for which the susceptibility to erosion is the dominant problem or hazard affecting their use. Erosion susceptibility and past erosion damage are the major soil factors that affect soils in this subclass.

Subclass w is made up of soils for which excess water is the dominant hazard or limitation affecting their use. Poor soil drainage, wetness, a high water table, and overflow are the factors that affect soils in this subclass.

Subclass s is made up of soils that have soil limitations within the rooting zone, such as shallowness of the rooting zone, stones, low moisture-holding capacity, low fertility that is difficult to correct, and salinity or sodium content.

Subclass c is made up of soils for which the climate (the temperature or lack of moisture) is the major hazard or limitation affecting their use.

iii. **Application.** The subclass represents the dominant limitation that determines the capability class. Within a capability class, where the kinds of limitations are essentially equal, the subclasses have the following priority: e, w, s, and c. See the rules (shown below) on appropriate entries for capability subclass.

3. **Capability Unit**
   i. **Definition.** Capability unit is the first category described in the land capability classification system. It is a grouping of one or more individual soil map units having similar potentials and continuing limitations or hazards.
   ii. **Application.** Use of this category and definition of codes are State options.

e. **Examples.** Capability subclasses are not assigned to soil components in capability class I (1) and are not assigned to soil or miscellaneous area components in capability class VIII (8). Subclass e is not used with soil components assigned to capability class V (5). Enter the appropriate capability unit code, if one is to be used in the area. Allowable entries for capability class are I (1), II (2), III (3), IV (4), V (5), VI (6), VII (7), or VIII (8). Allowable entries for subclass are e, w, s, or c. Valid entries for capability unit are integers ranging from 1 to 99. Enter the nonirrigated land capability class for all map unit components, including miscellaneous areas. Enter the irrigated land capability class and subclass if the soil map unit component is irrigated or potentially will be irrigated.

622.03 Farmland Classification

a. **Definition.** The farmland classification designates map units as prime farmland, farmland of statewide importance, farmland of local importance, or farmland of unique importance. Soil map units with components of prime farmland are classified as: *prime* where 50 percent or more of the components in the map unit composition are prime; *of statewide importance* where less than 50 percent of the components in the map unit are prime but a combination of lands of prime or statewide importance is 50 percent or more of the map unit composition; *of local importance* where less than 50 percent of the components in the map unit are of prime or statewide importance but the total of land of prime, statewide, and/or local importance is 50 percent or more of the map unit composition. All other soil map units are shown as not farmland unless they are designated as unique.

1. **Prime farmland** is defined as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses. It has the combination of soil properties, growing season, and moisture supply needed to produce sustained high yields of crops in an economic manner if it is treated and managed according to acceptable farming methods. In general, prime farmland has an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, an acceptable level of acidity or alkalinity, an acceptable content of salt or sodium, and few or no rocks. Its soils are permeable to water and air. Prime farmland is not excessively eroded or saturated with water for long periods of time, and it either does not flood frequently during the growing season or is protected from flooding. Users of the lists of prime farmland map units should recognize that soil properties are only one of several criteria that are necessary. Other considerations for prime farmland are the following:

i. **Land use.** Prime farmland is designated independently of current land use, but it cannot be areas of water or urban or built-up land as defined for the National Resource Inventories. Map units that are complexes or associations containing components of urban land or other miscellaneous areas as part of the map unit name (i.e., major components) cannot be designated as prime farmland. The soil survey memorandum of understanding determines the scale of mapping, and local land use interests should be considered in designing map units.
ii. **Flooding frequency.** Some map units may include both prime farmland and land not prime farmland because of variations in flooding frequency.
iii. **Irrigation.** Some map units have areas with a developed irrigation water supply that is dependable and of adequate quality while other areas do not have such a supply. In these map units, only the irrigated areas meet the prime farmland criteria.
iv. **Water table.** Most map units are drained but a few undrained areas are included. Only the drained areas meet the prime farmland criteria.
v. **Wind erodibility.** The product of I (soil erodibility) x C (climate factor) cannot exceed 60 to meet prime farmland criteria.

