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MUC Field Guide

A Key to Land Cover Classification

The GLOBE Program
Global Learning and Observations to Benefit the Environment
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The GLOBE Program is a hands-on science and education program that unites students, teachers, and scientists from around the world in study and research about the dynamics of Earth's environment. Hundreds of thousands of GLOBE students in over 90 countries have reported data from millions of measurements in the areas of Atmosphere/Climate, Hydrology, Soils and Land Cover/Biology.

GLOBE is implemented through a worldwide network of primary, middle, and secondary schools. Under the guidance of trained teachers, GLOBE students:

- take environmental measurements at or near their schools,
- report their data through the Internet to the GLOBE data archive,
- create maps and graphs to analyze GLOBE data sets, and
- collaborate with scientists and other GLOBE students around the world.

These global data sets are freely available via the Internet to the world-wide science community and to schools for student inquiry, scientific research, student-scientist partnerships, and worldwide school-to-school collaborations. Age-appropriate environmental science educational materials have been developed by scientists and educators as a resource for GLOBE teachers.

GLOBE is managed in the United States as an interagency program of the National Oceanic and Atmospheric Administration, the National Aeronautics and Space Administration, the National Science Foundation, the Environmental Protection Agency, and the U.S. Departments of Education and State. Internationally, GLOBE is implemented through bilateral agreements between the U.S. government and governments of partner nations.

For more information on GLOBE, contact the GLOBE Help Desk at 1-800-858-9947 or send email to help@globe.gov

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What is MUC?

MUC stands for Modified UNESCO Classification. It is a land cover classification system developed by the team of researchers at the University of New Hampshire as part of the Land Cover Investigation of The GLOBE Program. As the name implies, the MUC System is a modified version of the global land cover system developed by UNESCO (1973)*. It is a land cover classification system which follows international standards and ecological terminology for the identification of specific land cover classes.

In GLOBE, MUC data are used to validate remotely sensed data. MUC is designed to be used anywhere in the world. By using a standard international classification system, all the GLOBE data may be compiled into a single regional or global land cover data set.

* UNESCO. 1973. International Classification and Mapping of Vegetation, Series 6, Ecology and Conservation. Paris, France: United Nations Educational, Scientific and Cultural Organization. 32p.

How to Use the MUC Field Guide

This guide is designed to lead you through the MUC levels from the most general (level 1) to the most detailed. The most detailed will be either level 2, 3, or 4 depending on the particular land cover class. At each level, you will be either asked one or more questions about the site or given a list of options from which you select the best description of your site. Your selection or response to a question (usually either YES or NO) will direct you to the next question until you finally reach the most specific MUC level for your site. When you reach the most detailed level, you will be told 'DONE!'

Every class within each level has a unique identifier or numerical code. Your most detailed classification will be identified by a string of these numbers. In this Field Guide, the definition from the MUC System Glossary of Terms is given for each MUC level. The questions described above and these definitions are given on the left side of the page. Along the right side of the page, there may be definitions of words used in defining the MUC class, as well as some notes to help you decide how to make a selection. Drawings are interspersed throughout the guide to help you better understand the types of vegetation and the rules used in the MUC System. A table showing all the MUC classes is included at the end of this guide.

Some MUC definitions include specific examples of places or plant species. These are only examples. Other places may have this classification also, and a site may fit a given classification even if the example species are not present. You may wish to consult a local expert for examples specific to your area.

Key Factors That Affect Vegetation - Latitude

Often when using the MUC System you need to know in which climatic zone the site is located. Because of the tilt of Earth's axis and the resulting unequal distribution of sunlight and temperature, Earth can be divided into general global climate zones as shown in Figure 1. The exact boundaries of the zones, however, vary because climate is also affected by other factors such as proximity to mountains and oceans.

In addition to polar, temperate, and tropical zones shown in Figure 1, MUC uses the terms 'subtropical' and 'subpolar'. So when classifying your land cover site, know where you are in the globe and use the following definitions to help you choose the correct MUC class.

Tropical: *Geographically, the area between the Tropic of Cancer (23˚27'N) and the Tropic of Capricorn (23˚27'S), which includes tropical montane and alpine zones; climatically, the tropics are described as being where it almost never goes below freezing. In the temperate zone, locations near the water are considered tropical if the mean temperature for the coldest month of the year is above 18˚C. Generally, tropical regions are characterized by high mean temperatures, small annual variation in temperature, and abundant rainfall throughout the year, although mountainous areas within the tropics are more variable. The duration of the cool season increases with distance from the equator, and annual rainfall decreases.*

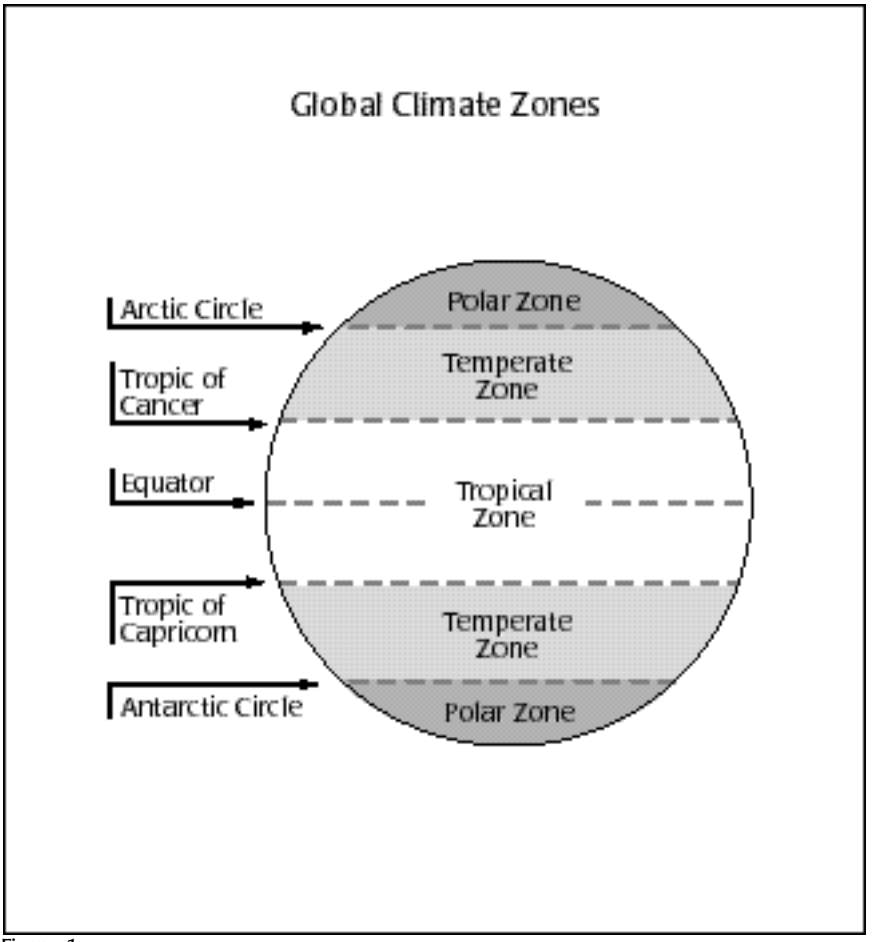
Subtropical: *Areas within tropical regions with variable (seasonal) temperature and moisture regimes; climatically, seasonal variation is marked by dry and wet seasons rather than cold and hot seasons; some of these regions are subject to temperatures below 0˚C but rarely have freezing periods longer than 24 hours.*

Temperate: *Temperate zones show significant seasonal temperature changes and can be broken down as follows:*

- ***Warm temperate:*** *mild or no winter and extremely wet, especially in summer.*
- ***Cool temperate:*** *cold, short winters or a winter free of frost and very cool summers (near the ocean) (e.g., central European or coastal northeastern USA).*
- ***Arid temperate:*** *large temperature contrasts between summer and winter, and little precipitation.*
- ***Boreal or cold temperate:*** *cool wet summers and cold winters, lasting more than six months.*
- ***Mediterranean:*** *wet winters with rain rather than snow and dry summers .*

Subpolar: *Transitional between the cold temperate zone and the polar zone.*

Polar: *In polar climates, the mean temperature of the warmest month is below 10˚C. and there is low precipitation distributed over the entire year. There is a short, wet, nightless summer and a very long, cold, dark winter. Generally, the climate is too cold to support the growth of trees. Geographically, the regions poleward of the Arctic and Antarctic Circles.*


Global Climate Zones
Arctic Circle
Tropic of Cancer
Equator
Tropic of Capricorn
Antarctic Circle
Polar Zone
Temperate Zone
Tropical Zone
Temperate Zone
Polar Zone
Figure 1

Key Factors That Affect Vegetation - Altitude

Changes in elevation can affect the environment as much as changes in latitude. Average annual temperature falls approximately 1˚C for every 150 meter increase in elevation, and, in terms of the length of the growing season, every 300 meter increase in elevation is roughly equivalent to moving toward the nearer pole by 400-500 km (roughly four to five degrees of latitude). Mountain tops can be thought of as climatic islands where, in the Northern Hemisphere, northern species extend their ranges southward onto mountains where conditions resemble those of more northern latitudes.

In addition, elevation affects precipitation. Mountain chains can cause moist air to rise and precipitate out almost all of its moisture. When this air reaches the other side of the mountain chain, it is dry and a rain shadow is created. Deserts and semiarid regions are found in such rain shadows.

MUC uses the terms 'lowland', 'submontane', 'montane', 'subalpine', and 'alpine'. Figure 2 and the following definitions will help you choose the correct MUC class.

Lowland: *An area of land that is low in relation to the surrounding country.*

Submontane: *Located at the base of a mountain or mountain range.*

Montane: *Of, growing in, or inhabiting mountain areas.*

Subalpine: *Of, designating, or growing or living in mountainous regions just below the timberline.*

Alpine: *Living or growing on mountains above the timberline.*

Note: *It may be necessary to consult local resources to determine the specific classification. Vegetation will vary depending on both the latitude and the altitude.*

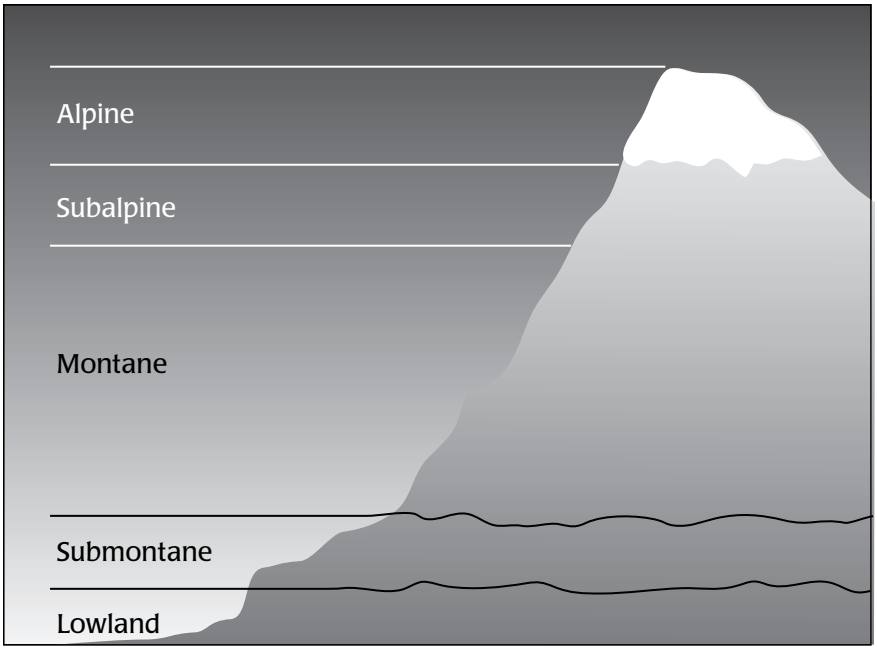
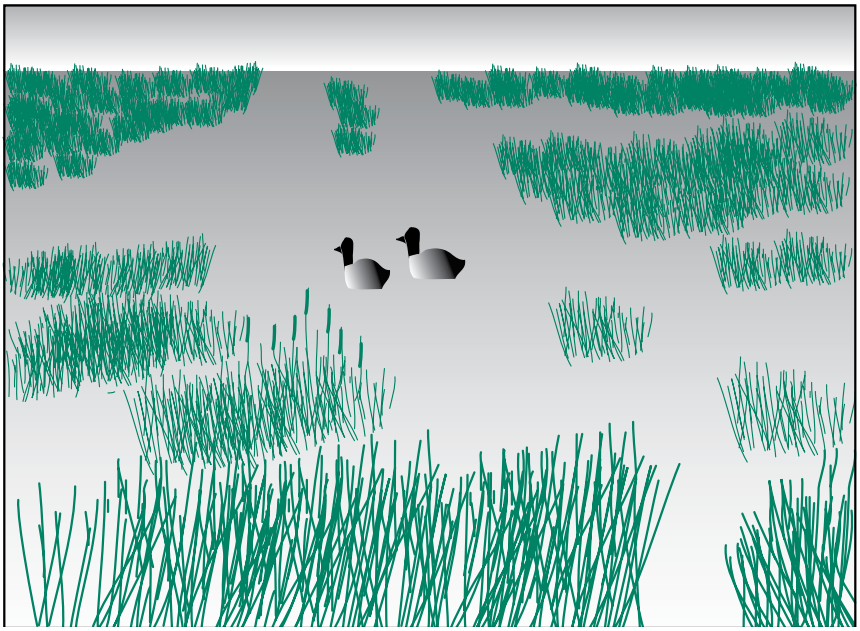
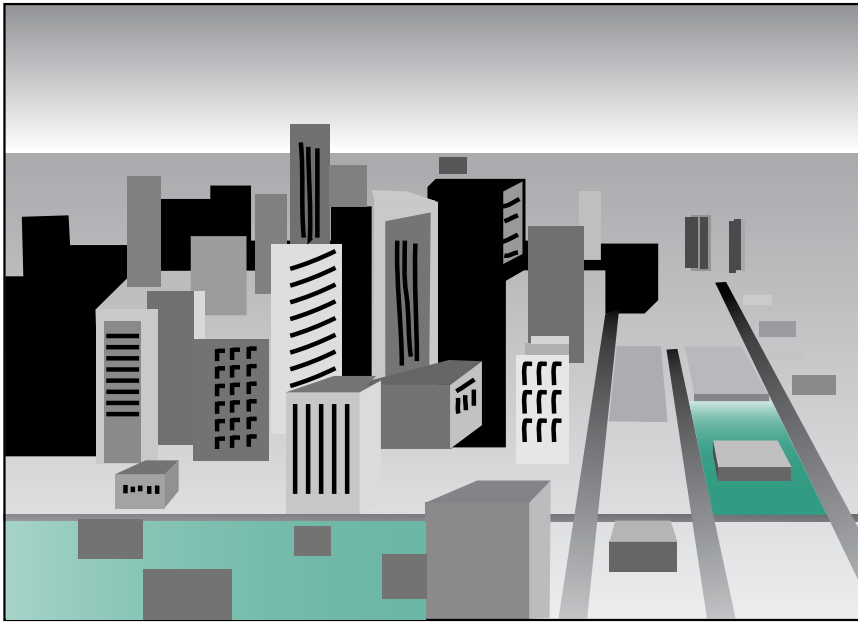


Figure 2





BEGIN

A Is the site developed?

If YES, go to **DEVELOPED** (below).

If NO, go to **NATURAL** (page 2).

__Note:__ You must first decide whether your site is developed or natural. A natural land cover site is any area that has an absence of current human manipulation. This includes closed forest, woodland, shrubland or thicket, dwarf-shrubland or dwarf-thicket, herbaceous vegetation, wetland, barren land, or open water.

A developed land cover site is any area that is currently manipulated (for example, mowed, groomed, irrigated, harvested, penned livestock, and fertilized) by humans. This includes urban and cultivated land (agricultural fields, athletic fields, golf courses, etc.).

Sometimes when selecting a land cover type, there may be 'gray' areas in which choosing between different classifications will seem difficult. Use your best judgement when a problem occurs.

DEVELOPED

Which of the following two choices (**Cultivated Land** or **Urban**) best describes your site?

Cultivated Land

The ground is covered by greater than 60% non-native cultivated species (e.g. agricultural crops, fruit trees, cultivated short grasses, and lawns) and usually can be distinguished by the regular geometric patterns created by the lawns and fields.

If YES go to **MUC 8** (page 103).

Urban

Areas developed for residential, commercial, industrial, or transportation uses. Must be greater that 40% urban land cover.

If YES, go to **MUC 9** (page 107).

NATURAL

A Is your site a wetland?

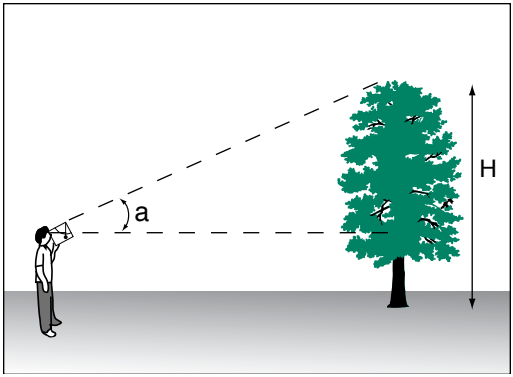
If YES, go to	If NO, go
MUC 6	to **B**
(page 99).	(below).

__Note:__ Wetlands include many types of vegetation adapted to soils that are periodically or constantly saturated during the growing season. There must be at least 40% vegetative cover. Some seasonally flooded grassland sites are classified in MUC grasslands rather than wetlands.

B During the growing season, is more than 40% of the site covered by the canopy of trees that are at least 5 meters tall?

If YES, go to	If NO, go
TREES	to **C**
(page 3).	(below).

__Note:__ When using the MUC system, it is important to make sure that the trees are at least 5 meters tall. Young or dwarf trees less than 5 meters tall are classified as shrubs.



C Do shrubs cover more than 40% of the ground?

If YES, go to	If NO, go
SHRUBS	to **D**
(page 4).	(page 5).

TREES

Which of the following two choices (**Closed Forest** or **Woodland**) best describes your site?

__Note:__ The primary difference between Closed Forest and Woodland is whether more than 50% of the branches in the tree canopy are interlocking. See pictures below describing interlocking branches.

Closed Forest

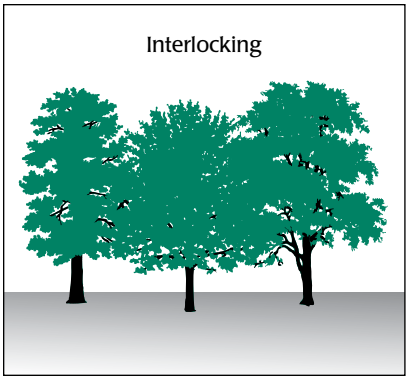
Are the crowns of the trees greater than 5 meters tall interlocking?

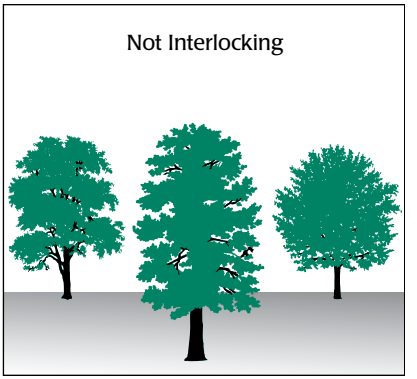
If YES, go to **MUC 0** (page 7).

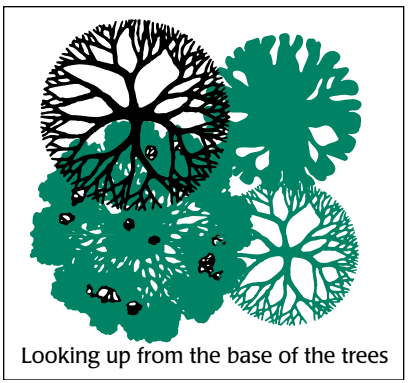
Woodland

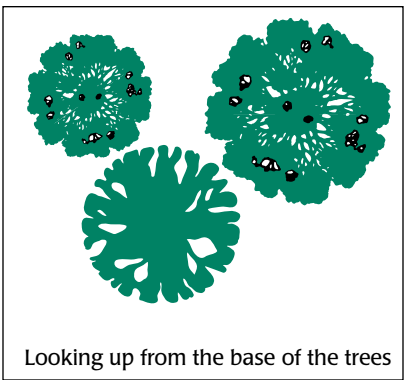
Are the crowns of the trees greater than 5 meters tall NOT interlocking?

If YES, go to **MUC 1** (page 31).






Looking up from the base of the trees


Looking up from the base of the trees

SHRUBS

Which of the following two choices (**Shrubland** or **Dwarf Shrubland**) best describes your site?

__Note:__ The primary difference between these two categories is the shrub height.

Shrubland

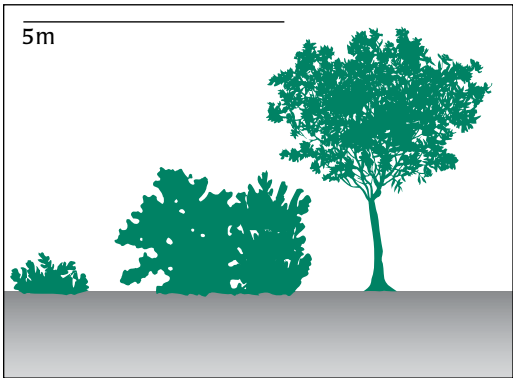
The shrub canopy is composed of matted, clumped or clustered woody plants 0.5 to 5 meters tall.

If YES, go to **MUC 2** (page 41).

Dwarf Shrubland

Shrubs rarely exceed 50 cm in height (sometimes called heaths or heathlike formations)

If YES, go to **MUC 3** (page 50).

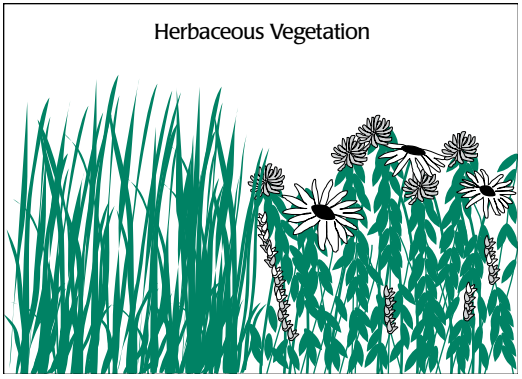


D Which of the following three choices (**Herbaceous Vegetation, Barren Land** or **Open Water**) best describes your site?

Herbaceous Vegetation

Dominated by herbaceous growth of two major types: graminoids and forbs. Total ground coverage must be greater than 60% herbaceous vegetation.

If YES, go to **MUC 4** (page 61).



__Forbs__ are broad-leaved herbaceous plants such as clover (Trifolium), sunflowers (Helianthus), ferns, and milkweeds (Asclepias).

__Graminoids__ include all herbaceous grasses and grass-like plants such as sedges (Carex), rushes (Juncus), and cattails (Typha).

__Herbaceous:__ Pertaining to or characteristic of an herb as distinguished from a woody plant. Vascular plant rooted in the ground with foliage that dies back annually. The meristem (stem growth tip) is located just above or below the ground.

Barren Land

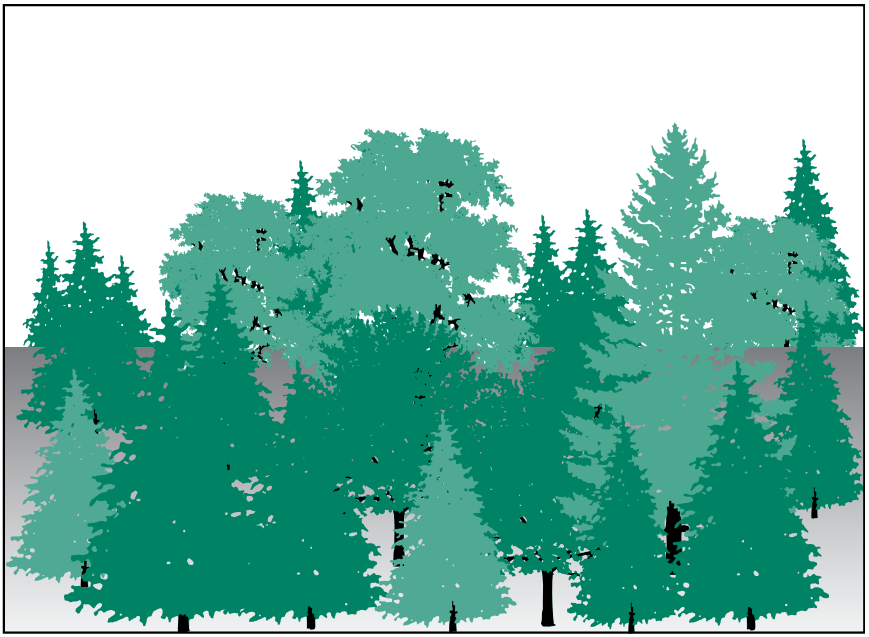
Land with less than 40% vegetative cover. Barren land has a limited ability to support life, and has thin soil.

If YES, go to **MUC 5** (page 96).

Open Water

Lakes, ponds, rivers and oceans. The surface of the land is continually submerged by water greater than 2 meters deep and at least one hectare in size; or continually submerged in an actively flowing channel or subtidal zone. Water should cover greater than 60% of the area.

If YES, go to **MUC 7** (page 101).



MUC 0 *Closed Forest* 0

Formed by trees at least 5 meters tall with their crowns interlocking. The tree canopy covers at least 40% of the ground.

A Is your site in an extremely dry (xeromorphic) climate?

If YES, go to	If NO, go
MUC 03 (page 29).	to **B** (below).

B Are at least 50% of the trees that reach the canopy evergreen?

If YES, go to	If NO, go to
MUC 01 (below).	**MUC 02** (page 24).

MUC 01 Mainly Evergreen

The canopy is never without green foliage. At least 50% of the trees that reach the canopy are evergreen. Individual trees may shed their leaves.

A Is your site located in a tropical or subtropical area?

If YES, go	If NO, go
to **B** (page 8).	to **D** (page 10).

Xeromorphic: *Climatic conditions favorable for the development of vegetation adapted to an environment that lacks fresh water. Xeromorphic adaptations can include a thickening of the outer protective layer (epidermis), reduction of leaf size, waxy or highly reflective leaves. The word "xeromorphic" comes from the Greek roots xero- , meaning "dry" and morphic, meaning "form".*

Evergreen: *Maintaining green leaves throughout the year. Leaves stay on the tree until new ones form to replace them, a process that may occur gradually throughout the year so the tree is never bare and always has some leaves that are more than one year old.*

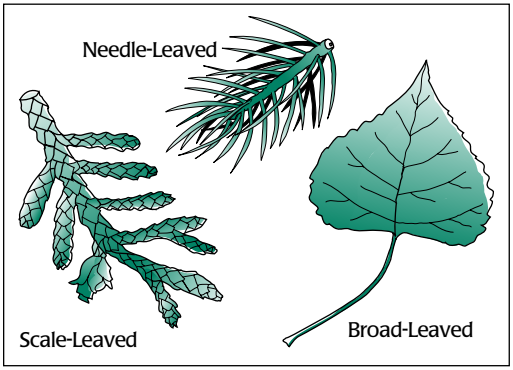
Deciduous: *Vegetation that sheds its leaves at the end of the growing period or in association with the unfavorable season (dry or cold).*

Note: *Please refer to page iv for the definitions of tropical and subtropical.*

B Do more than 50% of the trees have needle or scale leaves?

If YES, go to **MUC 018** (page 21).

If NO, go to **C** (below).



Broad-leaved: *A plant with leaves that are broad and flat rather than needle shaped.*

Needle-leaved: *A plant with slender, elongated leaves.*

Scale-leaved: *A plant with small, overlapping leaves that usually lie flat on the stem.*

C Which of the following four choices (**MUC 011, MUC 012, MUC 013 or MUC 014**) best describes your site?

Note: *Choose among these four choices within the tropical and subtropical mainly evergreen closed forest. These types are transitional, moving from tropical to subtropical zones and from very wet to slightly drier environments.*

MUC 011 Tropical Wet (Rain)

Often called a tropical rain forest. Consisting mainly of broad-leaved evergreen trees, neither cold nor drought resistant. Truly evergreen, i.e. the forest canopy remains green all year though a few individual trees may be leafless for a few weeks. Leaves of many species have "drip tips."

If YES, go to page 12.

MUC 012 Tropical and Subtropical Seasonal

Consisting mainly of broad-leaved evergreen trees. Foliage reduction during the dry season is noticeable, often as partial shedding. Transitional between Tropical Wet Forest and Tropical and Subtropical Semi-deciduous.

If YES, go to page 14.

MUC 013 Tropical and Subtropical Semi-Deciduous

Most of the upper canopy trees are drought-deciduous; many of the understory trees and shrubs are evergreen and more or less sclerophyllous. However, evergreen and deciduous woody plants and shrubs are not always separated by layers; they may occur mixed within the same layer, or shrubs may be primarily deciduous and trees evergreen. Nearly all trees have bud protection and leaves without "drip tips." Trees have rough bark, except some bottle trees, which may be present.

Sclerophyllous: *A plant with usually evergreen leaves that are thickened, hard, and leathery. These adaptations resist water loss and are common in, but not restricted to, regions with a long summer drought and predictable yet limited winter rain.*

If YES, go to page 15.

MUC 014 Subtropical Wet

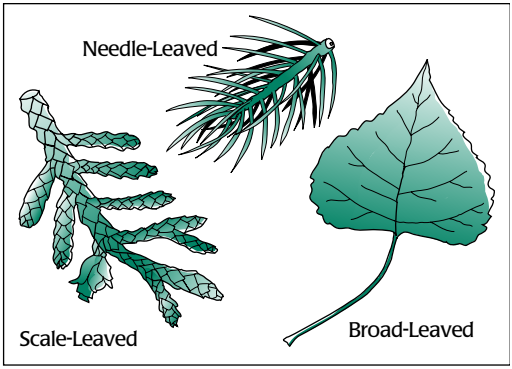
Present only locally and in small fragmentary stands, because the subtropical climate typically has a dry season. It usually grades into Tropical Wet Forest (e.g., Queensland, Australia and Taiwan). Some shrubs may grow in the understory. Seasonal temperature change occurs between summer and winter. There is a more pronounced temperature difference between summer and winter than the (Tropical Wet) Montane Forest (0113).

If YES, go to page 16.

D Do needle- or scale-leaved trees contribute more than 50% of the canopy?

If YES, go to **MUC 019** (page 22).

If NO, go to **E** (below).



Note: *Since you are not in a tropical or subtropical climate, you are in either a temperate or subpolar climate. Trees are not found in polar regions. See definitions on page iv.*

Broad-leaved: *A plant with leaves that are broad and flat rather than needle shaped.*

Needle-leaved: *A plant with slender, elongated leaves.*

Scale-leaved: *A plant with small, overlapping leaves that usually lie flat on the stem.*

E Which of the following three choices (**MUC 015, MUC 016** or **MUC 017**) best describes your site?

MUC 015 Temperate or Subpolar Wet

Occurs only in the extremely oceanic, nearly frost-free climates of the southern hemisphere, mainly in Chile. Consisting mostly of truly evergreen hemisclerophyllous trees and shrubs. Rich in epiphytic mosses, liverworts, and lichens that grow on trees, and in ground-rooted herbaceous ferns.

If YES, go to page 18.

Bryophyte: *Non-flowering plants (mosses and liverworts) characterized by rhizoids rather than true roots.*

Epiphytes: *Plants not connected with the soil, that grow on other plants upon which they depend for mechanical support but not for receiving food and water, such as certain orchids and ferns.*

Hemischlerophyllous: *Vegetation with slightly thickened foliage, with large soft leaves, that is resistant to water loss.*

Lichen: *Plant made up of an alga and a fungus living in a symbiotic relationship, characteristically forming a crustlike, scaly, or branching growth on rocks or tree trunks.*

Moss: *A bryophyte plant that has small leafy often tufted stems bearing sex organs at their tips.*

MUC 016 Temperate with Broad-Leaved Deciduous

Requires adequate summer rainfall. This is a mixed evergreen-deciduous class. The dominant trees are mainly hemisclerophyllous evergreen trees (more than 50% of the canopy) and shrubs, and the subdominant trees are deciduous broad-leaved trees and shrubs (more than 25% of the canopy). Rich in perennial herbaceous plants. Very few or no vascular epiphytes and vines.

If YES, go to page 18.

Herbaceous: *Pertaining to or characteristic of an herb as distinguished from a woody plant. Vascular plant rooted in the ground with foliage that dies back annually. The meristem (stem growth tip) is located just above or below the ground.*

Perennial Plant: *Plants that have a life span of more than two years.*

Vascular Epiphytes: *Epiphytes are plants that grow on other plants but are not parasitic. Vascular means that these plants have water and fluid conductive tissue (xylem and phloem) for transporting water and nutrients.*

MUC 017 Winter-Rain Broad-Leaved Sclerophyllous

Often understood as Mediterranean, but present also in southwestern Australia, Chile, and other locations. The climate has a pronounced summer drought. Consisting mainly of sclerophyllous evergreen trees and shrubs, most of which have rough bark. There is very little herbaceous undergrowth. No vascular and few non-flowering epiphytes and lichens, but evergreen woody vines are present.

If YES, go to page 20.

Sclerophyllous: *A plant with usually evergreen leaves that are stiff and firm and retain their stiffness even when wilted; they are common in, but not restricted to, regions with a long summer drought and predictable yet limited winter rain.*

MUC 011 Tropical Wet (Rain)

Which of the following five choices (**MUC 0111, MUC 0112, MUC 0113, MUC 0114** or **MUC 0115**) best describes your site?

Note: *The next MUC level is largely based on the vegetation types associated with different elevations. Since land cover types may be transitional, you may have to look at adjacent elevation classes to determine which selection best describes your site. Please refer to page vi for a discussion of how elevation affects vegetation.*

MUC 0111 Closed Forest, Mainly Evergreen, Tropical Wet (Rain), Lowland

Consists usually of numerous species of fast growing trees, many exceeding 50 meters tall, generally with smooth, often thin bark, some with buttresses. Emergent trees or at least a very uneven canopy often present. Undergrowth is sparse, composed mainly of tree seedlings. Palms and other tuft trees usually are rare. Crustose lichens and green algae are present, and climbing vines are usually only abundant in extremely humid regions (e.g., Sumatra, Atrato Valley, Columbia).

DONE!

Crustose Lichens: *Lichens that are encrusting. E.g., Caloplaca saxicola. Lichens are made up of an alga and a fungus living in a symbiotic relationship.*

Rosulate: *Leaves arranged in rosettes (circular clusters).*

Tuft Plant: *Woody plant with large leaf-fronds or rosulate branches at the tips of major trunk(s); for example, palms and tree ferns.*

MUC 0112 Closed Forest, Mainly Evergreen, Tropical Wet (Rain), Submontane

Emergent trees are largely absent and the canopy is relatively even. Forbs are common in the undergrowth. Vascular epiphytes and vines are abundant. E.g., Atlantic slopes of Costa Rica.

DONE!

Forb: *A broad-leaved herbaceous plant other than a grass such as clover, sunflowers, ferns and milkweeds.*

Vascular Epiphytes: *Epiphytes are plants that grow on other plants but are not parasitic. Vascular means that these plants have water and fluid conductive tissue (xylem and phloem) for transporting water and nutrients.*

MUC 0113 Closed Forest, Mainly Evergreen, Tropical Wet (Rain), Montane

Trees are less than 50 meters tall, have crowns that extend relatively far down the stem, and often have rough bark. Undergrowth abundant, often with ferns, herbs, mosses, and small palms. E.g., Sierra de Talamanca, Costa Rica.

DONE!

MUC 0114 Closed Forest, Mainly Evergreen, Tropical Wet (Rain), Subalpine

Occurs at elevations above montane forests, with characteristic vegetation, which is dependent on latitude.

DONE!

MUC 0115 Closed Forest, Mainly Evergreen, Tropical Wet (Rain), Cloud

Trees are gnarled, have rough bark and are rarely greater than 20 meters tall. Tree crowns, branches, and trunks are burdened with epiphytes, mainly chamaephytic bryophytes. Also, the ground is covered with hygromorphic chamaephytes such as *Selaginella* and ferns. E.g., Blue Mountains, Jamaica.

Bryophyte: *Non-flowering plants (mosses and liverworts) characterized by rhizoids rather than true roots.*

Chamaephyte: *A perennial plant that has its winter buds placed very close to the soil surface.*

DONE!

MUC 012 Tropical and Subtropical Seasonal

Which of the following four choices (**MUC 0121, MUC 0122, MUC 0123** or **MUC 0124**) best describes your site?

__Note:__ The next MUC level is largely based on the vegetation types associated with different elevations. Since land cover types may be transitional, you may have to look at adjacent elevation classes to determine which selection best describes your site. Please refer to page vi for a discussion of how elevation affects vegetation.

MUC 0121 Closed Forest, Mainly Evergreen, Tropical and Subtropical Seasonal, Lowland

Consists of fast growing trees, many exceeding 50 meters tall and usually forming an uneven canopy. Undergrowth is sparse, lichen and green algae are present, and climbing vines are absent.

DONE!

MUC 0122 Closed Forest, Mainly Evergreen, Tropical and Subtropical Seasonal, Submontane

Trees form an even canopy. Forbs are common in the undergrowth. Vascular epiphytes and vines are abundant.

DONE!

__Forb:__ A broad-leaved herbaceous plant other than a grass such as clover, sunflowers, ferns and milkweeds.

MUC 0123 Closed Forest, Mainly Evergreen, Tropical and Subtropical Seasonal, Montane

Trees are less than 50 meters tall, have crowns that extend relatively far down the stem and have rough bark. There are no tree ferns; instead, evergreen shrubs are most common.

DONE!

__Lichen:__ Plant made up of an alga and a fungus living in a symbiotic relationship, characteristically forming a crustlike, scaly, or branching growth on rocks or tree trunks.

__Sclerophyllous:__ A plant with usually evergreen leaves that are stiff and firm and retain their stiffness even when wilted; they are common in, but not restricted to, regions with a long summer drought and predictable yet limited winter rain.

__Vascular Epiphytes:__ Epiphytes are plants that grow on other plants but are not parasitic. Vascular means that these plants have water and fluid conductive tissue (xylem and phloem) for transporting water and nutrients.

MUC 0124 Closed Forest, Mainly Evergreen, Tropical and Subtropical Seasonal, Subalpine

This forest resembles the Winter-rain Evergreen Broad-leaved Sclerophyllous dry forest and usually occurs above the cloud forest. Trees are mostly evergreen sclerophyllous trees, smaller than 20 meters with little or no undergrowth, few climbing vines, and few epiphytes, except lichens.

DONE!

MUC 013 Tropical and Subtropical Semi-Deciduous

A Is the site located in a lowland area?

If YES, go to	If NO, go to
MUC 0131 (below).	**MUC 0133** (below).

MUC 0131 Closed Forest, Mainly Evergreen, Tropical and Subtropical Semi-Deciduous, Lowland

The taller trees may be bottle trees (e.g., *Ceiba*). There are practically no epiphytes present. The undergrowth is composed of shrubs and seedlings. Succulents such as thin-stemmed caespitose cacti may be present. Vines occur occasionally. A sparse layer of herbaceous vegetation may also be present.

DONE!

Caespitose: *Arranged or combined in a thick mat or clumps, having a low stem forming a dense turf or sod, growing in clusters.*

Epiphytes: *Plants not connected with the soil, that grow on other plants upon which they depend for mechanical support but not for receiving food and water, such as certain orchids and ferns.*

Herbaceous: *Pertaining to or characteristic of an herb as distinguished from a woody plant. Vascular plant rooted in the ground with foliage that dies back annually. The meristem (stem growth tip) is located just above or below the ground.*

Succulent: *Having thickened, juicy, fleshy tissues (leaves and stems), more or less soft in texture, that conserve moisture.*

MUC 0133 Closed Forest, Mainly Evergreen, Tropical and Subtropical Semi-Deciduous, Montane and Cloud

This forest is similar to a Semi-deciduous Lowland Forest, however, the canopy is lower and covered with xerophytic epiphytes such as *Tillandsia usneoides*.

DONE!

Xerophytic Epiphytes: *Epiphytes are plants that grow on other plant but are not parasitic. Epiphytic plants derive their nutrition from the air and rain instead of from the hosts that provide structural support. Xerophytic means that the epiphyte is adapted to a dry environment.*

MUC 014 Subtropical Wet

Which of the following five choices (**MUC 0141, MUC 0142, MUC 0143, MUC 0144** or **MUC 0145**) best describes your site?

Note: *The next MUC level is largely based on the vegetation types associated with different elevations. Since land cover types may be transitional, you may have to look at adjacent elevation classes to determine which selection best describes your site. Please refer to page vi for a discussion of how elevation affects vegetation.*

MUC 0141 Closed Forest, Mainly Evergreen, Subtropical Wet, Lowland

Consists usually of numerous species of fast growing trees, many exceeding 50 meters tall, generally with smooth, often thin bark, some with buttresses. Emergent trees or at least a very uneven canopy often present. Undergrowth is sparse, composed mainly of tree seedlings. Palms and other tuft trees usually are rare. Crustose lichens and green algae are present, and climbing vines are usually only abundant in extremely humid regions.

DONE!

Bryophyte: *Non-flowering plants (mosses and liverworts) characterized by rhizoids rather than true roots.*

Chamaephyte: *A perennial plant that has its winter buds placed very close to the soil surface.*

Crustose Lichens: *Lichens that are encrusting. E.g., Caloplaca saxicola. Lichens are made up of an alga and a fungus living in a symbiotic relationship.*

Hygromorphic: *The form of the plant is altered due to changes in moisture in the plant. E.g., hygromorphic chamaephytes Selaginella and herbaceous ferns.*

Moss: *A bryophyte plant that has small leafy often tufted stems bearing sex organs at their tips.*

Vascular Epiphytes: *Epiphytes are plants that grow on other plants but are not parasitic. Vascular means that these plants have water and fluid conductive tissue (xylem and phloem) for transporting water and nutrients.*

MUC 0142 Closed Forest, Mainly Evergreen, Subtropical Wet, Submontane

Emergent trees are largely absent and the canopy is relatively even. Forbs are common in the undergrowth. Vascular epiphytes and vines are abundant.

DONE!

MUC 0143 Closed Forest, Mainly Evergreen, Subtropical Wet, Montane

Trees are less than 50 meters tall, have crowns that extend relatively far down the stem, and often have rough bark. Undergrowth abundant, often with ferns, herbs, mosses, and small palms.

DONE!

MUC 0144 Closed Forest, Mainly Evergreen, Subtropical Wet, Subalpine

Occurs at elevations above montane forests, with characteristic vegetation, which is dependent on latitude.

DONE!

MUC 0145 Closed Forest, Mainly Evergreen, Subtropical Wet, Cloud

Trees are gnarled, have rough bark and are rarely greater than 20 meters tall. Tree crowns, branches, and trunks are burdened with epiphytes, mainly chamaephytic bryophytes. Also, the ground is covered with hygromorphic chamaephytes (e.g., *Selaginella* and herbaceous ferns).

DONE!

MUC 015 Temperate or Subpolar Wet

Which of the following two choices (**MUC 0151** or **MUC 0152**) best describes your site?

MUC 0151 Closed Forest, Mainly Evergreen, Temperate or Subpolar Wet, Temperate

Trees are generally greater than 10 meters tall. Vascular epiphytes and vines may be present.

DONE!

Vascular Epiphytes: *Epiphytes are plants that grow on other plants but are not parasitic. Vascular means that these plants have water and fluid conductive tissue (xylem and phloem) for transporting water and nutrients.*

MUC 0152 Closed Forest, Mainly Evergreen, Temperate or Subpolar Wet, Subpolar

Trees are generally less than 10 meters tall and often have reduced leaf size. There are few vascular epiphytes present. E.g., beech forests of New Zealand.

DONE!

MUC 016 Temperate with Broad-Leaved Deciduous

Which of the following four choices (**MUC 0161, MUC 0162, MUC 0163** or **MUC 0164**) best describes your site?

Note: *The next MUC level is largely based on the vegetation types associated with different elevations. Since land cover types may be transitional, you may have to look at adjacent elevation classes to determine which selection best describes your site. Please refer to page vi for a discussion of how elevation affects vegetation.*

MUC 0161 Closed Forest, Mainly Evergreen, Temperate with Broad-Leaved Deciduous, Lowland

Consists usually of numerous species of fast growing trees, many exceeding 50 meters tall, generally with smooth, often thin bark, some with buttresses. Emergent trees or at least a very uneven canopy often present. Undergrowth is sparse, composed mainly of tree seedlings. Palms and other tuft trees usually are rare. Crustose lichens and green algae are present, and climbing vines are usually only abundant in extremely humid regions.

DONE!

Crustose Lichens: *Lichens that are encrusting. E.g., Caloplaca saxicola. Lichens are made up of an alga and a fungus living in a symbiotic relationship.*

Rosulate: *Leaves arranged in rosettes (circular clusters).*

Tuft Tree: *Woody plant with large leaf-fronds or rosulate branches at the tips of major trunk(s); for example, palms and tree ferns.*

Undergrowth: *Shrubs, tree seedlings, and other plants that grow underneath the canopies of large trees.*

MUC 0162 Closed Forest, Mainly Evergreen, Temperate with Broad-Leaved Deciduous, Submontane

Emergent trees are largely absent and the canopy is relatively even. Forbs are common in the undergrowth. Vascular epiphytes and vines are abundant.

DONE!

Forb: *A broad-leaved herbaceous plant other than a grass such as clover, sunflowers, ferns and milkweeds.*

MUC 0163 Closed Forest, Mainly Evergreen, Temperate with Broad-Leaved Deciduous, Montane

Trees are less than 50 meters tall, have crowns that extend relatively far down the stem, and often have rough bark. Undergrowth abundant, often with ferns, herbs, mosses, and small palms.

DONE!

MUC 0164 Closed Forest, Mainly Evergreen, Temperate with Broad-Leaved Deciduous, Subalpine

Occurs at elevations above montane forests, with characteristic vegetation, which is dependent on latitude.

DONE!

MUC 017 Winter-Rain Broad-Leaved Schlerophyllous

A Are more than 50% of the trees that reach the uppermost tree canopy greater than 50 meters?

If YES, go to **MUC 0171** (below).

If NO, go to **MUC 0172** (below).

MUC 0171 Closed Forest, Mainly Evergreen, Winter-Rain Broad-Leaved Sclerophyllous, Lowland and Submontane >50m

Dominated by trees over 50 meters tall (at least 50% of the canopy) such as giant eucalyptus (e.g., *Eucalyptus regnans* in Victoria, Australia and *E. diversicolor* in Western Australia).

DONE!

MUC 0172 Closed Forest, Mainly Evergreen, Winter-Rain Broad-Leaved Sclerophyllous, Lowland and Submontane <50m

Dominated by trees less than 50 meters tall (more than 50% of the canopy). E.g., Californian live-oak forests.

DONE!

MUC 018 Tropical and Subtropical Needle-Leaved

Consisting mainly of needle-leaved or scale-leaved evergreen trees (more than 50% of the canopy). Broad-leaved trees may be present. Vascular epiphytes and vines rarely present. Species typical of the tropical/subtropical zone.

Note: *Refer to definitions of lowland and submontane on page vi.*

Vascular Epiphytes: *Epiphytes are plants that grow on other plants but are not parasitic. Vascular means that these plants have water and fluid conductive tissue (xylem and phloem) for transporting water and nutrients.*

A Is the site located in a lowland or submontane area?

If YES, go to **MUC 0181** (below).

If NO, go to **MUC 0182** (below).

MUC 0181 Closed Forest, Mainly Evergreen, Tropical and Subtropical Needle-Leaved, Lowland and Submontane

E.g., the pine forests of Honduras and Nicaragua.

DONE!

MUC 0182 Closed Forest, Mainly Evergreen, Tropical and Subtropical Needle-Leaved, Montane and Subalpine

E.g., the pine forests of the Philippines and southern Mexico.

DONE!

MUC 019 Temperate and Subpolar Needle-Leaved

Consisting mainly of needle-leaved or scale-leaved evergreen trees (more than 50% of the canopy), but broad-leaved trees may be present. Vascular epiphytes and vines are rarely present. Species typical of the temperate/subpolar zone.

Vascular Epiphytes: *Epiphytes are plants that grow on other plants but are not parasitic. Vascular means that these plants have water and fluid conductive tissue (xylem and phloem) for transporting water and nutrients.*

A Are more than 50% of the trees that reach the uppermost tree canopy greater than 50 meters tall?

If YES, go to **MUC 0191** (below).

If NO, go to **B** (below).

MUC 0191 Closed Forest, Mainly Evergreen, Temperate and Subpolar Needle-Leaved, Giant (>50m)

Dominated by trees (at least 50% of the canopy) greater than 50 meters tall (e.g., *Sequoia* and *Pseudo-tsuga* forest in the Pacific West of North America).

DONE!

B Which of the following three choices (**MUC 0192, MUC 0193** or **MUC 0194**) best describes your site?

Note: *The next MUC level is based on the shapes of the crowns of more than 50% of the trees that reach the canopy. Refer to the picture on page 23.*

MUC 0192 Closed Forest, Mainly Evergreen, Temperate and Subpolar Needle-Leaved, Irregularly Rounded Crowns

Dominated by trees 5-50 meters tall (more than 50% of the canopy), with broad, irregularly rounded crowns (e.g., *Pinus* spp.).

DONE!

MUC 0193 Closed Forest, Mainly Evergreen, Temperate and Subpolar Needle-Leaved, Conical Crowns

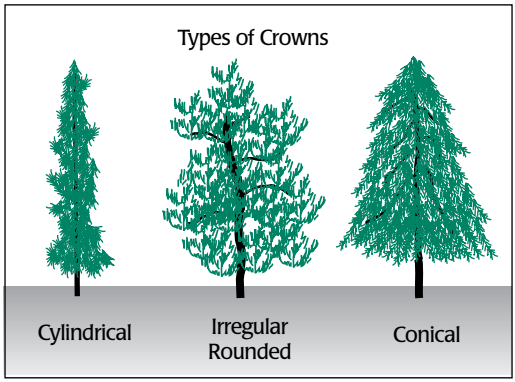
Dominated by trees 5-50 meters tall (more than 50% of the canopy), with conical crowns (like most *Picea* and *Abies*). E.g., California red fir forests.

DONE!

MUC 0194 Closed Forest, Mainly Evergreen, Temperate and Subpolar Needle-Leaved, Cylindrical Crowns

Dominated by trees 5-50 meters tall (more than 50% of the canopy), with crowns with very short branches and therefore a narrow cylindrical shape.

DONE!



Crown: *The leafy portion of a tree or shrub. The lower branches of a tree or shrub are part of the crown.*

MUC 02 Mainly Deciduous

The majority of trees (more than 50% of the canopy) shed their foliage simultaneously in connection with the unfavorable season (drought or cold).

A Do the deciduous trees lose their leaves because there is a dry season?

If YES, go to	If NO, go
MUC 021 (below).	to **B** (below).

B Do evergreen trees contribute more than 25% of the canopy?