2. **Unique farmland** is land other than prime farmland that is used for the production of specific high-value food and fiber crops. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high-quality and/or high yields of a specific crop when treated and managed according to acceptable farming methods. Examples of such crops are citrus, tree nuts, olives, cranberries, fruit, and vegetables. The specific characteristics of unique farmland are the following:
   i. It is used for a specific high-value food or fiber crop;
   ii. It has a moisture supply that is adequate for the specific crop (the supply is from stored moisture, precipitation, or a developed irrigation system); and
   iii. It combines favorable factors of soil quality, growing season, temperature, humidity, air drainage, elevation, aspect, or other conditions, such as nearness to market, that favor the growth of a specific food or fiber crop.

b. **Significance.** Farmland classification identifies the location and extent of the most suitable land for producing food, feed, fiber, forage, and oilseed crops. The Natural Resources Conservation Service (NRCS) has national leadership for the management and maintenance of the resource base that supports the productive capacity of American agriculture. This management and maintenance includes identifying, locating, and determining the extent of the most suitable land for producing food, feed, fiber, forage, and oilseed crops. Prime farmland information is one of the four designations of farmland. An NRCS state conservationist can approve and have recorded in the field office technical guide (FOTG) soil map units that meet the criteria for farmland of statewide and local importance if the units are capable of producing crops on farmable land. Farmable land is land in a jurisdiction for which cropland productivity index has been developed in the land evaluation (LE) part of Land Evaluation and Site Assessment (LESA). Unique farmland described above is recorded in the FOTG by approval of the NRCS state conservationist.

622.04 Highly Erodible Land – Highly Erodible Soil Map Unit List

a. **Definition.** Highly erodible land is defined by the Sodbuster, Conservation Reserve, and Conservation Compliance parts of the Food Security Act of 1985 and the Food, Agriculture, Conservation, and Trade Act of 1990. Determinations for highly erodible land are based on an erodibility index as defined in the *National Food Security Act Manual*.

622.05 Hydric Soils

a. **Definition.** A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. Hydric soils along with hydrophytic vegetation and wetland hydrology are used to define wetlands. (See attached information).

622.06 Ecological Sites

a. **Definition.** 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 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.

Forestland ecological sites and rangeland ecological sites are separated based on the historic climax plant community that existed at the time of European immigration and settlement. 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 site type of "rangeland" is assigned where overstory tree production was not significant in the climax vegetation. For details on developing ecological site descriptions refer to the *National Forestry Manual* and the *National Range and Pasture Handbook*.

Soil Drainage Classification and Hydric Soil Indicators

EAS/CSS 260 - Intro Soil Science

Cornell University

Drainage classification of soils refers to the frequency and duration of periods when the soil is saturated with water. **Hydric soils** , loosely corresponding to poorly and very poorly drainage designations and to aquic moisture regimes in soil taxonomy, are water-saturated for sufficient duration when plants and soil microbes are active (soil temp > ~5 C) to produce a reduced matrix (e.g. anaerobic environment) and also support hydrophilic vegetation. Collectively referred to as **hydric soil indicators** , mineral and organic soil features created under these conditions are utilized in conjunction with vegetation cues to infer the presence of hydric soils and to assist the wetland delineation process.

Soil drainage characterization is essential for taxonomic classification and determining suitability for various potential uses. For instance, constructing a sceptic field on a poorly-drained soil would be a particularly odious investment! Wetland determinations commonly carry the weight of federal, state, and (occasionally) local laws. Among many environmental services, wetlands provide important habitat for wildlife, reduce the intensity and duration of flood events, and act as natural filters for surface water resources. Consequently, wetlands are regulated differently than non-hydric land units. In New York State, the Department of Environmental Conservation (NYSDEC) enforces the Freshwater Wetlands Act of 1975 which restricts certain types of development on wetland parcels larger than 5 hectares (NYSDEC Freshwater Wetlands Program). The economic consequences of wetland delineation can be tremendous for landowners and would-be developers. Hence, many resources are dedicated to wetland delineation both in the public and private sectors.

Soil Drainage Classes in USDA's Soil Taxonomy (Soil Survey Staff, 1993):

Very Poorly Drained - Water is at or near the soil surface during much of the growing season. Internal free-water is shallow and persistent or permanent. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Commonly, the soil occupies a depression or is level. If rainfall is persistent or high, the soil can be sloping.