If YES, go to	If NO, go to
MUC 022 (page 25).	**MUC 023** (page 27).

MUC 021 Tropical and Subtropical Drought-Deciduous

The unfavorable season is mainly characterized by drought, in most cases by winter-drought. Foliage is shed regularly every year. Most trees have relatively thick, fissured bark.

__Note:__ Please refer to page iv for the definitions of tropical and subtropical.

A Is your site located in a lowland or submontane area?

__Lowland:__ An area of land that is low in relation to the surrounding country.

__Submontane:__ Located at the base of a mountain or mountain range.

If YES, go to	If NO, go to
MUC 0211 (page 25).	**MUC 0212** (page 25).

MUC 0211 Closed Forest, Mainly Deciduous, Tropical and Subtropical Drought-Deciduous, Broad-Leaved Lowland and Submontane

Practically no evergreen plants in stratum except some succulents. Woody and herbaceous vines and deciduous bottle-trees are present occasionally. Sparse herbaceous vegetation present in the undergrowth. E.g., the broad-leaved deciduous forests of northwestern Costa Rica.

DONE!

Epiphytes: *Plants not connected with the soil, that grow on other plants upon which they depend for mechanical support but not for receiving food and water, such as certain orchids and ferns.*

Herbaceous: *Pertaining to or characteristic of an herb as distinguished from a woody plant. Vascular plant rooted in the ground with foliage that dies back annually. The meristem (stem growth tip) is located just above or below the ground.*

Succulent: *Having thickened, juicy, fleshy tissues (leaves and stems), more or less soft in texture, that conserve moisture.*

Undergrowth: *Shrubs, tree seedlings, and other plants that grow underneath the canopies of large trees.*

Understory: *A layer of vegetation that grows beneath the overstory consisting of smaller trees and shrubs.*

Woody: *Pertaining to the hard, lignified, cellulose tissue that forms the main body of some perennial plants.*

MUC 0212 Closed Forest, Mainly Deciduous, Tropical and Subtropical Drought-Deciduous, Montane and Cloud

Some evergreen species are present in the understory. Drought resistant epiphytes are present or abundant, often of the bearded form (e.g., *Usnea* or *Tillandsia usneoides*). This formation is not frequent, but well developed. E.g., in northern Peru.

DONE!

MUC 022 Cold-Deciduous with Evergreens

The unfavorable season is mainly characterized by winter frost. Deciduous broad-leaved trees are dominant (more than 50% of the canopy), but evergreen species are present (more than 25% of the canopy) as part of the main canopy or the understory. Climbers and vascular epiphytes are scarce or absent.

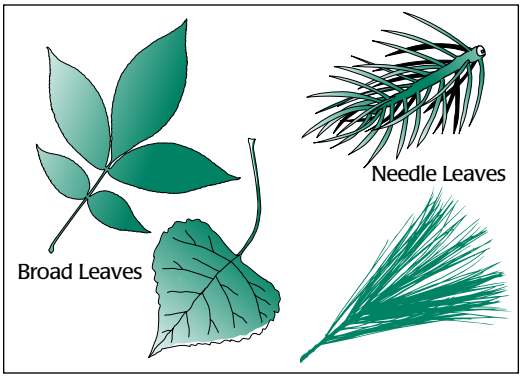
Go to **A** on next page.

Vascular Epiphytes: *Epiphytes are plants that grow on other plants but are not parasitic. Vascular means that these plants have water and fluid conductive tissue (xylem and phloem) for transporting water and nutrients.*

A Are the evergreen trees mainly needle-leaved?

If YES, go to **MUC 0222** (below).

If NO, go to **MUC 0221** (below).



Broad-leaved: *A plant with leaves that are broad and flat rather than needle shaped.*

Needle-leaved: *A plant with slender, elongated leaves; for example, pine and fir trees (Pinus and Abies).*

MUC 0221 Closed Forest, Mainly Deciduous, Cold-Deciduous with Evergreens, With Evergreen Broad-Leaved Trees and Climbers

Rich in epiphytes, including mosses. Vascular epiphytes may be present at the base of tree stems. Climbing vines may be common on flood plains. Ex. *Ilex aquifolium* and *Hedera helix* in western Europe and *Magnolia* spp. in North America.

DONE!

MUC 0222 Closed Forest, Mainly Deciduous, Cold-Deciduous with Evergreens, With Evergreen Needle-Leaved Trees

With evergreen needle-leaved trees such as hemlock (*Tsuga*) and pine (*Pinus*). E.g., the maple-hemlock or oak-pine forests of Northeastern, U.S.A.

DONE!

MUC 023 Cold-Deciduous without Evergreen Trees

Deciduous trees are absolutely dominant (more than 75% of the canopy). Evergreen herbs and some evergreen shrubs (less than 2 meters tall) may be present. Climbers insignificant but may be common on flood plains. Vascular epiphytes are absent (except occasionally at the lower base of the tree). Mosses, liverworts and particularly lichens are always present.

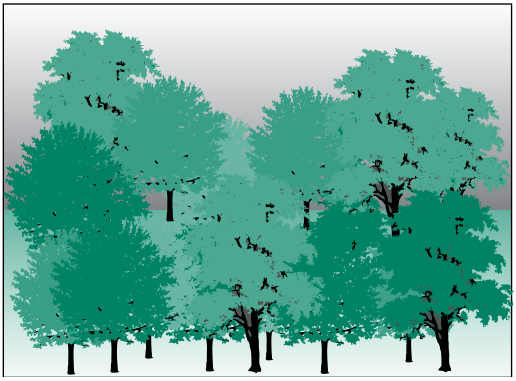
Go to **A** on the next page.

Bryophyte: *Non-flowering plants (mosses and liverworts) characterized by rhizoids, rather than true roots.*

Lichen: *Plant made up of an alga and a fungus living in a symbiotic relationship, characteristically forming a crustlike, scaly, or branching growth on rocks or tree trunks.*

Moss: *A bryophyte plant that has small leafy often tufted stems bearing sex organs at their tips.*

Vascular Epiphytes: *Epiphytes are plants that grow on other plants but are not parasitic. Vascular means that these plants have water and fluid conductive tissue (xylem and phloem) for transporting water and nutrients.*



A Which of the following three choices (**MUC 0231, MUC 0232** or **MUC 0233**) best describes your site?

Note: *The next MUC level is largely based on the vegetation types associated with different elevations and latitudes. Please refer to page vi for a discussion of how elevation affects vegetation.*

MUC 0231 Closed Forest, Mainly Deciduous, Cold-Deciduous without Evergreen Trees, Temperate Lowland and Submontane Broad-Leaved

Broad-Leaved Trees are up to 50 meters tall. Epiphytes are primarily algae and crustose lichens. E.g., the Mixed Mesophytic Forest of U.S.A.

DONE!

Crustose Lichen: *Lichens that are encrusting. E.g., Caloplaca saxicola. Lichens are plants made up of an alga and a fungus living in a symbiotic relationship, characteristically forming a crustlike, scaly, or branching growth on rocks or tree trunks.*

Mesophytic: *Growing in, or adapted to, a moderately moist environment.*

MUC 0232 Closed Forest, Mainly Deciduous, Cold-Deciduous without Evergreen Trees, Montane and Boreal

Trees may be up to 50 meters tall, but in montane or boreal forest normally not taller than 30 meters. Epiphytes are primarily lichens and bryophytes. This class includes lowland or submontane in topographic positions with high atmospheric humidity.

DONE!

Boreal: *Pertaining to climate with cool wet summers and cold winters lasting more than six months. A boreal zone can also be called cold temperate zone*

Montane: *Of, growing in, or inhabiting mountain areas.*

MUC 0233 Closed Forest, Mainly Deciduous, Cold-Deciduous without Evergreen Trees, Subalpine and Subpolar

Trees are not taller than 20 meters and tree trunks are frequently gnarled. Epiphytes are lichens and bryophytes, and are more abundant than in the Montane or Boreal class (0232). This class often grades into woodland.

DONE!

MUC 03 Extremely Xeromorphic (Dry)

Dense stands of trees adapted to dry conditions, such as bottle trees, tuft trees with succulent leaves and stem succulents. Undergrowth has shrubs adapted to dry conditions, succulent perennial herbs and annual and perennial herbaceous plants. Often grades into woodland.

A Do trees with thorns contribute more than 50% of the tree canopy cover?

If YES, go to **MUC 032** (page 30).

If NO, go to **B** (below).

B Do succulent trees contribute more than 50% of the canopy cover?

If YES, go to **MUC 033** (page 30).

If NO, go to **MUC 031** (below).

Annual Plant: *A plant that lives and grows for only one year or season.*

Herbaceous: *Pertaining to or characteristic of an herb as distinguished from a woody plant. Vascular plant rooted in the ground with foliage that dies back annually. The meristem (stem growth tip) is located just above or below the ground.*

Perennial Plant: *A plant that has a life span of more than two years.*

Rosulate: *Leaves arranged in rosettes (circular clusters).*

Sclerophyllous: *A plant with usually evergreen leaves that are thickened, hard, and leathery. These adaptations resist water loss and are common in, but not restricted to, regions with a long summer drought and predictable yet limited winter rain.*

Succulent: *Having thickened, juicy, fleshy tissues (leaves and stems), more or less soft in texture, that conserve moisture.*

Tuft Plant: *Woody plant with large leaf-fronds or rosulate branches at the tips of major trunk(s); for example, palms and tree ferns.*

MUC 031 Closed Forest, Extremely Xeromorphic (Dry), Sclerophyllous-Dominated

There is a predominance of sclerophyllous trees, many of which have bulbous stem bases largely embedded in the soil.

DONE!

MUC 032 Thorn-Dominated

Species with thorns are dominant (more than 50% of the tree canopy).

A Do deciduous thorny species contribute more than 75% of the tree canopy?

If YES, go to	If NO, go to
MUC 0322 (below).	**MUC 0321** (below).

MUC 0321 Closed Forest, Extremely Xeromorphic (Dry), Thorn-Dominated, Mixed Deciduous-Evergreen

Both deciduous and evergreen thorn species are more than 25% of the tree canopy.

DONE!

Evergreen: *Maintaining green leaves throughout the year. Leaves stay on the tree until new ones from to replace them, a process that may occur gradually throughout the year so the tree is never bare and always has some leaves that are more than one year old.*

MUC 0323 Closed Forest, Extremely Xeromorphic (Dry), Thorn-Dominated, Purely Deciduous

Deciduous thorn species are absolutely dominant (more than 75% of the canopy).

DONE!

Deciduous: *Vegetation that sheds its leaves at the end of the growing period or in association with the unfavorable season (dry or cold).*

MUC 033 Closed Forest, Extremely Xeromorphic (Dry), Mainly Succulent

Tree-formed (scapose) and shrub-formed (caespitose) succulents are very frequent (more than 50% of the canopy), but other trees and shrubs adapted to dry conditions are usually present as well.

DONE!

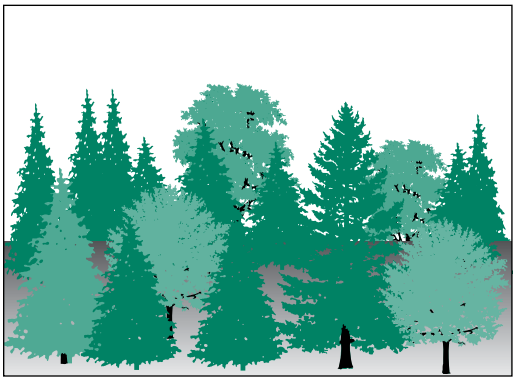
Caespitose: *Arranged or combined in a thick mat or clumps, having a low stem forming a dense turf or sod, growing in clusters.*

Scapose: *Bearing, resembling, or consisting of a scape (a leafless flower stalk).*

MUC 1 *Woodland* 1

Comprised of open stands of trees at least 5 meters tall with crowns not interlocking. The tree canopy covers at least 40% of the ground.

Definitions for Mainly Evergreen Woodland, Mainly Deciduous Woodland, and Extremely Xeromorphic Woodland are similar to forest definitions, with sparser stocking of individual trees.



A Is your site in an extremely dry (xeromorphic) climate?

If YES, go to **MUC 13** (page 38).

If NO, go to **B** (below).

Xeromorphic: *Climatic conditions favorable for the development of vegetation adapted to an environment that lacks fresh water. Xeromorphic adaptations can include a thickening of the outer protective layer (epidermis), reduction of leaf size, waxy or highly reflective leaves. The word "xeromorphic" comes from the Greek roots xero- , meaning "dry" and morphic, meaning "form".*

B Are at least 50% of the trees that reach the canopy evergreen?

If YES, go to **MUC 11** (page 32).

If NO, go to **MUC 12** (page 34).

Deciduous: *Vegetation that sheds its leaves at the end of the growing period or in association with the unfavorable season (dry or cold).*

Evergreen: *Maintaining green leaves or needles throughout the year. On evergreens, the leaves or needles stay on the tree until new ones form to replace them, a process that may occur gradually throughout the year so the tree is never bare and always has some leaves that are more than one year old.*

MUC 11 Woodland with Mainly Evergreen

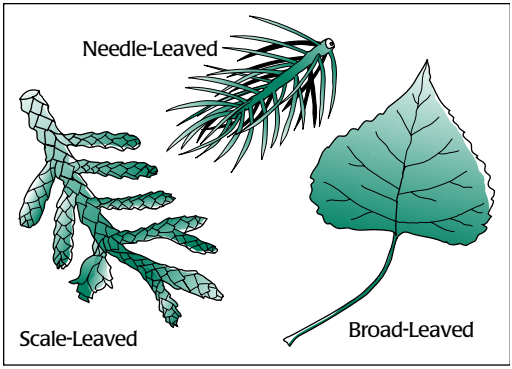
The canopy is never without green foliage. At least 50% of the trees that reach the canopy are evergreen. Individual trees may shed their leaves.

A Are at least 50% of the evergreen trees that reach the tree canopy broad-leaved?

If YES, go to **MUC 111** (below).

If NO, go to **MUC 112** (page 33).

Note: *Now that you have determined evergreen trees to be dominant, you have to determine whether broad-leaved or needle-leaved evergreen trees are dominant.*



Broad-leaved: *A plant with leaves that are broad and flat rather than needle shaped.*

Needle-leaved: *A plant with slender, elongated leaves; for example, pine and fir trees (Pinus and Abies).*

Scale-leaved: *A plant with small, overlapping leaves that usually lie flat on the stem; for example, eastern redcedar and western redcedar (Juniperus virginiana and Thuja plicata).*

MUC 111 Woodland, Mainly Evergreen, Broad-Leaved

Mainly sclerophyllous broad-leaved trees and shrubs, with no epiphytes.

DONE!

Epiphytes: *Plants not connected with the soil, that grow on other plants upon which they depend for mechanical support but not for receiving food and water, such as certain orchids and ferns.*

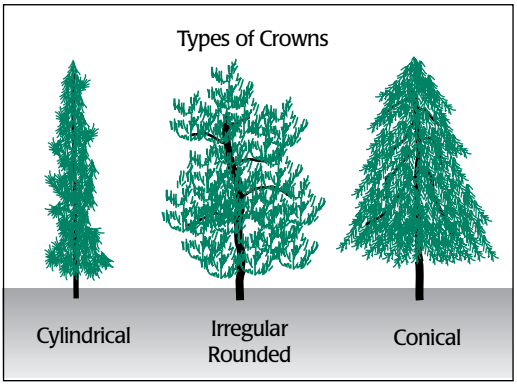
Sclerophyllous: *A plant with usually evergreen leaves that are thickened, hard, and leathery. These adaptations resist water loss and are common in, but not restricted to, regions with a long summer drought and predictable yet limited winter rain.*

MUC 112 Woodland with Mainly Needle-Leaved Evergreens

Trees are mainly needle- or scale-leaved (more than 50% of the canopy). Crowns of many trees extend to the base of the stem or are very branchy.

Which of the following three choices (**MUC 1121, MUC 1122,** or **MUC 1123**) best describes your site?

Note: *MUC classes here are based on the shapes of the crowns of more than 50% of the trees that reach the canopy.*



MUC 1121 Woodland, Mainly Evergreen, Needle-Leaved, Irregularly Rounded Crowns

Dominated by trees (more than 50% of the canopy) with broad, irregularly rounded crowns (e.g., *Pinus)*.
DONE!

MUC 1122 Woodland, Mainly Evergreen, Needle-Leaved, Conical Crowns

Dominated by trees (more than 50% of the canopy) with conical crowns. Mostly in subalpine areas.
DONE!

MUC 1123 Woodland, Mainly Evergreen, Needle-Leaved, Cylindrical Crowns

Dominated by trees (more than 50% of the canopy) with crowns with very short branches and therefore a narrow cylindrical shape (e.g., *Picea* in the boreal regions).
DONE!

Boreal Region: *A region that has a climate with cool wet summers and cold winters lasting more than six months. Also called cold temperate zone.*

MUC 12 Woodland with Mainly Deciduous Trees

The majority of trees (more than 50% of the canopy) shed their foliage simultaneously in connection with the unfavorable season (drought or cold).

A Do trees lose their leaves because there is a dry season?

If YES, go to	If NO, go
MUC 121	to **B**
(page 35).	(below).

Note: *If trees do not lose leaves because there is a dry season then they lose leaves because there is a cold season.*

B Do evergreen trees contribute more than 25% of the tree canopy cover?

If YES, go to	If NO, go to
MUC 122	**MUC 123**
(page 36).	(page 37).

MUC 121 Drought-Deciduous Woodland

The unfavorable season is mainly characterized by drought, in most cases by winter-drought. Foliage is shed regularly every year. Most trees have relatively thick, fissured bark.

__Note:__ The next MUC level is largely based on the vegetation types associated with different elevations. Please refer to page vi for a discussion of how elevation affects vegetation.

Which of the following two choices (**MUC 1211** or **MUC 1212**) best describes your site?

MUC 1211 Woodland, Mainly Deciduous, Drought-Deciduous, Broad-Leaved Lowland and Submontane

Practically no evergreen plants in any stratum except some succulents. Woody and herbaceous vines and deciduous bottle trees are present. Sparse herbaceous vegetation present in the undergrowth.

__Succulents:__ Having thickened, juicy, fleshy tissues (leaves and stems), more or less soft in texture that conserve moisture.

__Undergrowth:__ Shrubs, tree seedlings, and other plants that grow underneath the canopies of large trees.

DONE!

MUC 1212 Woodland, Mainly Deciduous, Drought-Deciduous, Montane and Cloud

Some evergreen species are present in the understory. Drought resistant epiphytes are present or abundant, often of the bearded form (e.g., *Usnea* or *Tillandsia usneoides*). This formation is not frequent, but well developed. E.g., in northern Peru.

__Understory:__ A layer of vegetation that grows beneath the overstory consisting of smaller trees and shrubs.

DONE!

MUC 122 Cold-Deciduous with Evergreens Woodland

The unfavorable season is mainly characterized by winter frost. Deciduous broad-leaved trees are dominant (more than 50% of the canopy), but evergreen species are present (more than 25% of the canopy) as part of the main canopy or the understory. Climbers and vascular epiphytes are scarce or absent.

Vascular Epiphytes: *Epiphytes are plants that grow on other plants but are not parasitic. Vascular means that these plants have water and fluid conductive tissue (xylem and phloem) for transporting water and nutrients.*

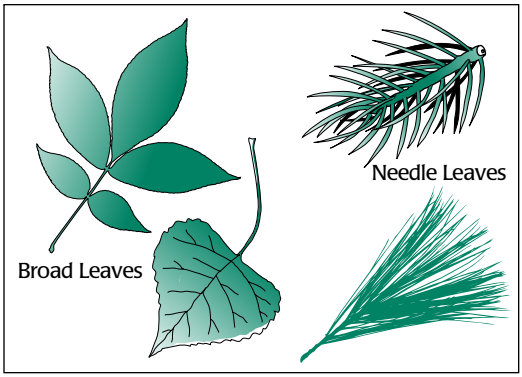
Understory: *A layer of vegetation that grows beneath the overstory consisting of smaller trees and shrubs.*

Note: *After determining that evergreen trees contribute at least 25% to the tree canopy, you have to determine what type of evergreen tree is dominant (greater than 50%).*

A Do more than 50% of the evergreen trees that reach the canopy have needle leaves?

If YES, go to **MUC 1222** (page 40).

If NO, go to **MUC 1221** (below).



Broad-leaved: *A plant with leaves that are broad and flat rather than needle shaped.*

Needle-leaved: *A plant with slender, elongated leaves; for example, pine and fir trees (Pinus and Abies).*

MUC 1221 Woodland, Mainly Deciduous, Cold-Deciduous with Evergreens, With Evergreen Broad-Leaved Trees and Climbers

Rich in epiphytes, including mosses. Vascular epiphytes may be present at the base of tree stems. Climbing vines may be common on flood plains.

DONE!

Ilex aquifolium and Hedera helix in western Europe and Magnolia spp. in North America are examples of this tree type.

Bryophyte: *Non-flowering plants (mosses and liverworts) characterized by rhizoids rather than true roots.*

Moss: *A bryophyte plant that has small leafy often tufted stems bearing sex organs at their tips.*

MUC 123 Cold-Deciduous without Evergreen Trees Woodland

Cold-deciduous tree species are absolutely dominant (more than 75% of the canopy). Evergreen herbs and some evergreen shrubs (less than 2 meters tall) may be present. Climbers insignificant but may be common on flood plains. Vascular epiphytes are absent (except occasionally at the lower base of the tree). Mosses, liverworts and particularly lichens are always present. Most frequent in the subarctic region.

Bryophyte: *Non-flowering plants (mosses and liverworts) characterized by rhizoids rather than true roots.*

Lichen: *Plant made up of an alga and a fungus living in a symbiotic relationship, characteristically forming a crustlike, scaly, or branching growth on rocks or tree trunks.*

Moss: *A bryophyte plant that has small leafy often tufted stems bearing sex organs at their tips.*

Vascular Epiphytes: *Epiphytes are plants that grow on other plants but are not parasitic. Vascular means that these plants have water and fluid conductive tissue (xylem and phloem) for transporting water and nutrients.*

A Are more than 75% of the trees that reach the tree canopy broad-leaved deciduous?

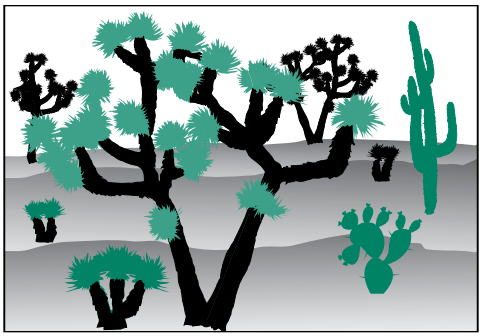
If YES, go to	If NO, go
MUC 1231 (page 40).	to **B** (below).

B Are more than 75% of the trees that reach the tree canopy needle-leaved deciduous?

If YES, go to	If NO, go to
MUC 1232 (page 40).	**MUC 1233** (page 40).

MUC 13 Extremely Xeromorphic (Dry) Woodland

Stands of trees and shrubs adapted to dry conditions, such as bottle trees, tuft trees with succulent leaves and stem succulents. Undergrowth has shrubs adapted to dry conditions, succulent perennial herbs and annual and perennial herbaceous plants. Woodlands may grade into forests.



Frond: *The large, compound leaf of a fern, cycad, or palm.*

Rosulate: *Leaves arranged in rosettes (circular clusters).*

Succulent: *Having thickened, juicy, fleshy tissues (leaves and stems), more or less soft in texture, that conserve moisture.*

Tuft Tree: *Woody plant with large leaf-fronds or rosulate branches at the tips of major trunk(s); for example, palms and tree ferns.*

Which of the following three choices (**MUC 131, MUC 132** or **MUC 133**) best describes your site?

MUC 131 Woodland, Extremely Xeromorphic (Dry), Sclerophyllous-Dominated

There is a predominance of sclerophyllous trees, many of which have bulbous stem bases largely embedded in the soil.

DONE!

Sclerophyllous: *A plant with usually evergreen leaves that are thickened, hard, and leathery. These adaptations resist water loss and are common in, but not restricted to, regions with a long summer drought and predictable yet limited winter rain.*

MUC 132 Extremely Xeromorphic Thorn-Dominated Woodland

Species with thorns are dominant (more than 50% of the canopy).

A Do deciduous thorn species comprise more than 75% of the canopy?

If YES, go to **MUC 1322** (below).

If NO, go to **MUC 1321** (below).

MUC 133 Woodland, Extremely Xeromorphic (Dry), Mainly Succulent

Tree-formed (scapose) and shrub-formed (caespitose) succulents are very frequent (more than 50% of the canopy), but other trees and shrubs adapted to dry conditions are usually present as well.

DONE!

Caespitose: *Arranged or combined in a thick mat or clumps, having a low stem forming a dense turf or sod, growing in clusters.*

Scapose: *Having a leafless flower stalk growing directly from the ground. E.g., agave/century plant.*

Succulent: *Having thickened, juicy, fleshy tissues (leaves and stems), more or less soft in texture, that conserve moisture.*

MUC 1321 Woodland, Extremely Xeromorphic (Dry), Thorn-Dominated, Mixed Deciduous-Evergreen

Both deciduous species and evergreen species are more than 25% of the tree canopy.

MUC 1322 Woodland, Extremely Xeromorphic (Dry), Thorn-Dominated, Purely Deciduous

Deciduous thorn species are absolutely dominant (more than 75% of the canopy).

DONE!

MUC 1222 Woodland, Mainly Deciduous, Cold-Deciduous with Evergreens, With Evergreen Needle-Leaved Trees

With evergreen needle-leaved trees such as hemlock (*Tsuga*) and pine (*Pinus)*. E.g., the maple-hemlock or oak-pine woodlands of Northeastern, U.S.A.

DONE!

MUC 1231 Woodland, Mainly Deciduous, Cold-Deciduous without Evergreen Trees, Broad-Leaved

Broad-leaved deciduous species are absolutely dominant (more than 75% of the canopy).

DONE!

MUC 1232 Woodland, Mainly Deciduous, Cold-Deciduous without Evergreen Trees, Needle-Leaved

Needle-leaved deciduous species are absolutely dominant (more than 75% of the canopy).

DONE!

MUC 1233 Woodland, Mainly Deciduous, Cold-Deciduous without Evergreen Trees, Mixed

Both broad-leaved and needle leaved deciduous species provide more than 25% of the canopy.

DONE!

The shrub canopy covers at least 40% of the ground and is composed of matted, clumped or clustered woody plants 0.5 to 5 meters tall.

A Is your site in an extremely dry (xeromorphic) climate?

If YES, go to	If NO, go
MUC 23 (page 47).	to **B** (below).

B Are at least 50% of the shrubs that reach the canopy evergreen?

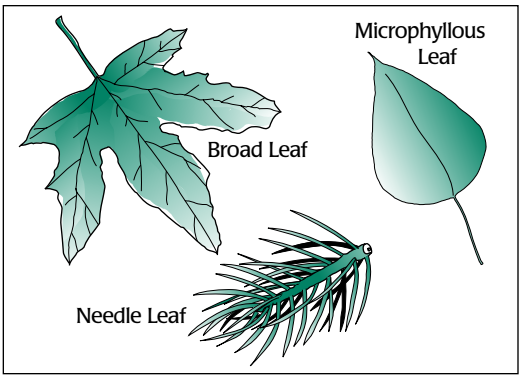
If YES, go to	If NO, go to
MUC 21 (below).	**MUC 22** (page 45).

MUC 21 Mainly Evergreen

The canopy is never without green foliage. At least 50% of the shrubs that reach the canopy are evergreen. Individual shrubs may shed their leaves.

A Do needle-leaved or microphyllous shrubs contribute more than 50% of the shrub canopy?

If YES, go to	If NO, go to
MUC 212 (page 44).	**MUC 211** (page 42).



Shrubland: most of the individual shrubs are not touching each other; often with grass growing between shrubs. Shrublands are also further defined (like Forests and Woodlands) as Evergreen Broad-leaved, Evergreen Needle-leaved, Mainly Deciduous, etc.

Thicket: individual shrub branches are interlocked.

***Xeromorphic:** Climatic conditions favorable for the development of vegetation adapted to an environment that lacks fresh water. Xeromorphic adaptations can include a thickening of the outer protective layer (epidermis), reduction of leaf size, waxy or highly reflective leaves. The word "xeromorphic" comes from the Greek roots xero- , meaning "dry" and morphic, meaning "form".*

***Deciduous:** Vegetation that sheds its leaves at the end of the growing period or in association with the unfavorable season (dry or cold).*

***Evergreen:** Maintaining green leaves throughout the year. Leaves stay on the tree until new ones from to replace them, a process that may occur gradually throughout the year so the tree is never bare and always has some leaves that are more than one year old.*

***Broad-leaved:** Having leaves that are broad and flat rather than needle shaped.*

***Needle-leaved:** Having slender, elongated leaves; for example, pine and fir trees (Pinus and Abies).*

***Microphyllous:** Having small leaves with a single unbranched vein (e.g., desert plants).*

MUC 211 Broad-Leaved

Evergreen broad-leaved species are dominant (more than 50% of the canopy).

A Are more than 50% of the shrub species bamboo?

If YES, go to **MUC 2111** (page 44).

If NO, go to **B** (below).

B Are tuft trees on the site?

If YES, go to **MUC 2112** (below).

If NO, go to **C** (page 43).

Rosulate: *Leaves arranged in rosettes (circular clusters).*

Tuft Tree: *Woody plant with large leaf-fronds or rosulate branches at the tips of major trunk(s); for example, palms and tree ferns.*

MUC 2112 Shrubland or Thicket, Mainly Evergreen, Broad-Leaved, Tuft-Tree

Composed of small trees and woody shrubs. E.g., Mediterranean dwarf palms shrubland or Hawaiian tree fern thicket or shrubland.

DONE!

C Which of the following three choices (**MUC 2113, MUC 2114,** or **MUC 2115**) best describes your site?

MUC 2113 Shrubland or Thicket, Mainly Evergreen, Broad-Leaved, Broad-Leaved Hemi-Sclerophyllous

Matted or clumped shrubs and plants with large soft leaves (caespitose, creeping or lodged nano- or microphanerophytes). E.g., subalpine *Rhododendron* thickets, or *Hibiscus tiliaeceus* matted thickets of Hawaii.

DONE!

MUC 2114 Shrubland or Thicket, Mainly Evergreen, Broad-Leaved, Broad-Leaved Sclerophyllous

Dominated by broad-leaved sclerophyllous shrubs and immature trees (e.g., chapparal or macchia). May often merge with parkland, grassland or heath.

DONE!

MUC 2115 Shrubland or Thicket, Mainly Evergreen, Broad-Leaved, Suffruticose

Stand of semi-lignified nanophanerophytes that in dry
years may shed part of their shoot systems (e.g., *Cistus* heath).

DONE!

Graminoid: *Grasses and grass-like plants.*

Hemi-schlerophyllous: *Vegetation with slightly thickened foliage, with large soft leaves, that is resistant to water loss. Examples include sub-alpine Rhododendron thickets and Hibiscus tiliaeceus matted thickets of Hawaii.*

Lignified: *Woody, hardened. Has formed or turned into wood through the formation and deposit of lignin in the cells.*

Microphanerophytes: *Small flowering plants.*

Nanophanerophytes: *Very small flowering plants.*

Phanerophyte: *Plants can be classified according to the position and type of buds during the dormant phase (either a cold or dry season). The harsher the conditions, the less exposed the buds. Phanerophyte plants are plants whose buds are fairly exposed and are most typical in environments where drought, cold, and exposure to strong winds are relatively infrequent.*

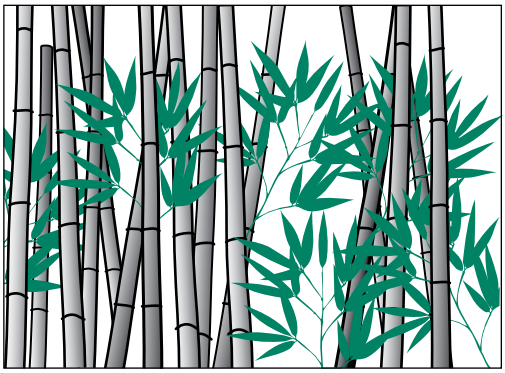
Sclerophyllous: *A plant with usually evergreen leaves that are thickened, hard, and leathery. These adaptations resist water loss and are common in, but not restricted to, regions with a long summer drought and predictable yet limited winter rain.*

Suffruticose: *Describing small plants that are woody only at the base and herbaceous at the top, as in alpine species of willow and thyme. The herbaceous parts die back to leave only the lower parts to survive the cold or dry unfavorable seasons.*

MUC 2111 Shrubland or Thicket, Mainly Evergreen, Broad-Leaved, Low Bamboo

Bamboo species are dominant. (Lignified creeping graminoid nano- or microphanerophytes).

DONE!



Graminoid: *Grasses and grass-like plants.*

Lignified: *Woody, hardened. Has formed or turned into wood through the formation and deposit of lignin in the cells.*

Microphanerophytes: *Small flowering plants.*

Nanophanerophytes: *Very small flowering plants.*

Phanerophyte: *Plants can be classified according to the position and type of buds during the dormant phase (either a cold or dry season). The harsher the conditions, the less exposed the buds. Phanerophyte plants are plants whose buds are fairly exposed and are most typical in environments where drought, cold, and exposure to strong winds are relatively infrequent.*

MUC 212 Needle-Leaved or Microphyllous

Dominant species (more than 50% of the canopy) have either needle leaves or small leaves.

A Do needle-leaved shrubs contribute more than 50% of the shrub canopy?

If YES, go to	If NO, go to
MUC 2121 (below).	**MUC 2122** (page 45).

MUC 2121 Shrubland or Thicket, Mainly Evergreen, Needle-Leaved or Microphyllous, Needle-Leaved

Composed of creeping or lodged needle-leaved shrubs (e.g., *Pinus mughus*, "Krummholz").

DONE!

MUC 2122 Shrubland or Thicket, Mainly Evergreen, Needle-Leaved or Microphyllous, Microphyllous

Evergreen species have small leaves, (e.g., desert plants) or leaves with a single unbranched vein. Mostly in tropical subalpine belts.

DONE!

Note: *Refer to page iv for a definition of tropical.*

Subalpine: *Of, designating, or growing or living in mountainous regions just below the timberline.*

MUC 22 Mainly Deciduous

The majority of shrubs (more than 50% of the canopy) shed their foliage simultaneously in connection with the unfavorable season (cold or drought).

A Does a cold season cause the deciduous shrubs to lose their leaves ?

If YES, go to	If NO, go
MUC 223	to **B**
(page 46).	(below).

Note: *If a cold season does not cause the shrubs to lose their leaves, then a dry season causes the shrubs to lose their leaves.*

B Do drought-deciduous shrubs contribute more than 75% of the canopy?

If YES, go to	If NO, go to
MUC 222	**MUC 221**
(page 46).	(below).

MUC 221 Shrubland or Thicket, Mainly Deciduous, Drought-Deciduous with Evergreen Woody Plants

Drought-deciduous shrubs are dominant (greater than 50% of the canopy) and are mixed with at least 25% evergreen woody plants. The unfavorable season is mainly characterized by drought.

DONE!

MUC 222 Shrubland or Thicket, Mainly Deciduous, Drought-Deciduous without Evergreen Woody Plants

Drought-deciduous shrubs are absolutely dominant (more than 75% of the canopy). The unfavorable season is mainly characterized by drought.

DONE!

MUC 223 Cold-Deciduous

The unfavorable season is mainly characterized by winter frost. Deciduous shrubs are dominant (more than 50% of the canopy).

A Is the site located in a subalpine or subpolar environment?

If YES, go to **MUC 2232** (page 47).

If NO, go to **MUC 2231** (below).

Note: *Refer to page iv for a definition of subpolar.*

Subalpine: *Of, designating, or growing or living in mountainous regions just below the timberline.*

MUC 2231 Shrubland or Thicket, Mainly Deciduous, Cold-Deciduous, Temperate

Composed of dense scrub without, or with very little herbaceous undergrowth. Very few to no cryptogams.

DONE!

Cryptogam: *A plant (as a fern, moss, alga, or fungus) reproducing by spores and not producing flowers or seeds.*

Note: *Refer to page iv for a definition of temperate.*

MUC 2232 Shrubland or Thicket, Mainly Deciduous, Cold-Deciduous, Subalpine and Subpolar

Composed of upright or lodged matted shrubs with great vegetative regeneration capacity and usually covered by snow for at least half a year.

DONE!

MUC 23 Extremely Xeromorphic (Subdesert) Shrubland

Very open stands of shrubs with various adaptations to dry conditions, such as: extremely thickened, hardened foliage; very reduced leaves; green branches without leaves; or succulent stems, some of them with thorns.

Succulent: *Having thickened, juicy, fleshy tissues (leaves and stems), more or less soft in texture, that conserve moisture.*

A Do evergreen species contribute more than 50% of the shrub canopy?

If YES, go to **MUC 231** (page 48).

If NO, go to **MUC 232** (page 49).

Deciduous: *Vegetation that sheds its leaves at the end of the growing period or in association with the unfavorable season (dry, cold).*

Evergreen: *Maintaining green leaves throughout the year. Leaves stay on the tree until new ones from to replace them, a process that may occur gradually throughout the year so the tree is never bare and always has some leaves that are more than one year old.*

MUC 231 Mainly Evergreen

The canopy is never without green foliage. At least 50% of the shrubs that reach the canopy are evergreen. In extremely dry years some leaves and shoot portions may be shed.

A Do deciduous shrubs contribute more than 25% of the shrub canopy?

If YES, go to	IF NO, go to
MUC 2312 (below).	**MUC 2311** (below).

MUC 2311 Shrubland or Thicket, Extremely Xeromorphic (Subdesert) Shrubland, Mainly Evergreen, Purely Evergreen

Composed of broad-leaved mostly sclerophyllous shrubs (e.g., mulga scrub in Australia) leafless green-stemmed plants (e.g. *Retama retam*) or succulents dominated by variously branched stem and leaf succulents.

Sclerophyllous: *A plant with usually evergreen leaves that are thickened, hard, and leathery. These adaptations resist water loss and are common in, but not restricted to, regions with a long summer drought and predictable yet limited winter rain.*

DONE!

MUC 2312 Shrubland or Thicket, Extremely Xeromorphic (Subdesert) Shrubland, Mainly Evergreen, Semi-Deciduous

May consist of either facultatively deciduous shrubs (e.g., *Atriplex-Kochia* saltbush in Australia and North America) or a combination of evergreen and deciduous shrubs (i.e. evergreen shrubs are dominant, deciduous shrubs cover more than 25%).

Facultative plants: *Plants that are able to adopt an alternative mode of living. A* ***facultatively deciduous shrub*** *will either shed or maintain its leaves depending on the environmental conditions. In contrast,* ***obligate plants*** *are restricted to one characteristic mode of life.*

DONE!

MUC 232 Mainly Deciduous

The majority of shrubs (more than 50% of the canopy) shed their foliage simultaneously in connection with the unfavorable season (cold or drought).

A Do succulents cover at least 25% of the ground?

If YES, go to **MUC 2322** (below).

IF NO, go to **MUC 2321** (below).

Succulent: *Having thickened, juicy, fleshy tissues (leaves and stems), more or less soft in texture, that conserve moisture.*

MUC 2321 Shrubland or Thicket, Extremely Xeromorphic (Subdesert) Shrubland, Mainly Deciduous, Without Succulents

Succulents cover less than 25% of the ground.

DONE!

MUC 2322 Shrubland or Thicket, Extremely Xeromorphic (Subdesert) Shrubland, Mainly Deciduous, With Succulents

Succulents cover at least 25% of the ground.

DONE!

MUC 3 *Dwarf-Shrubland or Dwarf-Thicket*

Shrubs rarely exceed 50 cm in height (sometimes called heaths or heathlike formations). The shrub canopy covers at least 40% of the ground. The shrub cover density distinguishes between Dwarf-Shrubland and Dwarf-Thicket classes.

Dwarf-Shrubland: *individual dwarf-shrubs are isolated or in clumps.*

Dwarf-Thicket: *individual shrub branches are interlocked.*

A Is the site located above the subpolar tree line?

If YES, go to	IF NO, go
MUC 34	to **B**
(page 59).	(below).

Note: *Refer to page iv for a definition of subpolar.*

B Is the site located in an extremely dry (xeromorphic) environment?

If YES, go to	If NO, go
MUC 33	to **C**
(page 57).	(below).

Xeromorphic: *Climatic conditions favorable for the development of vegetation adapted to an environment that lacks fresh water. Xeromorphic adaptations can include a thickening of the outer protective layer (epidermis), reduction of leaf size, waxy or highly reflective leaves. The word "xeromorphic" comes from the Greek roots xero- , meaning "dry" and morphic, meaning "form".*

C Are at least 50% of the shrubs that reach the canopy evergreen?

If YES, go to	If NO, go to
MUC 31	**MUC 32**
(below).	(page 54).

Deciduous: *Vegetation that sheds its leaves at the end of the growing period or in association with the unfavorable season (dry or cold).*

Evergreen: *Maintaining green leaves throughout the year. Leaves stay on the tree until new ones from to replace them, a process that may occur gradually throughout the year so the tree is never bare and always has some leaves that are more than one year old.*

Note: *Certain shrub species can maintain their leaves one year and lose their leaves another year during extremely unfavorable environmental conditions. To be classified as evergreen, there must be green foliage each year.*

MUC 31 Mainly Evergreen

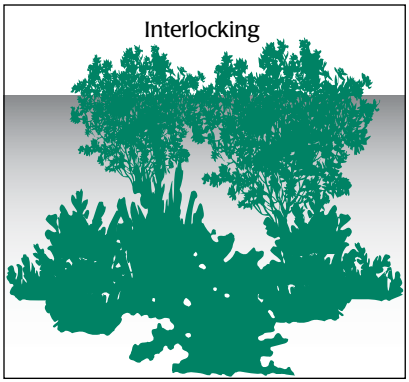
The canopy is never without green foliage. At least 50% of the shrubs that reach the canopy are evergreen. Individual shrubs may shed their leaves.

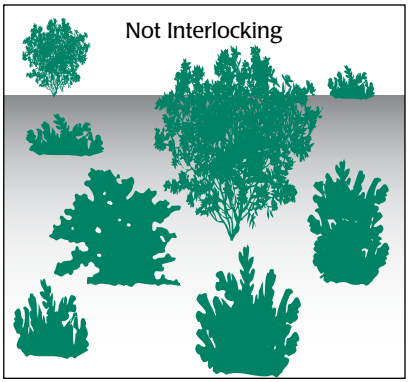
Go to next page.

A Is the shrub cover dense with the shrub canopies from individual shrubs interlocking?

If YES, go to **MUC 311** (page 52).

If NO, go to **B** (page 52).





MUC 312 Dwarf Shrubland

Open or less dense cover of dwarf-shrubs. Shrub canopies are not interlocked. Herbaceous vegetation (i.e. grasses and forbs) covers less than 25% of the ground.

Go to **MUC 3121** (below).

Forb: *A broad-leaved herbaceous plant other than a grass such as clover, sunflowers, ferns and milkweeds.*

Note: *There is only one choice for the next level.*

MUC 3121 Dwarf-Shrubland or Dwarf-Thicket, Mainly Evergreen, Dwarf-Shrubland, Cushion

Shrubs are isolated in clumps forming dense cushions and are often thorny (e.g., *Astragalus*- and *Acantholimon* "porcupine"-heath of the East Mediterranean mountains).

DONE!

B Does herbaceous vegetation cover more than 25% of the ground?

If YES, go to **MUC 313** (page 53).

If NO, go to **MUC 312** (page 51).

__Herbaceous:__ Pertaining to or characteristic of an herb as distinguished from a woody plant. Vascular plant rooted in the ground with foliage that dies back annually. The meristem (stem growth tip) is located just above or below the ground.

MUC 311 Dwarf Thicket

Composed of densely closed dwarf-shrub cover, which dominates the landscape.

A Which of the following two choices (**MUC 3111** or **MUC 3112**) best describes your site?

MUC 3111 Dwarf-Shrubland or Dwarf-Thicket, Mainly Evergreen, Dwarf-Thicket, Caespitose

Shrub branches stand upright and are often occupied by lichens (foliose). Cushion-shaped mosses, lichens and other herbaceous plants are often found on the ground (e.g., *Calluna* heath).

DONE!

__Bryophyte:__ Non-flowering plants (mosses and liverworts) characterized by rhizoids rather than true roots.

__Caespitose:__ Arranged or combined in a thick mat or clumps, having a low stem forming a dense turf or sod, growing in clusters.

__Foliose__: Leaf-like; made up of thin flat lobes.

__Lichen:__ Plant made up of an alga and a fungus living in a symbiotic relationship, characteristically forming a crustlike, scaly, or branching growth on rocks or tree trunks.

__Moss:__ A bryophyte plant that has small leafy often tufted stems bearing sex organs at their tips.

__Thallochamaephyte:__ A perennial, non-vascular, photosynthetic plant (a moss, alga or lichen) that is attached to the ground surface and has a cushion or turf growth form. Examples include ground-inhabitating, cushion or turf forming mosses, liverworts and fruticose lichens.

MUC 3112 Dwarf-Shrubland or Dwarf-Thicket, Mainly Evergreen, Dwarf-Thicket, Creeping

Shrub branches creep along the ground. Variously combined with shrubs (e.g., thallochamaephytes) with branches that may be embedded (e.g., *Loiseleuria* heath).

DONE!

MUC 313 Mixed Evergreen and Herbaceous Dwarf-Shrubland

Shrub canopies are not interlocked. Evergreen shrubs are mixed with herbaceous vegetation (at least 25% of the ground).

A Do many individual shrubs shed parts of their shoot systems during the dry season?

If YES, go to	If NO, go to
MUC 3132 (below).	**MUC 3131** (below).

MUC 3131 Dwarf-Shrubland or Dwarf-Thicket, Mainly Evergreen, Mixed Evergreen and Herbaceous Dwarf-Shrubland, True Evergreen and Herbaceous Mixed

True Evergreen individuals do not seasonally shed parts of their shoot systems. E.g., *Nardus Calluna*-heath.

DONE!

MUC 3132 Dwarf-Shrubland or Dwarf-Thicket, Mainly Evergreen, Mixed Evergreen and Herbaceous Dwarf-Shrubland, Partial Evergreen and Herbaceous Mixed

Many individuals shed parts of their shoot systems during the dry season (e.g., *Phyrgana* in Greece).

DONE!

MUC 32 Mainly Deciduous

The majority of shrubs (more than 50% of the canopy) shed their foliage simultaneously in connection with the unfavorable season (cold or drought).

A Do the shrubs lose their leaves during a cold season?

If YES, go to	If NO, go
MUC 323 (page 56).	to **B** (below).

Note: If a cold season does not cause the shrubs to lose their leaves, then a dry season causes the shrubs to lose their leaves.

B Which of the following two choices (**MUC 321** or **MUC 322**) best describes your site?

MUC 321 Dwarf-Shrubland or Dwarf-Thicket, Mainly Deciduous, Facultative Drought-Deciduous

Dwarf-shrubs shed their foliage only in extremely dry years.

DONE!

*Facultative plants: Plants that are able to adopt an alternative mode of living. A **facultatively deciduous shrub** will either shed or maintain its leaves depending on the environmental conditions. In contrast, **obligate plants** are restricted to one characteristic mode of life.*

MUC 322 Obligate Drought-Deciduous

Densely closed dwarf-shrubs lose all or at least part of their leaves in the dry season.

A Which of the following four choices (**MUC 3221, MUC 3222, MUC 3223** or **MUC 3224**) best describes your site?

MUC 3221 Dwarf-Shrubland or Dwarf-Thicket, Mainly Deciduous, Obligate Drought-Deciduous, Caespitose Dwarf-Thicket

Shrub branches stand upright and are often occupied by lichens (foliose). Cushion-shaped mosses, lichens and other herbaceous plants are often found on the ground (e.g., *Calluna* heath).

DONE!

MUC 3222 Dwarf-Shrubland or Dwarf-Thicket, Mainly Deciduous, Obligate Drought-Deciduous, Creeping Dwarf-Thicket

Shrub branches creep along the ground. Variously combined with shrubs (i.e. thallochamaephytes) with branches that may be embedded (e.g., *Loiseleuria* heath).

DONE!

MUC 3223 Dwarf-Shrubland or Dwarf-Thicket, Mainly Deciduous, Obligate Drought-Deciduous, Cushion Dwarf-Shrubland

Shrubs are isolated in clumps forming dense cushions and are often thorny.

DONE!

MUC 3224 Dwarf-Shrubland or Dwarf-Thicket, Mainly Deciduous, Obligate Drought-Deciduous, Mixed Dwarf-Shrubland

Deciduous and evergreen dwarf-shrubs, caespitose herbaceous plants, succulent perennial herbs, and other species intermixed**.**

DONE!

Bryophyte: *Non-flowering plants (mosses and liverworts) characterized by rhizoids rather than true roots.*

Caespitose: *Arranged or combined in a thick mat or clumps, having a low stem forming a dense turf or sod, growing in clusters.*

Foliose*: Leaf-like; made up of thin flat lobes.*

Lichen: *Plant made up of an alga and a fungus living in a symbiotic relationship, characteristically forming a crustlike, scaly, or branching growth on rocks or tree trunks.*

Moss: *A bryophyte plant that has small leafy often tufted stems bearing sex organs at their tips.*

Perennial: *Having a life span of more than two years.*

Succulent: *Having thickened, juicy, fleshy tissues (leaves and stems), more or less soft in texture, that conserve moisture.*

Thallochamaephyte: *A perennial, non-vascular, photosynthetic plant (a moss, alga or lichen) that is attached to the ground surface and has a cushion or turf growth form. Examples include ground-inhabitating, cushion or turf forming mosses, liverworts and fruticose lichens.*

MUC 323 *Cold-Deciduous*

Densely closed dwarf-shrubs shed foliage at the beginning of a cold season. Richer in mosses and ferns than the Obligate Drought-deciduous Dwarf Thicket or Shrubland class (322).

A Which of the following four choices (**MUC 3231**, **MUC 3232**, **MUC 3233** or **MUC 3234**) best describes your site?

Facultative plants: *Plants that are able to adopt an alternative mode of living. A* ***facultatively deciduous shrub*** *will either shed or maintain its leaves depending on the environmental conditions. In contrast,* ***obligate plants*** *are restricted to one characteristic mode of life.*

MUC 3231 Dwarf-Shrubland or Dwarf-Thicket, Mainly Deciduous, Cold-Deciduous, Caespitose Dwarf-Thicket

Shrub branches stand upright and are often occupied by lichens (foliose). Cushion-shaped mosses, lichens and other herbaceous plants are often found on the ground.

DONE!