Poorly Drained - The soil is wet at shallow depths periodically during the growing season or remains wet for long periods. Internal free-water is shallow or very shallow and common or persistent. Unless the soil is artificially drained, most mesophytic crops cannot be grown. The soil, however, is not continuously wet directly below plow depth. The water table is commonly the result of low or very low saturated hydraulic conductivity class or persistent rainfall, or a combination of both factors.

Somewhat Poorly Drained - The soil is wet at a shallow depth for significant periods during the growing season. Internal free-water is commonly shallow to moderately deep and transitory to permanent. Unless the soil is artificially drained, the growth of most mesophytic plants is markedly restricted. The soil commonly has a low or very low saturated hydraulic conductivity class, or a high water table, or receives water from lateral flow, or persistent rainfall, or some combination of these factors.

Moderately Well Drained - Water moves through the soil slowly during some periods of the year. Internal free water commonly is moderately deep and may be transitory or permanent. The soil is wet for only a short time within the rooting depth during the growing season. The soil commonly has a moderately low, or lower, saturated hydraulic conductivity class within 1 meter of the surface, or periodically receives high rainfall, or both.

Well Drained - Water moves through the soil readily, but not rapidly. Internal free-water commonly is deep or very deep; annual duration is not specified. Water is available to plants in humid regions during much of the growing season. Wetness does not inhibit growth of roots for significant periods during most growing seasons. The soil is deep to, or lacks redoximorphic features.

Somewhat Excessively Drained - Water moves through the soil rapidly. Internal free water commonly is very rare or very deep. The soils are commonly coarse-textured, have high saturated hydraulic conductivity, and lack redoximorphic features.

Excessively Drained - Water moves through the soil very rapidly. Internal free water commonly is very rare or very deep. The soils are commonly coarse-textured, have very high saturated hydraulic conductivity, and lack redoximorphic features.

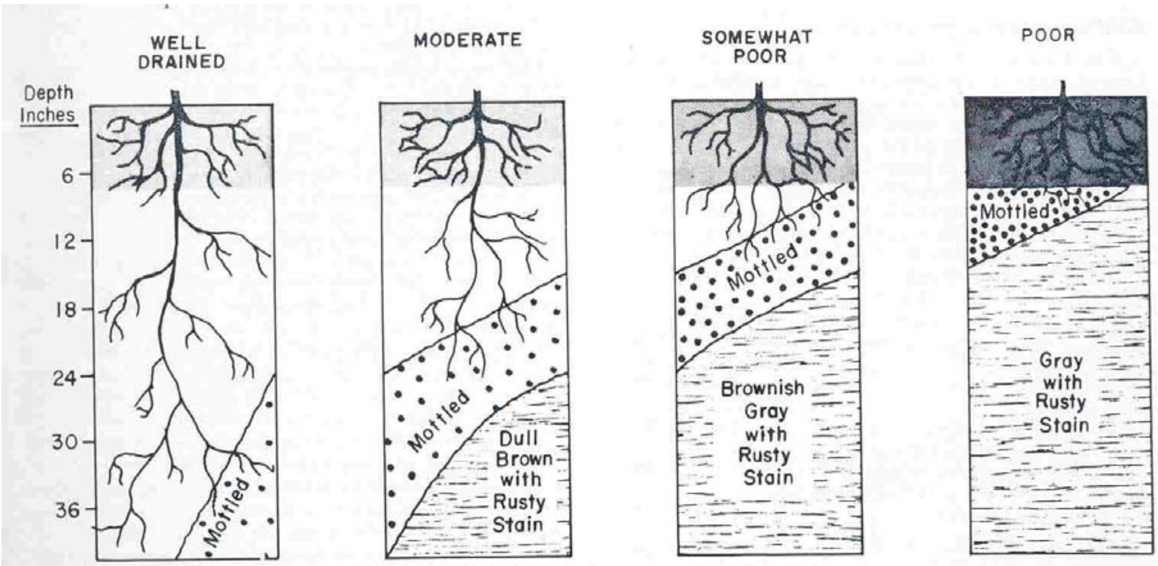

Figure 5.—Effect of soil drainage on root development.

Drainage classes recognized in the Tompkins County Soil Survey. Note the depth to redox features.

Hydric Soil Chemistry

Soil microbes oxidize carbon compounds to obtain energy (i.e. respiration) and require chemical elements to act as terminal electron acceptors in these reactions. In aerobic environments, oxygen serves as the primary electron acceptor, forming water as the respiratory by-product . When microbes are active under saturated or near-saturated condition, pools of oxygen in the soil air and dissolved O_2 in soil water are rapidly depleted. Suites of facultative and obligate anaerobic microbes become ascendant, utilizing oxidized forms of nitrogen, manganese, iron, sulfur, and carbon (primarily in this order) as terminal electron acceptors. In strongly anoxic environments, the reduced forms of these elements predominate (i.e. N_2, Mn^{2+}, Fe^{2+}, S^{2-}, CH_4). The soil signatures employed to identify hydric environments are directly and indirectly formed by anaerobic consumption of organic matter:

Carbon Anaerobic decomposition of organic matter is less efficient (i.e. rapid) than aerobic decomposition. All other factors being equal, hydric soils tend to accumulate more organic matter than their better drained counterparts.

Iron In oxidized form (Fe^{3+}), iron pigmentation ranges from orange to dark red. Soils with large amounts of reduced iron (Fe^{2+}) are typically gray to blue-green (termed "gleyed").

Sulfur Under extremely reduced conditions, sulfate ions (SO_4^{-2}) are reduced to sulfide (S^{2-}). Some of these sulfide ions combine with hydrogen to form the memorably-pungent hydrogen sulfide "swamp" gas (H2S).

Redox Features Together with organic matter, iron and manganese are primarily responsible for imparting color to soils. When Fe and Mn are reduced they become mobile, diffusing towards oxidized zones in the soil. Over time this results in areas of concentration and removal, creating a pattern of high pigmentation mottles in a gray, low-chroma matrix. Unlike with gleyed soils or the presence of swamp gas, redimorphic mottles do not necessarily indicate the current redox of the soil, but rather the long term conditions that predominate at the site.

Care must exercised when making inferences based on the presence or absence of hydric soil signatures. Chemical transformations depend on redox potential, rates of biological activity, and the basic mineralogical composition of the soil. For example, visible mottles may not be present in poorly-drained soils formed on red parent materials in coastal regions of the southern USA.

UNL WATER:

WETLANDS

What is a Wetland?

The word means different things to different people.

In general, wetlands describe a variety of areas where plants and animals suited to wet environments can be found. They are among the richest and biologically most productive habitats on the planet.

In the United States alone they support about 5,000 plant species and about one third of all bird species. About half to two thirds of America's wild ducks are hatched in the prairie pothole marshes of North Dakota, South Dakota, Minnesota and Iowa.

They provide critical habitat for about half the fish, one third of the birds, one fourth of the plants and one sixth of the mammals on threatened and endangered species lists.

Most organizations and government agencies define them, in part, by the presence of "Hydric" soils. Such soils lack air pockets, which have been replaced by water.

This is part of a definition of wetlands most agencies accept, along with the presence of water at or near the surface (since not all wetlands are wet) and the presence or evidence of hydrophic (or water-loving) vegetation, said Michael Whited of the USDA's Natural Resources Conservation Service (NRCS).

"If you think of hydric soils as a jar full of marbles, the space the air normally occupies around the marbles would be filled by water," said soil and wetlands scientist Whited.

"Hydric soils tend to be very grey in color and will often contain layers of organic material, such as peat. They are very fertile soils," he added.

The Dynamics of Wetlands

Wetlands are dynamic and productive ecosystems. They can produce more plant and animal life than woodlands or prairies of the same size.

They often undergo a variety of changes, both seasonally and from year-to-year. Wetlands can go dry and then flood, be burned by prairie fires and be subjected to other disturbances such as grazing.

These natural processes don't harm the wetland. In fact, it is the interaction of all of these processes that make wetlands so productive.

If some of these processes are altered, for example, by maintaining constant water levels, a wetland can begin to deteriorate.

Other factors that can cause wetland deterioration are influenced by people, such as permanent drainage, filling with soil, concrete or trash, diverting water or erosion.

Temporary and seasonally flooded wetlands do not contain water all year round. They go through a wet/dry cycle essential to their continued productivity and functioning. These wetlands provide valuable wildlife habitat, water storage and other functions.