Bryophyte: *Non-flowering plants (mosses and liverworts) characterized by rhizoids rather than true roots.*

Caespitose: *Arranged or combined in a thick mat or clumps, having a low stem forming a dense turf or sod, growing in clusters.*

Foliose*: Leaf-like; made up of thin flat lobes.*

Lichen: *Plant made up of an alga and a fungus living in a symbiotic relationship, characteristically forming a crustlike, scaly, or branching growth on rocks or tree trunks.*

Moss: *A bryophyte plant that has small leafy often tufted stems bearing sex organs at their tips.*

Perennial: *Having a life span of more than two years.*

Succulent: *Having thickened, juicy, fleshy tissues (leaves and stems), more or less soft in texture, that conserve moisture.*

MUC 3232 Dwarf-Shrubland or Dwarf-Thicket, Mainly Deciduous, Cold-Deciduous, Creeping Dwarf-Thicket

Shrub branches creep along the ground; combined with shrubs with branches that may be embedded.

DONE!

MUC 3233 Dwarf-Shrubland or Dwarf-Thicket, Mainly Deciduous, Cold-Deciduous, Cushion Dwarf-Shrubland

Shrubs are isolated in clumps forming dense cushions and are often thorny.

DONE!

MUC 3234 Dwarf-Shrubland or Dwarf-Thicket, Mainly Deciduous, Cold-Deciduous, Mixed Dwarf-Shrubland

Deciduous and evergreen dwarf-shrubs, caespitose herbaceous plants, succulent perennial herbs, and other species intermixed.

DONE!

MUC 33 Extremely Xeromorphic (Subdesert) Dwarf-Shrubland

Composed of open formations of dwarf-shrubs, succulents, and herbaceous plants adapted to survive or to avoid a long dry season. Mostly subdesertic.

A Are at least 50% of the shrubs that reach the shrub canopy evergreen?

If YES, go to	If NO, go to
MUC 331 (below).	**MUC 332** (page 58).

__Deciduous:__ Vegetation that sheds its leaves at the end of the growing period or in association with the unfavorable season (dry or cold).

__Evergreen:__ Maintaining green leaves throughout the year. Leaves stay on the tree until new ones from to replace them, a process that may occur gradually throughout the year so the tree is never bare and always has some leaves that are more than one year old.

__Herbaceous:__ Pertaining to or characteristic of an herb as distinguished from a woody plant. Vascular plant rooted in the ground with foliage that dies back annually. The meristem (stem growth tip) is located just above or below the ground.

__Succulent:__ Having thickened, juicy, fleshy tissues (leaves and stems), more or less soft in texture, that conserve moisture.

MUC 331 Mainly Evergreen

The canopy is never without green foliage. At least 50% of the shrubs that reach the canopy are evergreen. In extremely dry years some leaves and shoot portions may be shed.

A Do deciduous shrubs contribute more than 25% of the shrub canopy?

If YES, go to	If NO, go to
MUC 3312 (page 58).	**MUC 3311** (page 58).

MUC 3311 Dwarf-Shrubland or Dwarf-Thicket, Extremely Xeromorphic (Subdesert) Dwarf-Shrubland, Mainly Evergreen, Purely Evergreen

Composed of broad-leaved mostly sclerophyllous shrubs, leafless green-stemmed plants, or succulents dominated by variously branched stem and leaf succulents.

DONE!

Sclerophyllous: *A plant with usually evergreen leaves that are thickened, hard, and leathery. These adaptations resist water loss and are common in, but not restricted to, regions with a long summer drought and predictable yet limited winter rain.*

MUC 3312 Dwarf-Shrubland or Dwarf-Thicket, Extremely Xeromorphic (Subdesert) Dwarf-Shrubland, Mainly Evergreen, Semi-Deciduous

May consist of either facultatively deciduous shrubs or a combination of evergreen and deciduous shrubs (i.e. evergreen shrubs are dominant, deciduous shrubs cover more than 25%).

DONE!

Facultative plants: *Plants that are able to adopt an alternative mode of living. A* ***facultatively deciduous shrub*** *will either shed or maintain its leaves depending on the environmental conditions. In contrast,* ***obligate plants*** *are restricted to one characteristic mode of life.*

MUC 332 Mainly Deciduous

The majority of shrubs (more than 50% of the canopy) shed their foliage simultaneously in connection with the unfavorable season (cold or drought).

A Do succulents cover more than 25% of the ground?

If YES, go to **MUC 3322** (page 59).

IF NO, go to **MUC 3321** (page 59).

MUC 3321 Dwarf-Shrubland or Dwarf-Thicket, Extremely Xeromorphic (Subdesert) Dwarf-Shrubland, Mainly Deciduous, Without Succulents

Succulents cover less than 25% of the ground.

DONE!

MUC 3322 Dwarf-Shrubland or Dwarf-Thicket, Extremely Xeromorphic (Subdesert) Dwarf-Shrubland, Mainly Deciduous, With Succulents

Succulents cover at least 25% of the ground.

DONE!

MUC 34 Tundra

Slowly growing, low formations, consisting mainly of dwarf-shrubs, graminoids, mosses, liverworts and lichens, found beyond the subpolar tree line. Often showing plant patterns caused by freezing movements of the soil. Except in boreal regions, dwarf-shrub formations above the mountain tree line should not be called tundra, because they are, as a rule, richer in dwarf-shrubs and grasses, and grow taller due to greater solar radiation in lower latitudes.

A Do fruticose lichens contribute more than 50% of the vegetative cover?

If YES, go to	If NO, go to
MUC 342 (page 60).	**MUC 341** (page 60).

Boreal: *A climatic zone characterized by cool wet summers and cold winters lasting more than six months. Also called a cold temperate zone.*

Bryophyte: *Non-flowering plants (mosses and liverworts) characterized by rhizoids rather than true roots.*

Fruticose: *Having a shrubby, appearance.*

Graminoid: *Grasses and grass-like plants.*

Lichen: *Plant made up of an alga and a fungus living in a symbiotic relationship, characteristically forming a crustlike, scaly, or branching growth on rocks or tree trunks.*

Moss: *A bryophyte plant that has small leafy often tufted stems bearing sex organs at their tips.*

MUC 341 Mainly Bryophyte

Dominated by mats or small cushions of chamaephytic mosses (more than 50% of the vegetative cover). Groups of dwarf-shrubs are as a rule scattered irregularly and are not very dense. The general aspect is more or less dark green, olive green or brownish.

Chamaephytic: *Pertaining to a perennial plant that has its winter buds placed very close to the soil surface.*

A Do the shrub branches creep along the ground?

If YES, go to **MUC 3412** (below).

If NO, go to **MUC 3411** (below).

MUC 3411 Dwarf-Shrubland or Dwarf-Thicket, Tundra, Mainly Bryophyte, Caespitose

Clumped or clustered dwarf-shrubs are present.

DONE!

Caespitose: *Arranged or combined in a thick mat or clumps, having a low stem forming a dense turf or sod, growing in clusters.*

MUC 3412 Dwarf-Shrubland or Dwarf-Thicket, Tundra, Mainly Bryophyte, Creeping

Creeping or matted dwarf-shrubs are present.

DONE!

MUC 342 Dwarf-Shrubland or Dwarf-Thicket, Tundra, Mainly Lichen

Mats of fruticose lichens dominate (more than 50% of the vegetative cover), giving the formation a more or less pronounced gray aspect. Mostly evergreen, creeping or cushion-shaped dwarf-shrubs are present.

DONE!

MUC 4 *Herbaceous Vegetation* 4

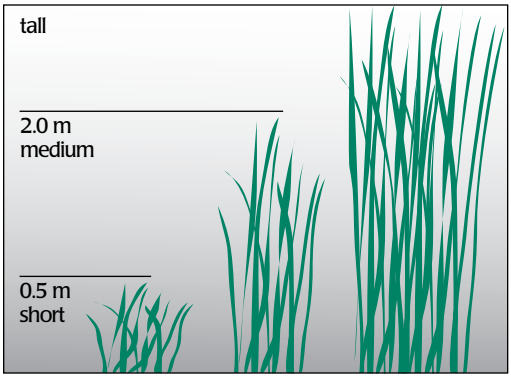
Dominated by herbaceous growth of two major types: graminoids and forbs. Total ground coverage must be greater than 60% herbaceous vegetation.

Graminoids include all herbaceous grasses and grass-like plants such as sedges (Carex), rushes (Juncus), and cattails (Typha). Forbs are broad-leaved herbaceous plants such as clover (Trifolium), sunflowers (Helianthus), ferns, and milkweeds (Asclepias).

A Of the total herbaceous vegetation, is your site covered by more than 50% forb vegetation?

If YES, go to **MUC 44** (page 93).

If NO, go to **B** (below).



***Note:** If graminoids are dominant at your site, you then determine the height of mature graminoids.*

B Of the total herbaceous vegetation, is your site covered by more than 50% graminoids that are greater than 2 meters tall when mature?

If YES, go to **MUC 41** (page 62).

If NO, go to **C** (below).

C Of the total herbaceous vegetation, is your site covered by more than 50% graminoids that are between 50 cm and 2 m when mature?

If YES, go to **MUC 42** (page 70).

If NO, go to **MUC 43** (page 80).

MUC 41 Tall Graminoid Vegetation (Tall Grasslands)

Plant community consists of dominant grasses over 2 meters tall when flowering or mature (more than 50% of the herbaceous vegetation). Forbs may be present but comprise less than 50% of herbaceous vegetation.

__Note:__ After determining the height of mature grasses, you next determine the percentage and type of woody vegetation.

A Are there trees or shrubs on your site?

If YES, go	If NO, go to
to **B**	**MUC 415**
(below).	(page 69).

B Does the canopy of tuft plants cover more than 25% of the ground?

If YES, go to	If NO, go
MUC 414	to **C**
(page 69).	(below).

C Does the site have trees (other than tuft trees) that are at least 5 meters tall?

If YES, go	If NO, go
to **D**	to **E**
(below).	(below).

D Does the canopy of trees that are at least 5 meters tall cover between 10 and 40% of the ground?

If YES, go to	If NO, go to
MUC 411	**MUC 412**
(page 63).	(page 65).

E Does shrub canopy cover more than 25% of the ground?

If YES, go to	If NO, go to
MUC 413	**MUC 415**
(page 67).	(page 69).

__Tree:__ A perennial plant that grows taller than five meters, with a single woody trunk that lacks lower branches but which supports branches well above the ground.

__Shrub:__ In MUC, woody plants less than 5 meters tall are considered shrubs even if they are immature or short trees.

__Rosulate:__ Leaves arranged in rosettes (circular clusters).

__Tuft Plant:__ Woody plant with large leaf-fronds or rosulate branches at the tips of major trunk(s); for example, palms and tree ferns.

MUC 411 Tall Grassland with Trees Covering 10-40%

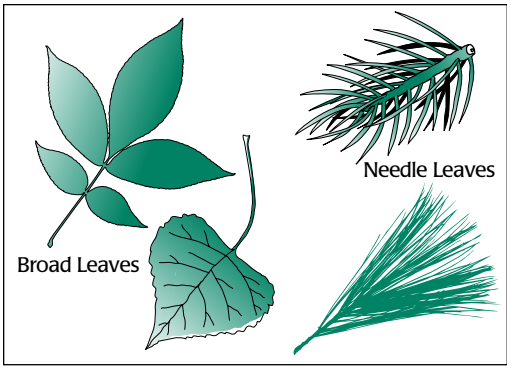
May be with or without shrubs. This is somewhat like a very open woodland with a more or less continuous ground cover (over 60%) of tall graminoids.

Note: After determining the percentage of tree canopy at your site, you need to describe the types of trees that contribute to the tree canopy.

A Do trees with broad leaves contribute more than 50% of the tree canopy?

If YES, go to **B** (below).

If NO, go to **MUC 4110** (page 64).



Broad-leaved: A plant with leaves that are broad and flat rather than needle shaped.

Needle-leaved: A plant with slender, elongated leaves; for example pine and fir trees (Pinus and Abies).

B Do deciduous trees contribute more than 50% of the tree canopy?

If YES, go to **MUC 4113** (page 64).

If NO, go to to **C** (below).

Deciduous: Vegetation that sheds its leaves at the end of the growing period or in association with the unfavorable season (dry or cold).

C Do broad -leaved evergreen trees contribute more than 50% of the tree canopy cover?

If YES, go to **MUC 4111** (page 64).

If NO, go to **MUC 4112** (page 64).

Evergreen: Maintaining green leaves throughout the year. Leaves stay on the tree until new ones from to replace them, a process that may occur gradually throughout the year so the tree is never bare and always has some leaves that are more than one year old.

MUC 4110 Herbaceous Vegetation, Tall Graminoid, With Trees Covering 10-40%, Trees: Needle-Leaved Evergreen

Needle-leaved evergreen species are greater than 50% of the tree canopy.

DONE!

MUC 4111 Herbaceous Vegetation, Tall Graminoid, With Trees Covering 10-40%, Trees: Broad-Leaved Evergreen

Broad-leaved evergreen species are greater than 50% of the tree canopy.

DONE!

MUC 4112 Herbaceous Vegetation, Tall Graminoid, With Trees Covering 10-40%, Trees: Broad-Leaved Semi-Evergreen

Trees present are at least 25% each of broad-leaved evergreen and broad-leaved deciduous trees, with neither greater than 50% of the tree canopy.

DONE!

Note: *This MUC class is the best choice for sites with a mixture of broad-leaved evergreen, needle-leaved evergreen, and deciduous trees where no one type contributes more than 50%. In some cases there may be less than 25% broad-leaved evergreen or broad-leaved deciduous.*

MUC 4113 Herbaceous Vegetation, Tall Graminoid, With Trees Covering 10-40%, Trees: Broad-Leaved Deciduous

Broad-leaved deciduous species are greater than 50% of the tree canopy. There may be some seasonal flooding. E.g., Northeast Bolivia.

DONE!

MUC 412 Tall Grassland with Trees Covering Less Than 10%

Grassland with trees covering less than 10% of the ground, with or without shrubs.

A Does the site have termite nests?

If YES, go to **MUC 4124** (page 66).

If NO, go to **B** (below).

B Do trees with broad leaves contribute more than 50% of the tree canopy?

If YES, go to **C** (below).

If NO, go to **MUC 4120** (below).

Broad-leaved: *A plant with leaves that are broad and flat rather than needle shaped.*

C Do deciduous trees contribute more than 50% of the tree canopy?

If YES, go to **MUC 4123** (page 66).

If NO, go to **MUC D** (below).

Deciduous: *Vegetation that sheds its leaves at the end of the growing period or in association with the unfavorable season (dry or cold).*

D Do broad-leaved evergreen trees contribute more than 50% of the tree canopy cover?

If YES, go to **MUC 4121** (page 66).

If NO, go to **MUC 4122** (page 66).

Evergreen: *Maintaining green leaves throughout the year. Leaves stay on the tree until new ones from to replace them, a process that may occur gradually throughout the year so the tree is never bare and always has some leaves that are more than one year old.*

MUC 4120 Herbaceous Vegetation, Tall Graminoid, With Trees Covering < 10%, Trees: Needle-Leaved Evergreen

Needle-leaved evergreen species are greater than 50% of the tree canopy.

DONE!

MUC 4121 Herbaceous Vegetation, Tall Graminoid, With Trees Covering < 10%, Trees: Broad-Leaved Evergreen

Broad-leaved evergreen species are greater than 50% of the tree canopy.

DONE!

MUC 4122 Herbaceous Vegetation, Tall Graminoid, With Trees Covering < 10%, Trees: Broad-Leaved Semi-Evergreen

Trees present are at least 25% each of broad-leaved evergreen and broad-leaved deciduous trees, with neither greater than 50% of the tree canopy.

DONE!

Note: *This MUC class is the best choice for sites with a mixture of broad-leaved evergreen, needle-leaved evergreen, and deciduous trees where no one type contributes more than 50%. In some cases there may be less than 25% broad-leaved evergreen or broad-leaved deciduous.*

MUC 4123 Herbaceous Vegetation, Tall Graminoid, With Trees Covering < 10%, Trees: Broad-Leaved Deciduous

Broad-leaved deciduous species are greater than 50% of the tree canopy. There may be some seasonal flooding.

DONE!

MUC 4124 Herbaceous Vegetation, Tall Graminoid, With Trees Covering < 10%, Tropical and Subtropical with Trees and Shrubs in Tufts on Termite Nests

Tropical or subtropical tall grassland with trees and/or shrubs growing in tufts on termite nests. Also called termite savannah.

DONE!

Note: *Refer to page iv for definitions of tropical and subtropical.*

Note*: In MUC, savannahs are types of grasslands. They are generally found in regions with long dry periods and receiving more rainfall than desert areas but not enough to support complete forest cover. Fire often plays an important role in maintaining the vegetation. Also spelled savanna.*

MUC 413 Tall Grassland with Shrubs

The shrub canopy must cover more than 25% of the ground.

A Does the site have termite nests?

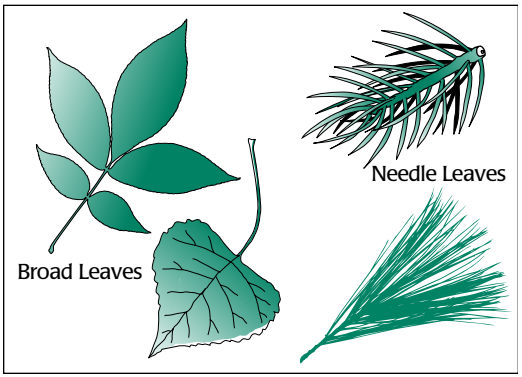
If YES, go to **MUC 4134** (page 68).

If NO, go to **B** (below).

B Do shrubs with broad leaves contribute more than 50% of the shrub canopy?

If YES, go to **C** (below).

If NO, go to **MUC 4130** (page 68).



Broad-leaved: *A plant with leaves that are broad and flat rather than needle shaped.*

Needle-leaved: *A plant with slender, elongated leaves; for example pine and fir trees (Pinus and Abies).*

C Do broad-leaved deciduous shrubs contribute more than 50% of the shrub canopy?

If YES, go to **MUC 4133** (page 68).

If NO, go to **D** (below).

Deciduous: *Vegetation that sheds its leaves at the end of the growing period or in association with the unfavorable season (dry or cold).*

D Do broad-leaved evergreen shrubs contribute more than 50% of the shrub canopy?

If YES, go to **MUC 4131** (page 68).

If NO, go to **MUC 4132** (page 68).

Evergreen: *Maintaining green leaves throughout the year. Leaves stay on the tree until new ones from to replace them, a process that may occur gradually throughout the year so the tree is never bare and always has some leaves that are more than one year old.*

MUC 4130 Herbaceous Vegetation, Tall Graminoid, With Shrubs, Shrubs: Needle-Leaved Evergreen

Needle-leaved evergreen species are greater than 50% of the shrub canopy.

DONE!

MUC 4131 Herbaceous Vegetation, Tall Graminoid, With Shrubs, Shrubs: Broad-Leaved Evergreen

Broad-leaved evergreen species are greater than 50% of the shrub canopy.

DONE!

MUC 4132 Herbaceous Vegetation, Tall Graminoid, With Shrubs, Shrubs: Broad-Leaved Semi-Evergreen

Shrubs present are at least 25% each of broad-leaved evergreen and broad-leaved deciduous shrubs, with neither greater than 50% of the shrub canopy.

DONE!

Note: *This MUC class is the best choice for sites with a mixture of broad-leaved evergreen, needle-leaved evergreen, and deciduous shrubs where no one type contributes more than 50%. In some cases there may be less than 25% broad-leaved evergreen or broad-leaved deciduous.*

MUC 4133 Herbaceous Vegetation, Tall Graminoid, With Shrubs, Shrubs: Broad-Leaved Deciduous

Broad-leaved deciduous species are greater than 50% of the shrub canopy. There may be some seasonal flooding.

DONE!

MUC 4134 Herbaceous Vegetation, Tall Graminoid, With Shrubs, Tropical and Subtropical with Trees and Shrubs in Tufts on Termite Nests

Tropical or subtropical tall grassland with trees and/or shrubs growing in tufts on termite nests. Also called termite savannah.

DONE!

Note*: In MUC, savannahs are types of grasslands. They are generally found in regions with long dry periods and receiving more rainfall than desert areas but not enough to support complete forest cover. Fire often plays an important role in maintaining the vegetation. Also spelled savanna.*

Note: *Refer to page iv for definitions of tropical and subtropical.*

MUC 414 Tall Grasslands with Tuft Plants

The canopy of the tuft plants (usually palms) must cover more than 25% of the ground.

__Note:__ There is only one level 4 class in this category.

If YES, go to **MUC 4141** (below).

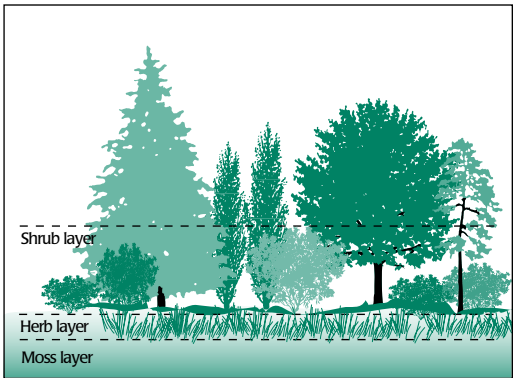
MUC 4141 Herbaceous Vegetation, Tall Graminoid, With Tuft Plants, Tropical with Palms

Tropical grasslands with palms. E.g., the palm savannas of Arocomia totai and Attalea princeps north of Santa Cruz de la Sierra, Bolivia.

DONE!

MUC 415 Tall Grasslands without Woody Synusia

Grasslands without trees or shrubs.



__Synusia:__ A layer or stratum of a plant community. A structural unit of a major ecological community characterized by relative uniformity of life form or of height and usually constituting a particular stratum of that community.

__Note:__ There is only one level 4 in this category.

Go to **MUC 4151** (below).

MUC 4151 Herbaceous Vegetation, Tall Graminoid, Without Woody Synusia, Tropical

Tropical grassland as in various low-latitude regions of Africa. There may be some seasonal flooding.

DONE!

MUC 42 Medium-Tall Graminoid

The dominant grasses are 50 cm to 2 m tall when flowering or mature (greater than 50% of the herbaceous vegetation). Forbs may be present but comprise less than 50% of the herbaceous vegetation.

A Are there trees or shrubs on your site?

If YES, go	If NO, go to
to **B** (below).	**MUC 425** (page 79).

B Does the canopy of tuft plants cover more than 25% of the ground?

If YES, go to	If NO, go
MUC 424 (page 78).	to **C** (below).

C Does the site have trees (other than tuft trees) that are at least 5 meters tall?

If YES, go	If NO, go
to **D** (below).	to **E** (below).

D Does the canopy of trees that are at least 5 meters tall cover between 10 and 40 % of the ground?

If YES, go to	If NO, go to
MUC 421 (page 71).	**MUC 422** (page 73).

E Does shrub canopy cover more than 25% of the ground?

If YES, go to	If NO, go to
MUC 423 (page 75).	**MUC 425** (page 79).

Note: *After determining the height of mature grasses, you next determine the percentage of woody vegetation.*

Tree: *A perennial plant that grows taller than five meters, with a single woody trunk that lacks lower branches but which supports branches well above the ground.*

Shrub: *In MUC, woody plants less than 5 meters tall are considered shrubs even if they are immature or short trees.*

Rosulate: *Leaves arranged in rosettes (circular clusters).*

Tuft Plant: *Woody plant with large leaf-fronds or rosulate branches at the tips of major trunk(s); for example, palms and tree ferns.*

MUC 421 Medium Tall Graminoid With Trees Covering 10-40%

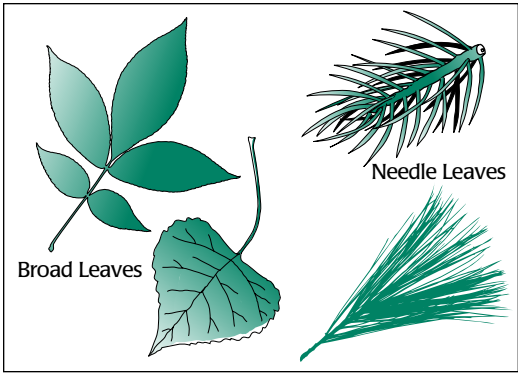
May be with or without shrubs. This is somewhat like a very open woodland with a more or less continuous ground cover of medium tall graminoids.

__Note:__ After determining the percentage of tree canopy at your site, you need to describe the types of trees that contribute to the tree canopy.

A Do trees with broad leaves contribute more than 50% of the tree canopy?

If YES, go to **B** (below).

If NO, go to **MUC 4210** (page 72).



__Broad-leaved:__ A plant with leaves that are broad and flat rather than needle shaped.

__Needle-leaved:__ A plant with slender, elongated leaves; for example pine and fir trees (Pinus and Abies).

B Do deciduous trees contribute more than 50% of the tree canopy?

If YES, go to **MUC 4213** (page 72).

If NO, go to **C** (below).

__Deciduous:__ Vegetation that sheds its leaves at the end of the growing period or in association with the unfavorable season (dry or cold).

C Do broad-leaved evergreen trees contribute more than 50% of the tree canopy cover?

If YES, go to **MUC 4211** (page 72).

If NO, go to **MUC 4212** (page 72).

__Evergreen:__ Maintaining green leaves throughout the year. Leaves stay on the tree until new ones from to replace them, a process that may occur gradually throughout the year so the tree is never bare and always has some leaves that are more than one year old.

MUC 4210 Herbaceous Vegetation, Medium Tall Graminoid, With Trees Covering 10-40%, Trees: Needle-Leaved Evergreen

Needle-leaved evergreen species are greater than 50% of the tree canopy.

DONE!

MUC 4211 Herbaceous Vegetation, Medium Tall Graminoid, With Trees Covering 10-40%, Trees: Broad-Leaved Evergreen

Broad-leaved evergreen species are greater than 50% of the tree canopy.

DONE!

MUC 4212 Herbaceous Vegetation, Medium Tall Graminoid, With Trees Covering 10-40%, Trees: Broad-Leaved Semi-Evergreen

Trees present are at least 25% each of broad-leaved evergreen and broad-leaved deciduous trees, with neither greater than 50% of the tree canopy.