During dry times, some wetland plants are able to start growing. Many of these plants produce seeds, or tubers, that are eaten by water birds and other wildlife.

When water returns, older plants that have died decompose quickly, releasing nutrients into the system. These nutrients feed algae, which in turn feed insects and other invertebrates.

Invertebrates found in these wetlands are specially adapted to the wet/dry cycle. They reproduce quickly and profusely once water returns. Wetland wildlife are well adapted to these changes.

Functions of Wetlands

Wetlands serve many functions and values that often go unnoticed.

They are particularly valuable components of the ecosystem. Much of this stems from their habitat for fish and wildlife, as well as for protecting water quality, erosion prevention, flood storage and recreation.

Their cleansing power provides natural pollution control and the way they filter and collect sediment from runoff water helps prevent mud from clogging lakes and reservoirs downstream. Wetlands help slow water flows, reducing downstream soil erosion.

Some wetlands, particularly those on floodplains and in coastal areas, function in aiding flood control by storing excess water during storm events.

Many wetlands temporarily store water, allowing it to percolate into the ground or evaporate. This can reduce peak flooding after a storm.

Wetlands shelter and feed thousands of different plants and animals, including many that are threatened and endangered. Nine of Nebraska's eleven federal endangered and threatened species use wetlands.

They also provide important winter cover for pheasants and other upland wildlife.

The ecological diversity of wetlands offers one of the most beautiful and aesthetically pleasing features of any landscape.

Importance of Wetlands

Groups as diverse as government agencies and conservation organizations are concluding one thing these days....that wetlands are valuable ecosystems.

Fish and Wildlife

Wetlands are important to fish and wildlife populations and that roughly 96 percent of commercially important species of fish are wetlands-dependent. A 1989 study by the American Fisheries Society's Endangered Species Committee found nearly one third of native North American freshwater fish species are endangered, threatened or of special concern. Of that number, 93 percent were adversely affected by habitat loss.

In addition, one tenth of North America's freshwater mussels (such as clams) have become extinct. About three quarters of the remaining are classified as rare or imperiled. This is primarily due to habitat destruction from dam construction and pollution.

Also, about 80 percent of America's bird population relies on wetlands, according to the U.S. Fish and Wildlife Service. A prime example is the wood stork, whose population has dropped from 60,000 birds in the 1930's to around 10,000 by 1984. All of this decline is attributed to the loss and degradation of wetlands, according to the U.S. Environmental Protection Agency's Office of Wetlands, Oceans and Watersheds.

Some species of frogs, toads and salamanders depend exclusively on seasonal wetland areas as their only habitat. Seasonal wetlands are those areas that have standing water for relatively brief periods. They are temporary and often isolated, making them safe from predatory fish and other creatures, allowing the amphibians to thrive.

Water Quality

Wetlands also are invaluable for a variety of water quality functions they naturally perform. These include, but are not limited, to the following:

- Denitrification: Some studies show that in certain instances, wetlands can remove from 70 to 90 percent of nitrates. One study in the southeastern U.S. projected a 20-fold increase in nitrogen loadings to streams as a result of a total conversion to adjacent bottomland hardwood forested wetlands to cropland.

- Trapping sediments which can keep large amounts of phosphorous from entering adjacent rivers, as well as preventing erosion and sedimentation.
- Flood control: Wetlands can help buffer storm surges. A recent study by the U.S. Army Corps of Engineers indicates. Studies in the midwest show flood water flows can be reduced by 80 percent in watersheds with wetlands, as opposed to those without them.
- Groundwater Recharge: Returning water to underground aquifers is known as "groundwater recharge." Much of the water in a wetland used for recharge would have been deposited there during wet periods, so the wetland would not only stem flooding by retaining water, but by having that water available to recharge groundwater.
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- ## Did You Know?
- Nebraska has lost more than one third of its wetlands in the last 125 years. At the time of statehood in 1867, Nebraska had an estimated 2.9 million acres of wetlands, which covered about six percent of the state, according to T.E. Dahl of the U.S. Department of the Interior, Fish and Wildlife Service.
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- ## Did You Know?
- The Rainwater Basin wetlands encompass 4,200 square miles in 17 south-central Nebraska counties.
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