DONE!

Note: *This MUC class is the best choice for sites with a mixture of broad-leaved evergreen, needle-leaved evergreen, and deciduous trees where no one type contributes more than 50%. In some cases there may be less than 25% broad-leaved evergreen or broad-leaved deciduous.*

MUC 4213 Herbaceous Vegetation, Medium Tall Graminoid, With Trees Covering 10-40%, Trees: Broad-Leaved Deciduous

Broad-leaved deciduous species are greater than 50% of the tree canopy. There may be some seasonal flooding.

DONE!

MUC 422 Medium Tall Graminoid With Trees Covering Less Than 10%

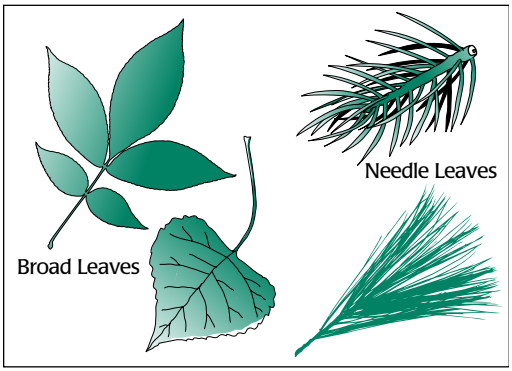
Grassland with trees covering less than 10% of the ground, with or without shrubs.

A Does the site have termite nests?

If YES, go to	If NO, go
MUC 4224 (page 74).	to **B** (below).

B Do trees with broad leaves contribute more than 50% of the tree canopy?

If YES, go	If NO, go to
to **C** (below).	**MUC 4220** (page 74).



Broad-leaved: *A plant with leaves that are broad and flat rather than needle shaped.*

Needle-leaved: *A plant with slender, elongated leaves; for example pine and fir trees (Pinus and Abies).*

C Do deciduous trees contribute more than 50% of the tree canopy?

If YES, go to	If NO, go
MUC 4223 (page 74).	to **D** (below).

Deciduous: *Vegetation that sheds its leaves at the end of the growing period or in association with the unfavorable season (dry or cold).*

D Do broad-leaved evergreen trees contribute more than 50% of the tree canopy cover?

If YES, go to	If NO, go to
MUC 4221 (page 74).	**MUC 4222** (page 74).

Evergreen: *Maintaining green leaves throughout the year. Leaves stay on the tree until new ones from to replace them, a process that may occur gradually throughout the year so the tree is never bare and always has some leaves that are more than one year old.*

MUC 4220 Herbaceous Vegetation, Medium Tall Graminoid, With Trees Covering < 10%, Trees: Needle-Leaved Evergreen

Needle-leaved evergreen species are greater than 50% of the tree canopy.

DONE!

MUC 4221 Herbaceous Vegetation, Medium Tall Graminoid, With Trees Covering < 10%, Trees: Broad-Leaved Evergreen

Broad-leaved evergreen species are greater than 50% of the tree canopy.

DONE!

MUC 4222 Herbaceous Vegetation, Medium Tall Graminoid, With Trees Covering < 10%, Trees: Broad-Leaved Semi-Evergreen

Trees present are at least 25% each of broad-leaved evergreen and broad-leaved deciduous trees, with neither greater than 50% of the tree canopy.

DONE!

Note: *This MUC class is the best choice for sites with a mixture of broad-leaved evergreen, needle-leaved evergreen, and deciduous trees where no one type contributes more than 50%. In some cases there may be less than 25% broad-leaved evergreen or broad-leaved deciduous.*

MUC 4223 Herbaceous Vegetation, Medium Tall Graminoid, With Trees Covering < 10%, Trees: Broad-Leaved Deciduous

Broad-leaved deciduous species are greater than 50% of the tree canopy. There may be some seasonal flooding.

DONE!

MUC 4224 Herbaceous Vegetation, Medium Tall Graminoid, With Trees Covering < 10%, Tropical and Subtropical with Trees and Shrubs in Tufts on Termite Nests

Tropical or subtropical medium tall grassland with trees and/or shrubs growing in tufts on termite nests.
Also called termite savannah.

DONE!

Note*: In MUC, savannahs are types of grasslands. They are generally found in regions with long dry periods and receiving more rainfall than desert areas but not enough to support complete forest cover. Fire often plays an important role in maintaining the vegetation. Also spelled savanna.*

Note: *Refer to page iv for definitions of tropical and subtropical*

MUC 423 Medium Tall Graminoid with Shrubs

The shrub canopy must cover more than 25% of the ground.

A Does the site have termite nests?

If YES, go to **MUC 4234** (page 77).

If NO, go to **B** (below).

B Is more than 25% of the ground covered by deciduous, thorny shrubs?

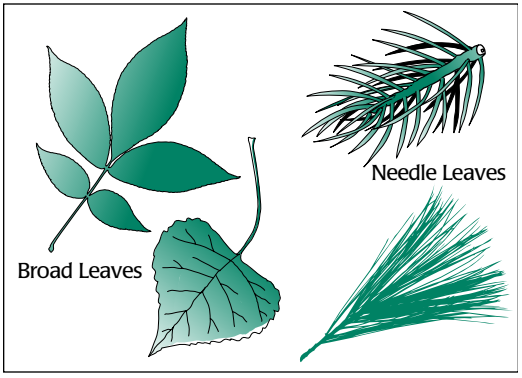
If YES, go to **MUC 4235** (page 77).

If NO, go to **C** (below).

C Is more than 50% of the shrub canopy from broad-leaved shrubs?

If YES, go to **D** (below).

If NO, go to **MUC 4230** (page 76).



D Do deciduous shrubs contribute more than 50% of the shrub canopy?

If YES, go to **MUC 4233** (page 76).

If NO, go to **E** (page 76).

Deciduous: *Vegetation that sheds its leaves at the end of the growing period or in association with the unfavorable season (dry, cold).*

Evergreen: *Maintaining green leaves throughout the year. Leaves stay on the tree until new ones from to replace them, a process that may occur gradually throughout the year so the tree is never bare and always has some leaves that are more than one year old.*

Broad-leaved: *A plant with leaves that are broad and flat rather than needle shaped.*

Needle-leaved: *A plant with slender, elongated leaves; for example pine and fir trees (Pinus and Abies).*

E Do broad-leaved evergreen shrubs contribute more than 50% of the shrub canopy?

If YES, go to **MUC 4231** (below).

If NO, go to **MUC 4232** (below).

MUC 4151 Herbaceous Vegetation, Medium Tall Graminoid, With Shrubs, Shrubs: Needle-Leaved Evergreen

Needle-leaved evergreen species are greater than 50% of the shrub canopy.

DONE!

MUC 4151 Herbaceous Vegetation, Medium Tall Graminoid, With Shrubs, Shrubs: Broad-Leaved Evergreen

Broad-leaved evergreen species are greater than 50% of the shrub canopy.

DONE!

MUC 4151 Herbaceous Vegetation, Medium Tall Graminoid, With Shrubs, Shrubs: Broad-Leaved Semi-Evergreen

Shrubs present are at least 25% each of broad-leaved evergreen and broad-leaved deciduous shrubs, with neither greater than 50% of the shrub canopy.

DONE!

Note: *This MUC class is the best choice for sites with a mixture of broad-leaved evergreen, needle-leaved evergreen, and deciduous shrubs where no one type contributes more than 50%. In some cases there may be less than 25% broad-leaved evergreen or broad-leaved deciduous.*

MUC 4151 Herbaceous Vegetation, Medium Tall Graminoid, With Shrubs, Shrubs: Broad-Leaved Deciduous

Broad-leaved deciduous species are greater than 50% of the shrub canopy. There may be some seasonal flooding.

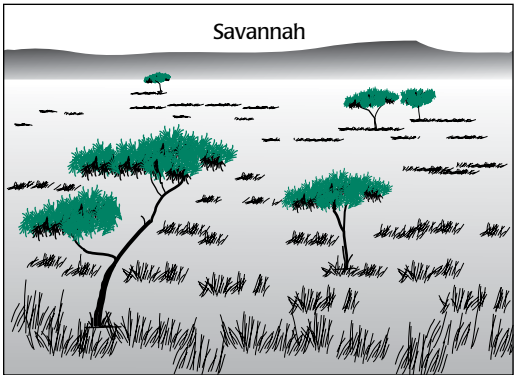
DONE!

MUC 4151 Herbaceous Vegetation, Medium Tall Graminoid, With Shrubs, Tropical and Subtropical with Trees and Shrubs in Tufts on Termite Nests

Tropical or subtropical medium tall grassland with trees and/or shrubs growing in tufts on termite nests. Also called termite savannah.

DONE!

Note: *Refer to page iv for definitions of tropical and subtropical.*

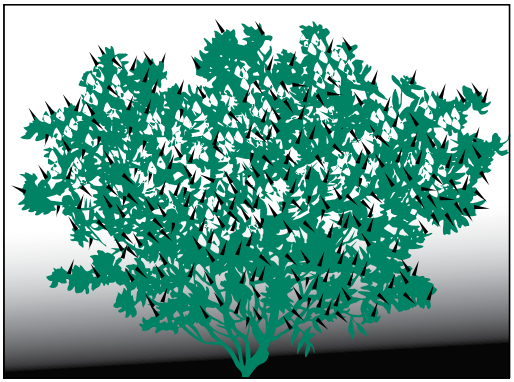


Note*: In MUC, savannahs are types of grasslands. They are generally found in regions with long dry periods and receiving more rainfall than desert areas but not enough to support complete forest cover. Fire often plays an important role in maintaining the vegetation. Also spelled savanna.*

MUC 4151 Herbaceous Vegetation, Medium Tall Graminoid, With Shrubs, Woody Synusia of Deciduous Thorny Shrubs

Consists of deciduous thorny shrubs covering at least 25% of the ground.

DONE!



E.g. the tropical thorn bush savannah of the Sahel region in Africa with Acacia tortilis, A. senegal and other species.

Synusia: *A layer or stratum of a plant community. A structural unit of a major ecological community characterized by relative uniformity of life form or of height and usually constituting a particular stratum of that community.*

MUC 424 Medium Tall Graminoid with Open Synusia of Tuft Plants

The canopy of the tuft plants (usually palms) must cover more than 25% of the ground.

Go to **MUC 4241** (below).

Note: *This section only has one choice for MUC level 4.*

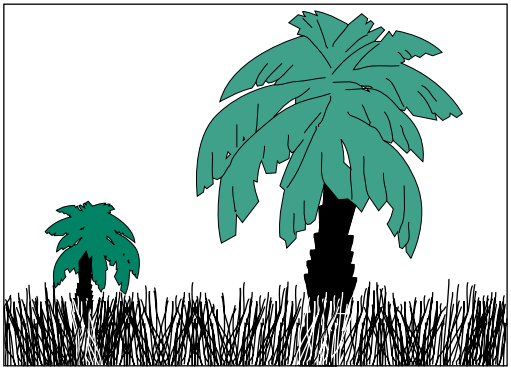
Synusia: *A layer or stratum of a plant community. A structural unit of a major ecological community characterized by relative uniformity of life form or of height and usually constituting a particular stratum of that community.*

MUC 4241 Herbaceous Vegetation, Medium Tall Graminoid, Open Synusia of Tuft Plants, Subtropical with Open Palm Groves

Medium tall grassland with open groves of palms (e.g., Corrientes, Argentina). There may be some seasonal flooding (e.g., *Mauritia* palm groves in the Colombian and Venezuelan Ilanos).

DONE!

Grove: *A small wood without underbush.*

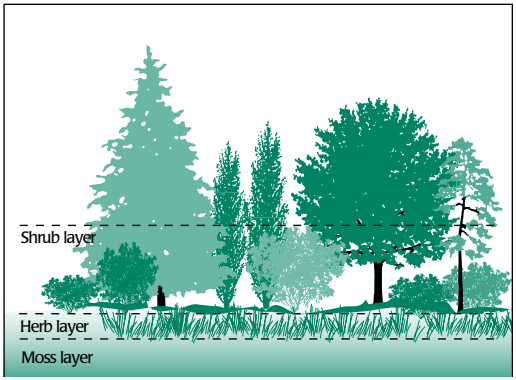


MUC 425 Medium Tall Graminoid without Woody Synusia

Medium tall grasslands without trees or shrubs (less than 25% of the ground).

E.g., St. Augustine grass (Stenotaphrum secundatum), the tall-grass prairie in eastern Kansas, or on sandy soil or dunes, such as the communities of Andropogon hallii in the Nebraska Sand Hills.

Which of the following two choices (**MUC 4251** or **MUC 4252**) best describes your site?



Synusia: *A layer or stratum of a plant community. A structural unit of a major ecological community characterized by relative uniformity of life form or of height and usually constituting a particular stratum of that community.*

MUC 4251 Herbaceous Vegetation, Medium Tall Graminoid, Without Woody Synusia, Mainly Sod Grasses

Perennial, highly branched, creeping grass, which binds the sand or soils with its root system. In some locations the grassland is wet or flooded most of the year (e.g., Typha swamps). If that is the case classify as a wetland. See MUC class 6 (page 99).

DONE!

MUC 4252 Herbaceous Vegetation, Medium Tall Graminoid, Without Woody Synusia, Mainly Bunch Grasses

Grasses that chiefly grow in tufts forming an irregular textured surface.

E.g., the hard tussock (Festuca novae-zelandiae) grasslands in New Zealand.

DONE!

MUC 43 Short Graminoid

The dominant grasses are less than 50 cm tall when flowering or mature (more than 50% of the herbaceous vegetation). Forbs may be present but they comprise less than 50% of the herbaceous vegetation.

A Does the canopy of tuft plants cover more than 25% of the ground?

If YES, go to	If NO, go
MUC 434 (page 88).	to **B** (below).

Rosulate: Leaves arranged in rosettes (circular clusters).

Tuft Plant: Woody plant with large leaf-fronds or rosulate branches at the tips of major trunk(s); for example, palms and tree ferns.

B Are there trees greater than 5 meters in height?

If YES, go to	If NO, go
to **C** (below).	to **D** (below).

Shrub: In MUC, woody plants less than 5 meters tall are considered shrubs even if they are immature or short trees.

Tree: A perennial plant that grows taller than five meters, with a single woody trunk that lacks lower branches but which supports branches well above the ground.

C Does the canopy of trees cover between 10 and 40% of the ground?

If YES, go to	If NO, go
MUC 431 (page 82).	to **MUC 432** (page 83).

D Does the shrub canopy cover more than 25% of the ground?

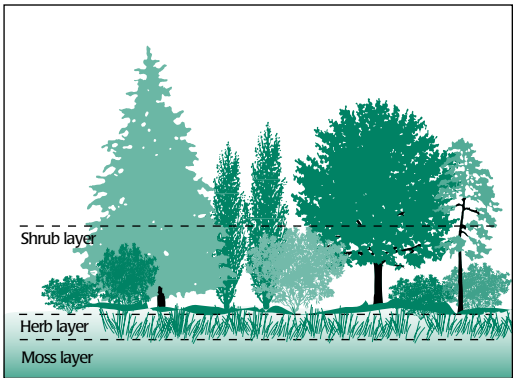
If YES, go to	If NO, go
MUC 433 (page 86).	to **E** (page 81).

E Which of the following three choices (**MUC 435, MUC 436** or **MUC 437**) best describes your site?

MUC 435 Short Graminoid with Mainly Bunch Grasses with Woody Synusia-Grasses that grow in tufts, with woody plants interspersed

Grasses that grow in tufts, with woody plants interspersed.

If YES, go to page 88.



Synusia: *A layer or stratum of a plant community. A structural unit of a major ecological community characterized by relative uniformity of life form or of height and usually constituting a particular stratum of that community.*

MUC 436 Short Graminoid without Woody Synusia-Short grasslands without trees or shrubs

Short grasslands without trees or shrubs.

If YES, go to page 91.

MUC 437 Short Graminoid with Short to Medium Tall Mesophytic

Plants growing in or adapted to a moderately moist environment.

Mesophytic: *Growing in, or adapted to, a moderately moist environment.*

If YES, go to page 92.

MUC 431 Short Graminoid with Trees Covering 10-40%

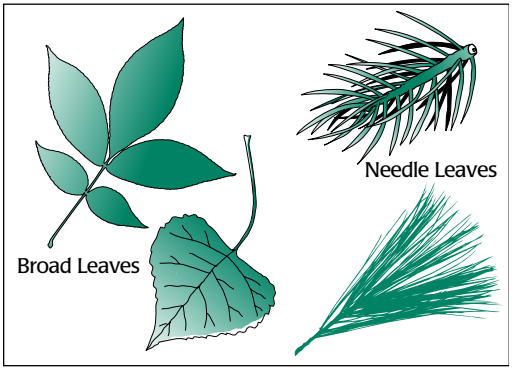
May be with or without shrubs. This is somewhat like a very open woodland with a more or less continuous ground cover of short graminoids.

__Note:__ After determining the percentage of tree canopy at your site, you need to describe the types of trees that contribute to the tree canopy.

A Do trees with broad leaves contribute more than 50% of the tree canopy?

If YES, go to **B** (below).

If NO, go to **MUC 4310** (page 83).



__Broad-leaved:__ A plant with leaves that are broad and flat rather than needle shaped.

__Needle-leaved:__ A plant with slender, elongated leaves; for example pine and fir trees (Pinus and Abies).

B Do deciduous trees contribute more than 50% of the tree canopy?

If YES, go to **MUC 4313** (page 83).

If NO, go to **C** (below).

C Do broad-leaved evergreen trees contribute more than 50% of the tree canopy cover?

If YES, go to **MUC 4311** (page 83).

If NO, go to **MUC 4312** (page 83).

MUC 4310 Herbaceous Vegetation, Short Graminoid, With Trees Covering 10-40%, Trees: Needle-Leaved Evergreen

Needle-leaved evergreen species are greater than 50% of the tree canopy.

DONE!

MUC 4311 Herbaceous Vegetation, Short Graminoid, With Trees Covering 10-40%, Trees: Broad-Leaved Evergreen

Broad-leaved evergreen species are greater than 50% of the tree canopy.

DONE!

MUC 4312 Herbaceous Vegetation, Short Graminoid, With Trees Covering 10-40%, Trees: Broad-Leaved Semi-Evergreen

Trees present are at least 25% each of broad-leaved evergreen and broad-leaved deciduous trees, with neither greater than 50% of the tree canopy.

DONE!

Note: *This MUC class is the best choice for sites with a mixture of broad-leaved evergreen, needle-leaved evergreen, and deciduous trees where no one type contributes more than 50%. In some cases there may be less than 25% broad-leaved evergreen or broad-leaved deciduous.*

MUC 4313 Herbaceous Vegetation, Short Graminoid, With Trees Covering 10-40%, Trees: Broad-Leaved Deciduous

Broad-leaved deciduous species are greater than 50% of the tree canopy. There may be some seasonal flooding.

DONE!

MUC 432 Short Graminoid with Trees Covering Less Than 10%

Grassland with trees covering less than 10% of the ground, with or without shrubs.

A Does the site have termite nests?

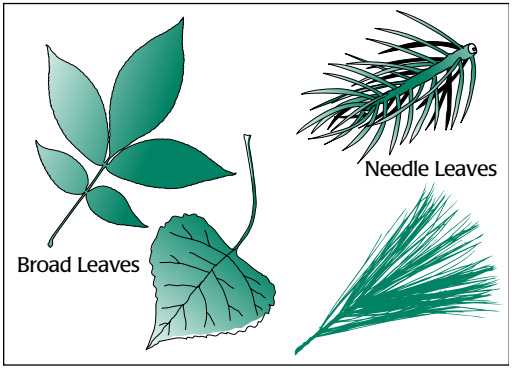
If YES, go to	If NO, go
MUC 4324	to **B**
(page 85).	(page 84).

B Do trees with broad leaves contribute more than 50% of the tree canopy?

If YES, go to **C** (below).

If NO, go to **MUC 4320** (below).

Note: After determining the percentage of tree canopy at your site, you need to describe the types of trees that contribute to the tree canopy.



Broad-leaved: A plant with leaves that are broad and flat rather than needle shaped.

Needle-leaved: A plant with slender, elongated leaves; for example pine and fir trees (Pinus and Abies).

C Do deciduous trees contribute more than 50% of the tree canopy?

If YES, go to **MUC 4323** (page 85).

If NO, go to **D** (below).

D Do broad-leaved evergreen trees contribute more than 50% of the tree canopy cover?

If YES, go to **MUC 4321** (page 85).

If NO, go to **MUC 4322** (page 85).

MUC 4320 Herbaceous Vegetation, Short Graminoid, With Trees Covering < 10%, Trees: Needle-Leaved Evergreen

Needle-leaved evergreen species are greater than 50% of the tree canopy.

DONE!

MUC 4321 Herbaceous Vegetation, Short Graminoid, With Trees Covering < 10%, Trees: Broad-Leaved Evergreen

Broad-leaved evergreen species are greater than 50% of the tree canopy.

DONE!

MUC 4322 Herbaceous Vegetation, Short Graminoid, With Trees Covering < 10%, Trees: Broad-Leaved Semi-Evergreen

Trees present are at least 25% each of broad-leaved evergreen and broad-leaved deciduous trees, with neither greater than 50% of the tree canopy.

DONE!

Note: *This MUC class is the best choice for sites with a mixture of broad-leaved evergreen, needle-leaved evergreen, and deciduous shrubs where no one type contributes more than 50%. In some cases there may be less than 25% broad-leaved evergreen or broad-leaved deciduous.*

MUC 4323 Herbaceous Vegetation, Short Graminoid, With Trees Covering < 10%, Trees: Broad-Leaved Deciduous

Broad-leaved deciduous species are greater than 50% of the tree canopy. There may be some seasonal flooding.

DONE!

MUC 4324 Herbaceous Vegetation, Short Graminoid, With Trees Covering < 10%, Tropical and Subtropical with Trees and Shrubs in Tufts on Termite Nests

Tropical or subtropical short grassland with trees and/or shrubs growing in tufts on termite nests. Also called termite savannah.

DONE!

Note*: In MUC , savannahs are types of grasslands. They are generally found in regions with long dry periods and receiving more rainfall than desert areas but not enough to support complete forest cover. Fire often plays an important role in maintaining the vegetation. Also spelled savanna.*

Note: *Refer to page iv for definitions of tropical and subtropical.*

MUC 433 Short Graminoid with Shrubs

The shrub canopy must cover more than 25% of the ground.

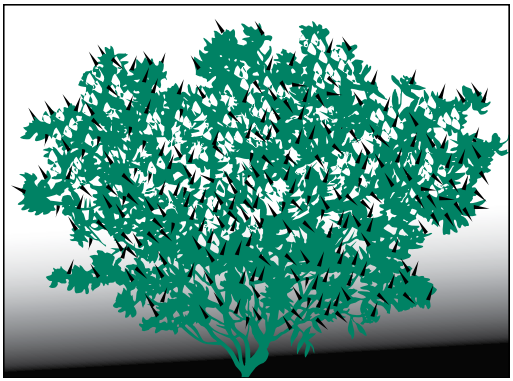
A Does the site have termite nests?

If YES, go to	If NO, go
MUC 4334 (below).	to **B** (below).

B Is more than 25% of the ground covered by deciduous, thorny shrubs?

If YES, go to	If NO, go
MUC 4335 (page 87).	to **C** (page 87).

Note: *Now you need to describe the types of shrubs that contribute to the shrub canopy.*



Note: *Refer to page iv for definitions of tropical and subtropical.*

MUC 4334 Herbaceous Vegetation, Short Graminoid, With Shrubs, Tropical and Subtropical with Trees and Shrubs in Tufts on Termite Nests

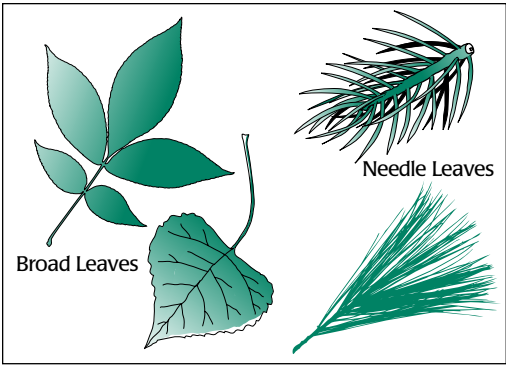
Tropical or subtropical short grassland with trees and/or shrubs growing in tufts on termite nests. Also called termite savannah.

DONE!

C Is more than 50% of the shrub canopy from broad-leaved shrubs?

If YES, go to **D** (below).

If NO, go to **MUC 4330** (page 90).



Broad-leaved: *A plant with leaves that are broad and flat rather than needle shaped.*

Needle-leaved: *A plant with slender, elongated leaves; for example pine and fir trees (Pinus and Abies).*

D Do deciduous shrubs contribute more than 50% of the shrub canopy?

If YES, go to **MUC 4333** (page 90).

If NO, go to **E** (page 90).

Deciduous: *Vegetation that sheds its leaves at the end of the growing period or in association with the unfavorable season (dry or cold).*

MUC 4335 Herbaceous Vegetation, Short Graminoid, With Shrubs, Woody Synusia of Deciduous Thorny Shrubs

Consists of deciduous thorny shrubs covering at least 25% of the ground.

DONE!

MUC 434 Short Graminoid with Open Synusia of Tuft Plants

The canopy of the tuft plants (usually palms) must cover more than 25% of the ground.

Go to **MUC 4341** (below).

Note: *This section has only one choice for MUC level 4.*

Synusia: *A layer or stratum of a plant community. A structural unit of a major ecological community characterized by relative uniformity of life form or of height and usually constituting a particular stratum of that community.*

MUC 4341 Herbaceous Vegetation, Short Graminoid, Open Synusia of Tuft Plants, Subtropical with Open Palm Groves

Short grassland with open groves of palms. The canopy of palms must cover more than 25% of the ground.

DONE!

Grove: *A small wood without underbush.*

MUC 435 Short Graminoid with Mainly Bunch Grasses with Woody Synusia

Grasses that grow in tufts, with woody plants interspersed.

Which of the following four choices (**MUC 4351, MUC 4352, MUC 4353** or **MUC 4354**) best describes your site?

MUC 4351 Herbaceous Vegetation, Short Graminoid, Mainly Bunch Grasses with Woody Synusia, Tropical Alpine with Tuft Plants

This grassland often contains *Espeletia, Lobelia, Senecio,* microphyllous dwarf-shrubs, and cushion plants (often with woolly leaves). Above the timberline in low latitudes: Paramo and related vegetation types without snow in the alpine regions of Kenya, Colombia, Venezuela, etc.

DONE!

Cushion Plant: *A plant that has small, hairy, or thick leaves borne on short stems and forming a cushion-like appearance. These plants are adapted to cold, dry, or windy conditions.*

Dwarf Shrub: *Shrub that rarely exceeds 50 cm in height (sometimes called heaths or heathlike formations).*

Microphyllous: *Having small leaves with a single unbranched vein. Microphyllous leaves are an adaptation to low moisture levels.*

MUC 4352 Herbaceous Vegetation, Short Graminoid, Mainly Bunch Grasses with Woody Synusia, Tropical Alpine without Tuft Plants

Similar to Tropical Alpine with Tuft Plants (4351) but very open and without tuft plants. In these grasslands there is frequent nocturnal snowfall (though the snow is gone by 9 a.m.).

E.g. the Super-Paramo (i.e. above Paramo) of J. Cuatrescasas.

DONE!

MUC 4353 Herbaceous Vegetation, Short Graminoid, Mainly Bunch Grasses with Woody Synusia, Tropical and Subtropical Alpine with Open Stands of Evergreens

This grassland may also have deciduous shrubs and dwarf shrubs.

E.g., Puna south of Oruro, Bolivia.

DONE!

MUC 4354 Herbaceous Vegetation, Short Graminoid, Mainly Bunch Grasses with Woody Synusia, With Dwarf Shrubs

Consists of bunch grass with varying coverage of dwarf shrubs. Cushion plants may also grow in this grassland, and may be locally more important than the dwarf-shrubs.

E.g., Puna south of Oruro, Bolivia.

DONE!

E Do broad-leaved evergreen shrubs contribute more than 50% of the shrub canopy?

If YES, go to **MUC 4331** (below).

If NO, go to **MUC 4332** (below).

MUC 4330 Herbaceous Vegetation, Short Graminoid, With Shrubs, Shrubs: Needle-Leaved Evergreen

Needle-leaved evergreen species are greater than 50% of the shrub canopy.

DONE!

MUC 4331 Herbaceous Vegetation, Short Graminoid, With Shrubs, Shrubs: Broad-Leaved Evergreen

Broad-leaved evergreen species are greater than 50% of the shrub canopy.

DONE!

MUC 4332 Herbaceous Vegetation, Short Graminoid, With Shrubs, Shrubs: Broad-Leaved Semi-Evergreen

Shrubs present are at least 25% each of broad-leaved evergreen and broad-leaved deciduous shrubs, with neither greater than 50% of the shrub canopy.

DONE!

Note: *This MUC class is the best choice for sites with a mixture of broad-leaved evergreen, needle-leaved evergreen, and deciduous shrubs where no one type contributes more than 50%. In some cases there may be less than 25% broad-leaved evergreen or broad-leaved deciduous.*

MUC 4333 Herbaceous Vegetation, Short Graminoid, With Shrubs, Shrubs: Broad-Leaved Deciduous

Broad-leaved deciduous species are greater than 50% of the shrub canopy. There may be some seasonal flooding.

DONE!

MUC 436 Short Graminoid without Woody Synusia

Short grasslands without trees or shrubs.

Which of the following two choices (**MUC 4361** or **MUC 4362**) best describes your site?

MUC 4361 Herbaceous Vegetation, Short Graminoid, Without Woody Synusia, Short-Grass Communities

These communities may fluctuate in structure and floristic composition due to greatly fluctuating precipitation of the semi-arid climate.

E.g., short-grass (Bouteloua gracilis and Buchloe dactyloides) prairie of eastern Colorado.

DONE!

MUC 4362 Herbaceous Vegetation, Short Graminoid, Without Woody Synusia, Bunch-Grass Communities

E.g., blue tussock (*Poa cloensoi*) communities of New Zealand, and alpine dry Puna with *Festuca orthophylla* of northern Chile and southern Bolivia.

DONE!

MUC 437 Short Graminoid with Short to Medium Tall Mesophytic Communities

Plants growing in or adapted to a moderately moist environment.

Mesophytic: *Growing in, or adapted to, a moderately moist environment.*

Which of the following two choices (**MUC 4371** or **MUC 4372**) best describes your site?

MUC 4371 Herbaceous Vegetation, Short Graminoid, Short to Medium Tall Mesophytic Communities, Sodgrass Communities

The grassland is often rich in forbs, and occurs in lower altitudes with a cool, humid climate in North America and Eurasia. Many plants may remain at least partly green during the winter, even below the snow in the higher latitudes.

DONE!

MUC 4372 Herbaceous Vegetation, Short Graminoid, Short to Medium Tall Mesophytic Communities, Alpine and Subalpine Meadows

These grasslands are usually moist much of the summer due to snow melt water. May be rich in forbs (e.g. Olympic Peninsula, Washington); rich in dwarf-shrubs (e.g. the Rocky Mountains of Colorado); snow-bed communities rich in small forbs and/or forb-like dwarf-shrubs (e.g. *Salix herbacea*); or avalanche meadows, occurring as narrow strips of grassland between forests on steep slopes of high mountains where avalanches, descending annually in spring, prevent forest growth.

Note: *Please refer to page vi for definitions of alpine and subalpine.*

DONE!

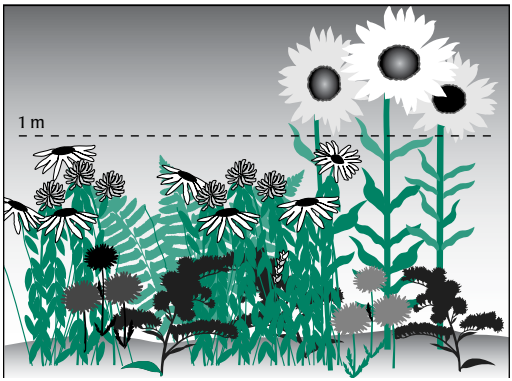
MUC 44 Forb Vegetation

Broad-leaved herbaceous plants dominate the plant community, such as clover, sunflowers (*Helianthus*), ferns, and milkweeds (*Asclepias*) (all herbaceous plants except grasses). Forbs cover at least 50% of the herbaceous area. Grasses may be present but often less than (often much less than) 50%.

A Are more than 50% of the forbs greater than 1 meter tall when mature?

If YES, go to **MUC 441** (below).

If NO, go to **MUC 442** (page 95).



MUC 441 Tall Communities

The dominant forb growth forms are more than 1 meter tall when mature.

A Are there stands of ferns at your site?

If YES, go to **MUC 4411** (page 94).

If NO, go to **B** (page 94).

B Are greater than 50% of the forbs annual plants?

If YES, go to **MUC 4412** (below).

If NO, go to **MUC 4413** (below).

Annual Plant: *A plant that lives and grows for only one year or season.*

Perennial Plant: *A plant that has a life span of more than two years.*

MUC 4411 Herbaceous Vegetation, Forb Vegetation, Tall Communities, Fern Thickets

Ferns occur sometimes in nearly pure stands, especially in humid climates (e.g. *Pteridium aquilinum)*.

DONE!

MUC 4412 Herbaceous Vegetation, Forb Vegetation, Tall Communities, Mainly Annual

Annual forbs, which germinate in the beginning and die at the end of each growing season, are the dominant form (greater than 50% of forb vegetation).

DONE!

MUC 4413 Herbaceous Vegetation, Forb Vegetation, Tall Communities, Mainly Perennial Flowering Forbs and Ferns

Some part of the plant is alive all year round.

DONE!

MUC 442 Low Communities

These communities are dominated by forbs less than 1 meter tall when fully developed.

A Are greater than 50% of the forbs perennial plants?

If YES, go to **MUC 4421** (below).

If NO, go to **MUC 4422** (below).

Annual Plant: *A plant that lives and grows for only one year or season.*

Perennial Plant: *A plant that has a life span of more than two years.*

MUC 4421 Herbaceous Vegetation, Forb Vegetation, Low Communities, Mainly Perennial Flowering Forbs and Ferns

Some part of the plant is alive all year round.

DONE!

MUC 4422 Herbaceous Vegetation, Forb Vegetation, Low Communities, Mainly Annual

Annual forbs, which germinate in the beginning and die at the end of each growing season, are the dominant form (greater than 50% of forb vegetation). There are several types of low annual forbs.

DONE!

Ephemeral forb communities in tropical and subtropical regions: *Forbs grow with very little precipitation where, from autumn to spring, clouds moisten vegetation and soil. The dry season aspect is desert-like. E.g., the coastal hills of Peru and northern Chile*

Ephemeral or episodical forb communities of arid regions: *The "flowering desert" consists of mostly fast growing forbs, sometimes concentrated in depressions where water can accumulate in shrub or dwarf shrub formations of arid regions. E.g., the Sonoran Desert.*

MUC 5 *Barren Land*

Land with less than 40% vegetative cover. Barren land has a limited ability to support life, and is usually made up of thin soil, sand, or rocks.

A Does the site have snow or ice during the warm season?

If YES, go	If NO, go
to **C**	to **B**
(page 97).	(below).

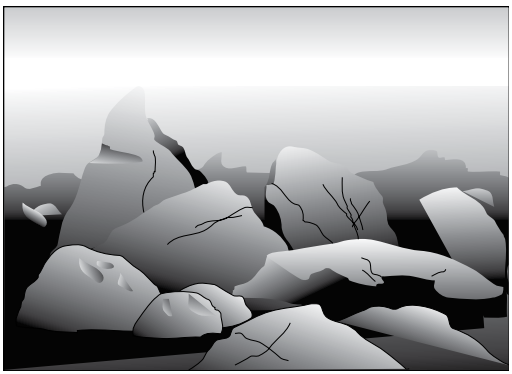
B Does the site consist of bare rock?

If YES, go to	If NO, go
MUC 53	to **D**
(below).	(page 98).

MUC 53 Barren Land, Bare Rock

Exposed bedrock, desert pavement, scarps, talus slides, volcanic material, rock glaciers and other accumulations of rock without vegetative cover.

DONE!



Scarp: *A sloping cliff or embankment. A scarp may be formed by faulting or erosional processes.*

Talus: *Rock debris at the base of a cliff.*

C Which of the following two choices (**MUC 54** or **MUC 55**) best describes your site?

MUC 54 Barren Land, Perennial Snowfields

Accumulations of snow and ice that did not entirely melt during the previous summer, occurring where the daily average temperature is 0˚ C in the warmest summer months.

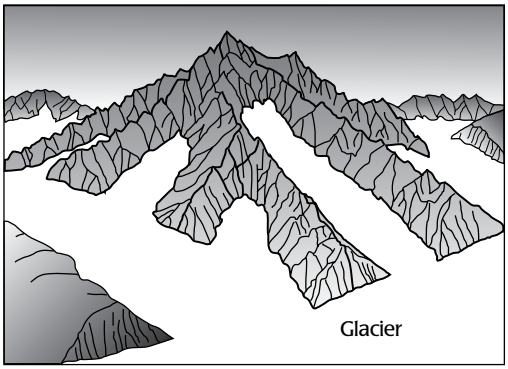
DONE!

MUC 55 Barren Land, Glaciers

Snow compacted into firn and finally to ice under weight of successive annual accumulations. Re-frozen melt water contributes to increasing density of the glacial ice mass. All glaciers exhibit evidence of present or past motions (moraines, crevasses, etc.).

DONE!

***Glacier**: A land-bound mass of moving glacial ice. Glaciers move across the landscape under their own weight by plastic flow and sliding.*



***Crevasse:** A large, open fissure in the brittle surface of a glacier.*

***Firn:** Granular old snow at the surface of a glacier that has been partially consolidated, or compacted, by thawing and freezing but not yet converted to glacial ice.*

***Moraine:** A mass of till (unstratified and unsorted glacial debris) deposited on the land after a glacier recedes.*

D Which of the following three choices (**MUC 51, MUC 52** or **MUC 56**) best describes your site?

MUC 51 Barren Land, Dry Salt Flats

Occur on flat-floored bottoms of interior desert basins. High concentrations of salts are present due to extensive water evaporation.

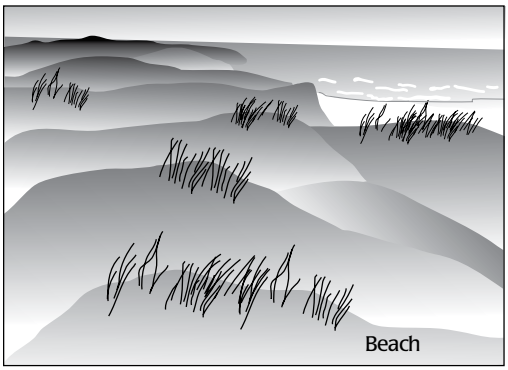
Desert: Occurs in areas with low precipitation, less than 25 cm per year. Deserts are usually sandy or rocky, and lack trees.

DONE!

MUC 52 Barren Land, Sandy Areas

Accumulations of sand/gravel (e.g., beaches or dunes).

DONE!



MUC 56 Barren Land, Other

Dirt, gravel, other loose rock, etc.

DONE!

Marshes, swamps, bogs and other types of wetlands which are periodically or constantly saturated during the growing season. This periodic or constant saturation produces soils with special chemical characteristics and vegetation specifically adapted to wet conditions. The area must have at least 40% vegetative cover to be classified as a wetland.

Note: MUC classes here are based on the proximity to a type of water body.

A Is the wetland adjacent to a body of water that has tides?

If YES, go to	If NO, go
MUC 63 (page 100).	to **B** (below).

B Is the wetland adjacent to a river channel?

If YES, go to	If NO, go
MUC 61 (page 100).	to **C** (below).

C Is the wetland adjacent to open water that is greater than 1 hectare (100 x 100 m) and greater than 2 m deep?

If YES, go to	If NO, go to
MUC 64 (page 100).	**MUC 62** (page 100).

Bog: *A poorly drained wetland area that supports vegetation, particularly sphagnum moss, adapted to an acidic environment. Peat forms its base.*

Emergent Vegetation: *Vegetation whose roots grow in shallow water but whose photosynthesizing structures (stems and leaves) grow mostly above the water surface. Cattails, pickerelweeds, and arrowheads are all emergent plants.*

Herbaceous: *Pertaining to or characteristic of an herb as distinguished from a woody plant. Vascular plant rooted in the ground with foliage that dies back annually. The meristem (stem growth tip) is located just above or below the ground.*

Marsh: *A wetland frequently or continually covered by water. Emergent herbaceous vegetation dominate with few, or no, woody plants. It generally has a soil as its base.*

Swamp: *A wetland dominated by trees or shrubs. Sometimes a forested fen or reedgrass-dominated wetland is called a swamp.*

MUC 61 Wetland, Riverine

Wetlands adjacent to a fresh water river channel (riparian wetlands).

DONE!

MUC 62 Wetland, Palustrine

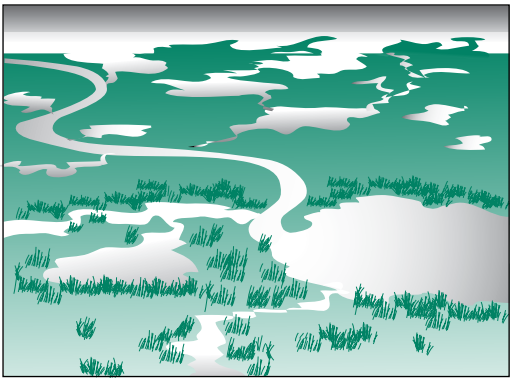
Wetlands dominated by trees, shrubs, persistent emergents (plants), mosses, lichens, etc. The wetlands surround water that is less than 1 hectare in size, has no active channel or tide, is less than 2 meters deep, and has low salinity. This water should be included as part of the wetland.

DONE!

MUC 63 Wetland, Estuarine

Wetlands occurring adjacent to a tidal channel, or in and adjacent to the intertidal zone.

DONE!



An estuary is a water passage where the tide meets the current of a stream. Deepwater tidal habitats and adjacent tidal wetlands are usually semi-enclosed by land but have open, partially obstructed, or sporadic access to ocean water (at least occasionally diluted by freshwater runoff from the land).

MUC 64 Wetland, Lacustrine

Wetlands surrounding open water (e.g., ponds and lakes) that are greater than 1 hectare in size and greater than 2 meters deep.

DONE!

Lake: *A body of fresh water that is deep enough so that rooted plants do not grow all the way across the bottom.*

Lakes, ponds, rivers and oceans. The surface of the land is continually submerged by water greater than 2 meters deep and at least one hectare in size; or continually submerged in an actively flowing channel or subtidal zone. Water should cover greater than 60% of the area.

A Which of the following two choices (**MUC 71** or **MUC 72**) best describes your site?

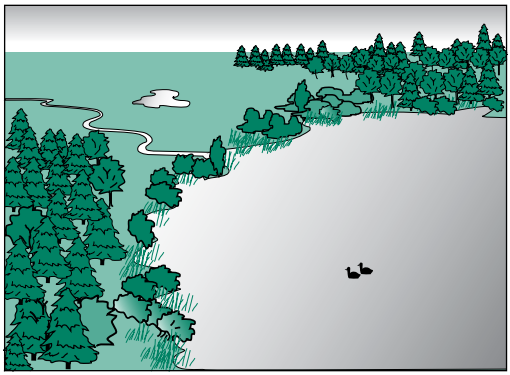
Freshwater: *Of, relating to, or living in water that contains very little salt (less than 0.05 percent, as compared with brackish water that has 0.5 to 3.0 percent), such as that in rivers, ponds and lakes.*

Salt: *Any ionic compound. An ion is an atom or molecule that has become either positively or negatively charged by losing or gaining an electron.*

MUC 71 Open Water, Freshwater

Lakes, ponds, and rivers with low salinity.

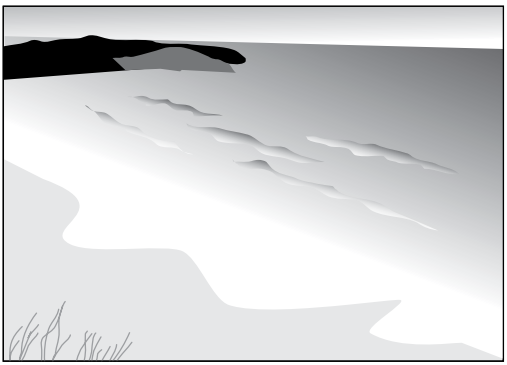
DONE!

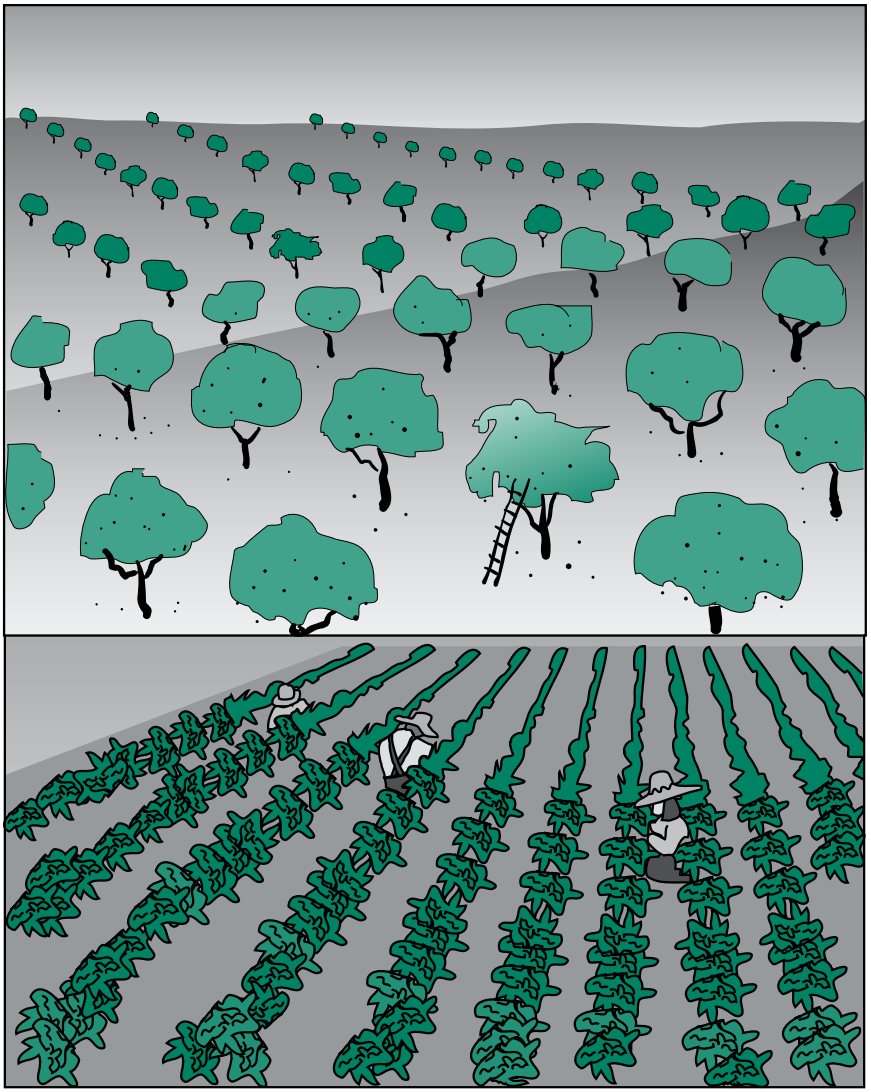


MUC 72 Open Water, Marine

Open ocean overlying the continental shelf or an actively flowing tidal channel.

DONE!





The ground is covered by greater than 60% non-native cultivated species (e.g. agricultural crops, cultivated short grasses, and lawns) and usually can be distinguished by the regular geometric patterns created by the lawns and fields.

A Is your site cultivated for agricultural purposes?

If YES, go to	If NO, go to
MUC 81 (page 104).	**MUC 82** (below).

MUC 82 Non-Agriculture

Land is used for parks, playing fields, cemeteries, and golf courses.

A Is your site a park or athletic field?

If YES, go to	If NO, go to **B**
MUC 821 (below).	(below).

B Is your site a golf course?

If YES, go to	If NO, go to **C**
MUC 822 (page 106).	(below).

C Is your site a cemetery?

If YES, go to	If NO, go to
MUC 823 (page 106).	**MUC 824** (page 106).

MUC 83 Cultivated Land, Non-Agriculture, Parks and Athletic Fields

Examples include baseball diamonds, soccer fields, play grounds, and parks.

DONE!

MUC 81 Agriculture

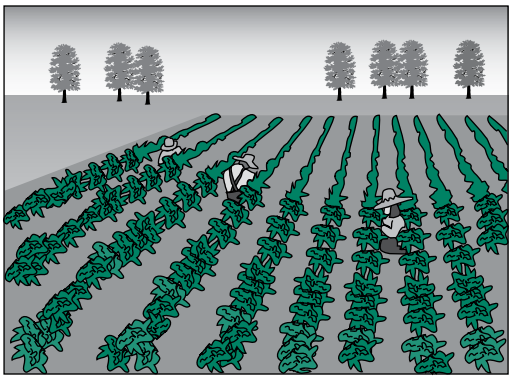
Land is used for growing crops, orchards, horticulture, feeding livestock, and other agriculture.

A Which of the following choices (**MUC 811, MUC 812, MUC 813** or **MUC 814**) best describes your site?

MUC 811 Cultivated Land, Agriculture, Row Crop and Pasture

Examples include corn, wheat, cow pastures, fallow fields, cultivated cranberry bogs, and rice fields.

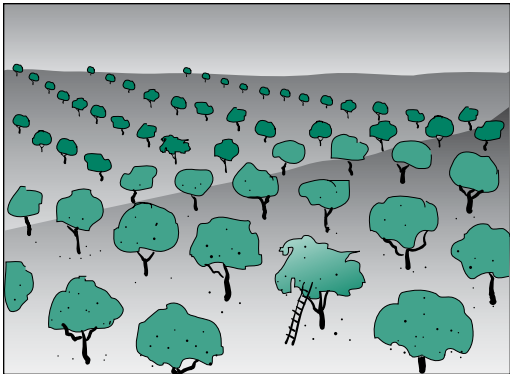
DONE!



MUC 812 Cultivated Land, Agriculture, Orchard and Horticulture

Examples include apple orchards, vineyards, and tree nurseries.

DONE!



Horticulture: *Cultivation of flowers, fruits, vegetables, or ornamental plants.*

MUC 813 Cultivated Land, Agriculture, Confined Livestock Feeding

These areas are found on large farms and are used for feeding beef cattle, dairy cows (with confined feedlots), hogs and poultry.

DONE!

MUC 814 Cultivated Land, Agriculture, Other Agriculture

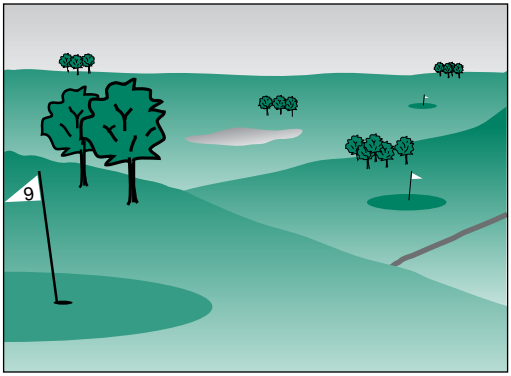
Examples include corrals and breeding and training facilities on horse farms.

DONE!

MUC 812 Cultivated Land, Non-Agriculture, Golf Courses

Golf Courses

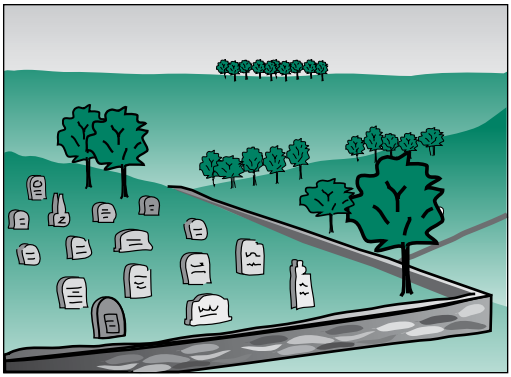
DONE!



MUC 813 Cultivated Land, Non-Agriculture, Cemeteries

Cemeteries

DONE!



MUC 814 Cultivated Land, Non-Agriculture, Other Non-Agriculture

Any other non-agricultural cultivated areas that do not fit into classes 821, 822 or 823 (parks and playing fields, golf courses, or cemeteries).

DONE!

Areas developed for residential, commercial, industrial, or transportation uses. Must be greater than 40% urban land cover.

A Is greater than 50% of the area residential property?

If YES, go to	If NO, go
MUC 91 (below).	to **B** (below).

B Is greater than 50% of the area used for commercial or industrial purposes?

If YES, go to	If NO, go
MUC 92 (below).	to **C** (below).

C Is greater than 50% of the area used for transportation?

If YES, go to	If NO, go to
MUC 93 (page 108).	**MUC 94** (page 108).

Note: *Residential property includes the buildings and surrounding land which is paved or maintained as part of the residence. Cultivated land, natural land cover, and other urban land cover adjacent to residences should be classified separately.*

Note: *Mixed use buildings should be assigned to the class of their primary use (e.g., a 5-story apartment house with a restaurant and shops on the ground floor is classified as residential).*

MUC 91 Urban, Residential

Greater than 50% of the urban land cover consists of residential property (e.g., apartments, private dwellings).

DONE!

MUC 92 Urban, Commercial and Industrial

Greater than 50% of the urban land cover consists of commercial or industrial property (e.g., businesses, factories, warehouses).

DONE!

MUC 93 Urban, Transportation

Greater than 50% of the urban land cover consists of transportation routes (e.g., roads, highways, railroads, and airport runways).

DONE!

MUC 94 Urban, Other

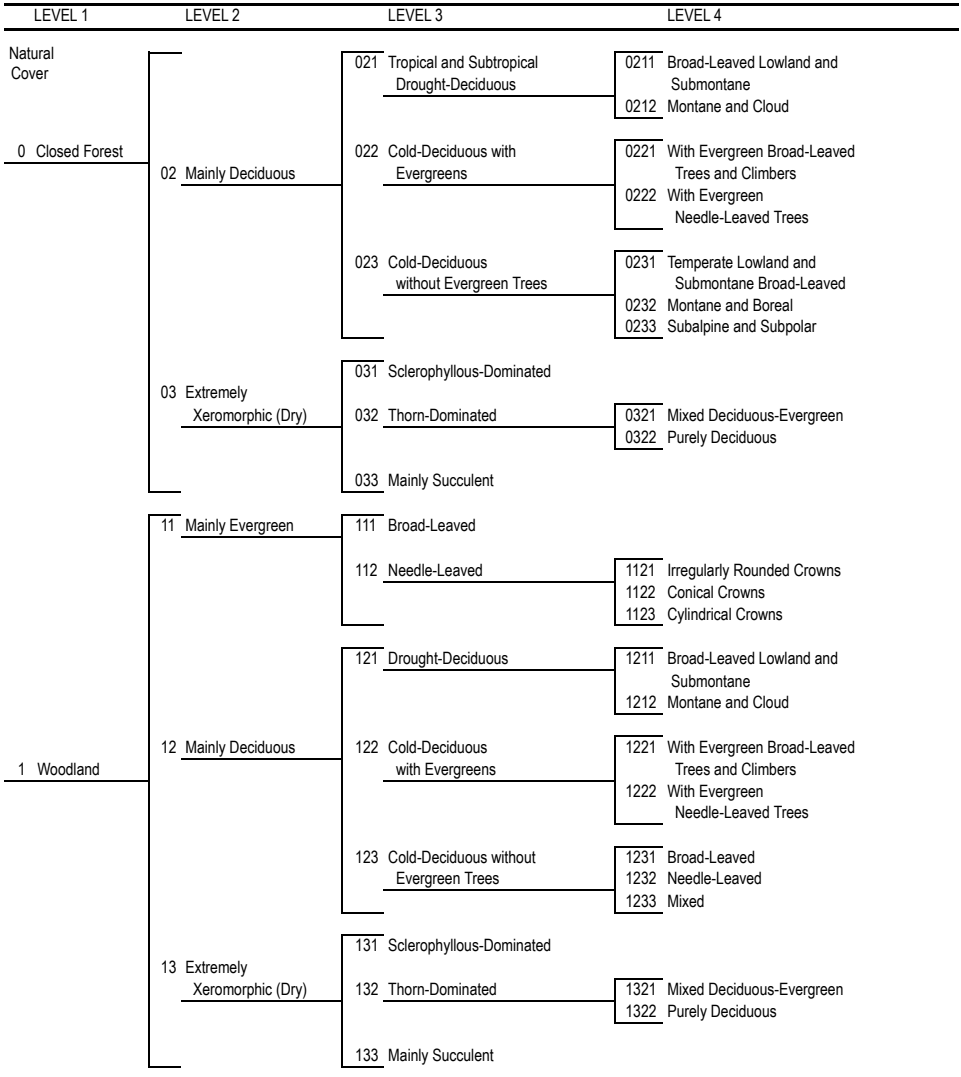
At least 50% of the urban land cover consists of developed areas that do not fit into residential, commercial, or transportation categories.

DONE!

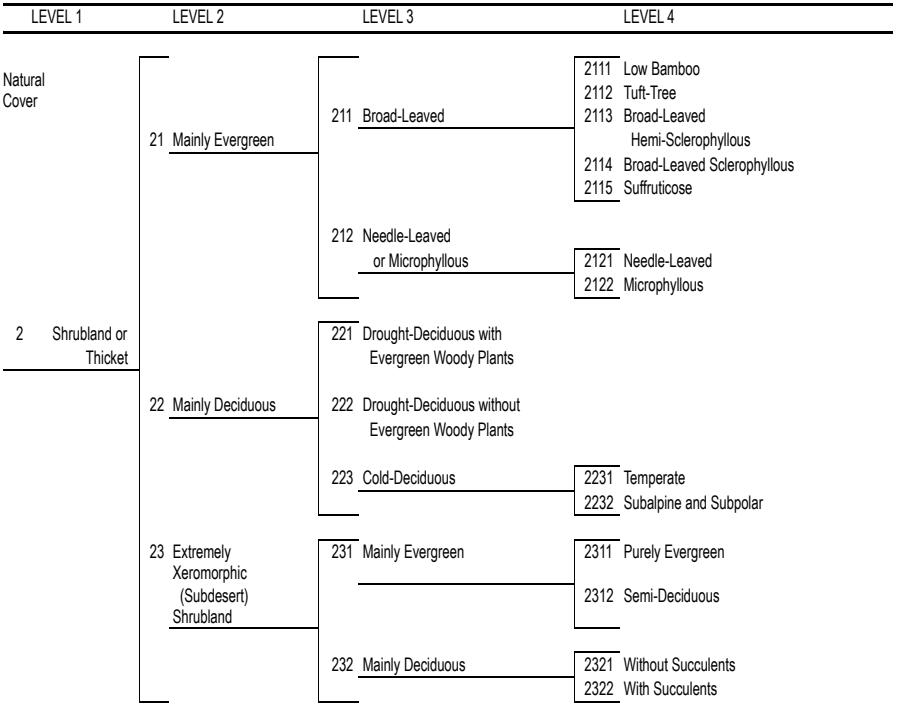
MUC 0 (MUC 01)

LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
Natural Cover			
0 Closed Forest	01 Mainly Evergreen	011 Tropical Wet (Rain)	0111 Lowland
			0112 Submontane
			0113 Montane
			0114 Subalpine
			0115 Cloud
		012 Tropical and Subtropical Seasonal	0121 Lowland
			0122 Submontane
			0123 Montane
			0124 Subalpine
		013 Tropical and Subtropical Semi-Deciduous	0131 Lowland
			0133 Montane and Cloud
		014 Subtropical Wet	0141 Lowland
			0142 Submontane
			0143 Montane
			0144 Subalpine
			0145 Cloud
		015 Temperate or Subpolar Wet	0151 Temperate
			0152 Subpolar
		016 Temperate with Broad-Leaved Deciduous	0161 Lowland
			0162 Submontane
			0163 Montane
			0164 Subalpine
		017 Winter-Rain Broad-Leaved Sclerophyllous	0171 Lowland and Submontane >50m
			0172 Lowland and Submontane <50m
		018 Tropical and Subtropical Needle-Leaved	0181 Lowland and Submontane
			0182 Montane and Subalpine
		019 Temperate and Subpolar Needle-Leaved	0191 Giant (>50 m)
			0192 Irregularly Rounded Crowns
			0193 Conical Crowns
			0194 Cylindrical Crowns

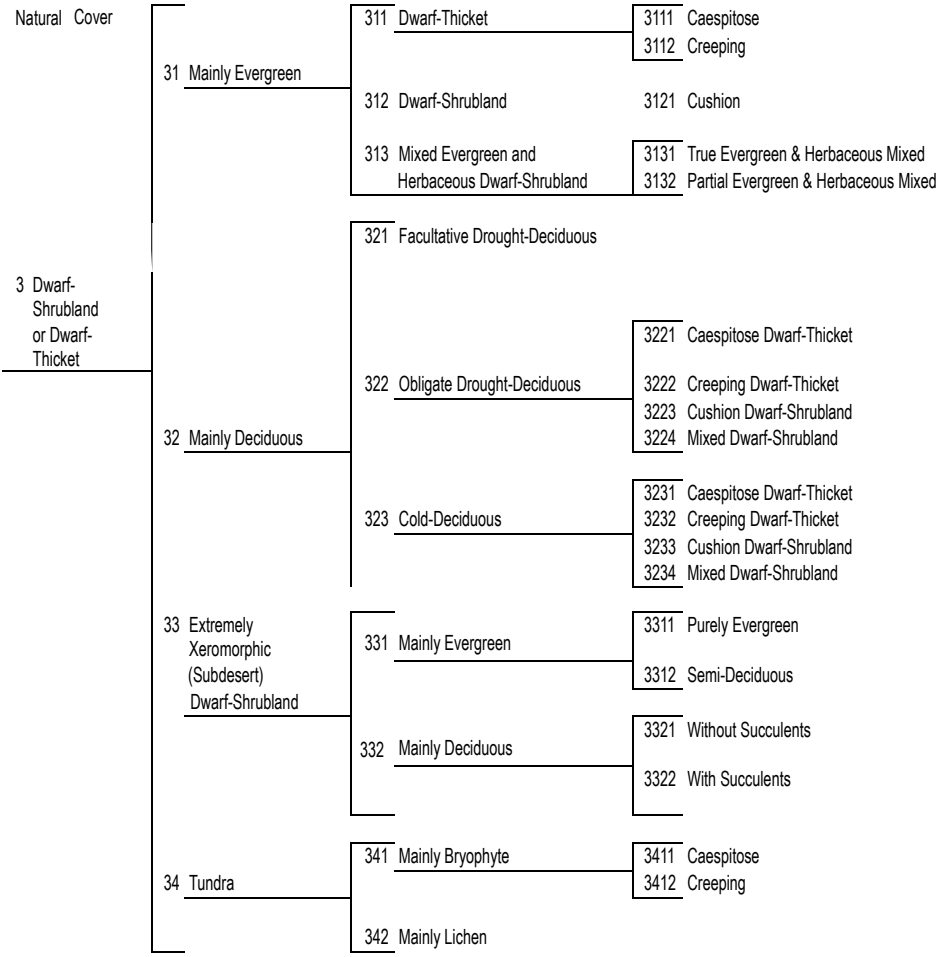
MUC 0 (MUC 02, MUC 03)
MUC 1



MUC 2


LEVEL 1
LEVEL 2
LEVEL 3
LEVEL 4
Natural Cover
2 Shrubland or Thicket
21 Mainly Evergreen
22 Mainly Deciduous
23 Extremely Xeromorphic (Subdesert) Shrubland
211 Broad-Leaved
212 Needle-Leaved or Microphyllous
221 Drought-Deciduous with Evergreen Woody Plants
222 Drought-Deciduous without Evergreen Woody Plants
223 Cold-Deciduous
231 Mainly Evergreen
232 Mainly Deciduous
2111 Low Bamboo
2112 Tuft-Tree
2113 Broad-Leaved Hemi-Sclerophyllous
2114 Broad-Leaved Sclerophyllous
2115 Suffruticose
2121 Needle-Leaved
2122 Microphyllous
2231 Temperate
2232 Subalpine and Subpolar
2311 Purely Evergreen
2312 Semi-Deciduous
2321 Without Succulents
2322 With Succulents

MUC 3


LEVEL 1
LEVEL 2
LEVEL 3
LEVEL 4
Natural Cover
3 Dwarf-Shrubland or Dwarf-Thicket
31 Mainly Evergreen
32 Mainly Deciduous
33 Extremely Xeromorphic (Subdesert) Dwarf-Shrubland
34 Tundra
311 Dwarf-Thicket
3111 Caespitose
3112 Creeping
312 Dwarf-Shrubland
3121 Cushion
313 Mixed Evergreen and Herbaceous Dwarf-Shrubland
3131 True Evergreen & Herbaceous Mixed
3132 Partial Evergreen & Herbaceous Mixed
321 Facultative Drought-Deciduous
322 Obligate Drought-Deciduous
3221 Caespitose Dwarf-Thicket
3222 Creeping Dwarf-Thicket
3223 Cushion Dwarf-Shrubland
3224 Mixed Dwarf-Shrubland
323 Cold-Deciduous
3231 Caespitose Dwarf-Thicket
3232 Creeping Dwarf-Thicket
3233 Cushion Dwarf-Shrubland
3234 Mixed Dwarf-Shrubland
331 Mainly Evergreen
3311 Purely Evergreen
3312 Semi-Deciduous
332 Mainly Deciduous
3321 Without Succulents
3322 With Succulents
341 Mainly Bryophyte
3411 Caespitose
3412 Creeping
342 Mainly Lichen

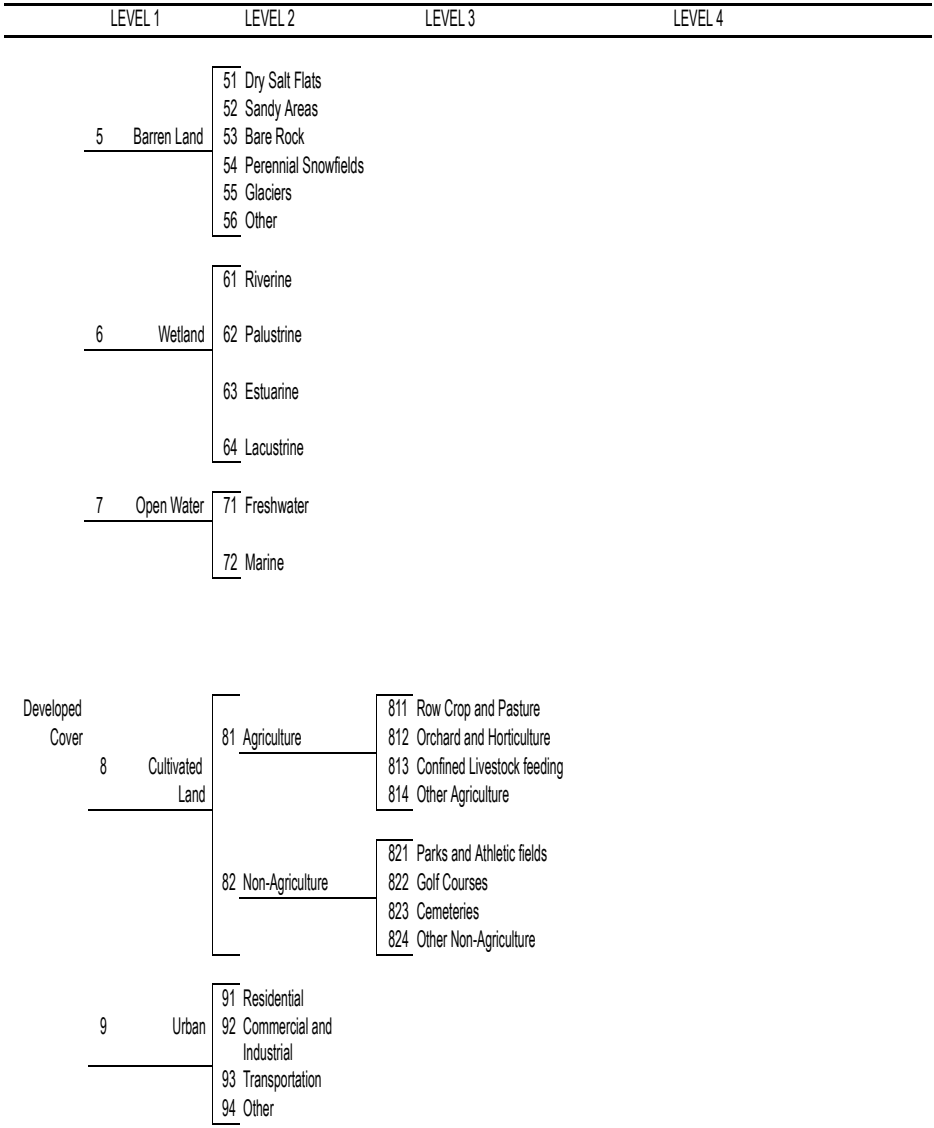
MUC 4 (MUC 41, MUC 42)

LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
4 Herbaceous Vegetation	41 Tall Graminoid	411 With Trees Covering 10-40 %	4110 Trees: Needle-Leaved Evergreen
			4111 Trees: Broad-Leaved Evergreen
			4112 Trees: Broad-Leaved Semi-Evergreen
			4113 Trees: Broad-Leaved Deciduous
		412 With Trees Covering < 10 %	4120 Trees: Needle-Leaved Evergreen
			4121 Trees: Broad-Leaved Evergreen
			4122 Trees: Broad-Leaved Semi-Evergreen
			4123 Trees: Broad-Leaved Deciduous
			4124 Tropical and Subtropical with Trees and Shrubs in Tufts on Termite Nests
		413 With Shrubs	4130 Shrubs: Needle-Leaved Evergreen
			4131 Shrubs: Broad-Leaved Evergreen
			4132 Shrubs: Broad-Leaved Semi-Evergreen
			4133 Shrubs: Broad-Leaved Deciduous
			4134 Tropical and Subtropical with Trees and Shrubs in Tufts on Termite Nests
		414 With Tuft Plants	4141 Tropical with Palms
		415 Without Woody Synusia	4151 Tropical
	42 Medium Tall Graminoid	421 With Trees Covering 10-40 %	4210 Trees: Needle-Leaved Evergreen
			4211 Trees: Broad-Leaved Evergreen
			4212 Trees: Broad-Leaved Semi-Evergreen
			4213 Trees: Broad-Leaved Deciduous
		422 With Trees Covering < 10 %	4220 Trees: Needle-Leaved Evergreen
			4221 Trees: Broad-Leaved Evergreen
			4222 Trees: Broad-Leaved Semi-Evergreen
			4223 Trees: Broad-Leaved Deciduous
			4224 Tropical and Subtropical with Trees and Shrubs in Tufts on Termite Nests
		423 With Shrubs	4230 Shrubs: Needle-Leaved Evergreen
			4231 Shrubs: Broad-Leaved Evergreen
			4232 Shrubs: Broad-Leaved Semi-Evergreen
			4233 Shrubs: Broad-Leaved Deciduous
			4234 Tropical and Subtropical with Trees and Shrubs in Tufts on Termite Nests
			4235 Woody Synusia of Deciduous Thorny Shrubs
		424 Open Synusia of Tuft Plants	4241 Subtropical with Open Palm Groves
		425 Without Woody Synusia	4251 Mainly Sod Grasses
			4252 Mainly Bunch Grasses

MUC 4 (MUC 43, MUC 44)

LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
Natural Cover			
4 Herbaceous Vegetation	43 Short Graminoid	431 With Trees Covering 10-40 %	4310 Trees: Needle-Leaved Evergreen
			4311 Trees: Broad-Leaved Evergreen
			4312 Trees: Broad-Leaved Semi-Evergreen
			4313 Trees: Broad-Leaved Deciduous
		432 With Trees Covering < 10 %	4320 Trees: Needle-Leaved Evergreen
			4321 Trees: Broad-Leaved Evergreen
			4322 Trees: Broad-Leaved Semi-Evergreen
			4323 Trees: Broad-Leaved Deciduous
			4324 Tropical and Subtropical with Trees and Shrubs in Tufts on Termite Nests
		433 With Shrubs	4330 Shrubs: Needle-Leaved Evergreen
			4331 Shrubs: Broad-Leaved Evergreen
			4332 Shrubs: Broad-Leaved Semi-Evergreen
			4333 Shrubs: Broad-Leaved Deciduous
			4334 Tropical and Subtropical with Trees and Shrubs in Tufts on Termite Nests
			4335 Woody Synusia of Deciduous Thorny Shrubs
		434 Open Synusia of Tuft Plants	4341 Subtropical with Open Palm Groves
		435 Mainly Bunch Grasses with Woody Synusia	4351 Tropical Alpine with Tuft Plants
			4352 Tropical Alpine without Tuft Plants
			4353 Tropical and Subtropical Alpine with Open Stands of Evergreens
			4354 With Dwarf Shrubs
		436 Without Woody Synusia	4361 Short-Grass Communities
			4362 Bunch-Grass Communities
		437 Short to Medium Tall Mesophytic Communities	4371 Sodgrass Communities
			4372 Alpine and Subalpine Meadows
	44 Forb Vegetation	441 Tall Communities	4411 Fern Thickets
			4412 Mainly Annual
			4413 Mainly Perennial Flowering Forbs and Ferns
		442 Low Communities	4421 Mainly Perennial Flowering Forbs and Ferns
			4422 Mainly Annual

MUC 5
MUC 6
MUC 7
MUC 8
MUC 9



MUC Level 1 – At a Glance

Which of the following best describes your site?

Closed Forest

Formed by trees at least 5 meters tall with their crowns interlocking. The tree canopy covers at least 40% of the ground.

If YES, go to **MUC 0** (page 7).

Woodland

Comprised of open stands of trees at least 5 meters tall with crowns not interlocking. The tree canopy covers at least 40% of the ground. Definitions for Mainly Evergreen Woodland, Mainly Deciduous Woodland, and Extremely Xeromorphic Woodland are similar to forest definitions, with sparser stocking of individual trees.

If YES, go to **MUC 1** (page 31).

Shrub or Thicket

The shrub canopy covers at least 40% of the ground and is composed of matted, clumped or clustered woody plants 0.5 to 5 meters tall.

If YES, go to **MUC 2** (page 41).

Dwarf-Shrubland or Dwarf-Thicket

Shrubs rarely exceed 50 cm in height (sometimes called heaths or heathlike formations). The shrub canopy covers at least 40% of the ground. Dwarf-Shrubland or Dwarf-Thicket classes are distinguished by the cover density.

If YES, go to **MUC 3** (page 50).

Herbaceous Vegetation

Dominated by herbaceous growth of two major types: graminoids and forbs. Graminoids include all herbaceous grasses and grass-like plants such as sedges (Carex), rushes (Juncus), and cattails (Typha). Forbs are broad-leaved herbaceous plants such as clover (Trifolium), sunflowers (Helianthus), ferns, and milkweeds (Asclepias). Total ground coverage must be greater than 60% herbaceous vegetation.

If YES, go to **MUC 4** (page 61).

Barren Land

Land with less than 40% vegetative cover. Barren land has a limited ability to support life, and is usually made up of thin soil, sand, or rocks.

If YES, go to **MUC 5** (page 96).

Wetland

Marshes, swamps, bogs and other types of wetlands which are periodically or constantly saturated during the growing season. This periodic or constant saturation produces soils with special chemical characteristics and vegetation specifically adapted to wet conditions. The area must have at least 40% vegetative cover to be classified as a wetland.

If YES, go to **MUC 6** (page 99).

Open Water

Lakes, ponds, rivers and oceans. The surface of the land is continually submerged by water greater than 2 meters deep and at least one hectare in size; or continually submerged in an actively flowing channel or subtidal zone. Water should cover greater than 60% of the area.

If YES, go to **MUC 7** (page 101).

Cultivated Land

The ground is covered by greater than 60% non-native cultivated species (e.g. agricultural crops, fruit trees, cultivated short grasses, and lawns) and usually can be distinguished by the regular geometric patterns created by the lawns and fields.

If YES, go to **MUC 8** (page 103).

Urban

Areas developed for residential, commercial, industrial, or transportation uses. Must be greater than 40% urban land cover.

If YES, go to **MUC 9** (page 107).