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Classification for Ecosystems
with an Illustrated Summary
of the Natural Vegetation
of North America

David E. Brown
Charles H. Lowe
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General Technical Report RM-73
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Foreword

The classification system illustrated here is the product of field research conducted throughout the North American Southwest, literature synthesis, and modification through discussion with users and academicians over the past decade. A multiple-level and open-ended arrangement of hierarchical components in the system provides for unlimited information content, thereby insuring sensitivity to scale. The fourth level of the classification is the basis for the recent vegetation map of the southwestern United States and adjacent northwestern Mexico at scale 1:1,000,000 (Brown et al. 1977).

In April 1979, the agency leaders of the Bureau of Land Management, Fish and Wildlife Service, Forest Service, Geological Survey, and Soil Conservation Service endorsed a four-component classification system to be used for renewable resource inventories and assessments (Driscoll et al. 1978). The hierarchical components are vegetation, soil, landform, and aquatic (water). The vegetation system with some modification is that prepared by the United Nations Educational, Scientific, and Cultural Organization (1973). This modified system and the system presented here are generally comparable at the Community (Series) and Association levels, but differences do occur. These differences will be resolved in the future as more information is obtained and understood about plant community systems.

A handwritten signature in dark ink, reading "Richard S. Driscoll". The signature is written in a cursive, flowing style with a large initial 'R'.

Fort Collins, Colorado

Richard S. Driscoll

A Digitized Systematic Classification for Ecosystems with an Illustrated Summary of the Natural Vegetation of North America

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Contents

	Page
Introduction	1
A Digitized Hierarchy of the World's Natural Ecosystems	2
First Level	2
Second Level	3
Upland Formations	3
Wetland Formations	3
Third Level	4
Fourth Level	4
Fifth Level	4
Sixth Level	4
Seventh Level	5
Literature Cited	5
Tables	
Table 1.—Summary for the natural vegetation of the world to the first digit level	8
Table 2.—Summary for the natural upland and wetland vegetation of the world to the second level (formation-type)	8
Table 3.—Summary for the natural upland and wetland vegetation of nearctic and adjacent Neotropical North America to the third level	8
Table 4.—Nomenclature of upland biotic communities (fourth level) of nearctic and adjacent Neotropical North America with some community (series) and association level examples	9
Table 5.—Nomenclature of wetland biotic communities (fourth level) of nearctic and adjacent Neotropical North America with some community (series) and association level examples for the North American Southwest	11
Figures	14

A Digitized Systematic Classification for Ecosystems with an Illustrated Summary of the Natural Vegetation of North America

David E. Brown, Charles H. Lowe, and Charles P. Pase

INTRODUCTION

While the classification, analysis, and mapping of various biotic units has long been progressing in Europe, the Soviet Union, and the United States, recent efforts in the "developing" countries now indicate worldwide interest and activity in these fields (Aubreville 1958, Fittkau 1969, Flores et al. 1971, Whittaker 1973, Comision Tecnico Consultiva para la Determinacion Regional de los Coeficientes de Agostadero 1974). These endeavors have produced numerous resource classifications, particularly for vegetation. With some exceptions (Braun-Blanquet 1932, 1964; Daubenmire 1952, 1969; Gaussen 1953, 1955; Ellenberg and Mueller-Dombois 1967; Lactate 1969; Dasmann 1972; Pfister et al. 1977), classifications are based largely on limited criteria for potential vegetation (Kuchler 1964, 1967), or on partly artificial criteria such as land use per se (Anderson 1971, Anderson et al. 1972).

Again with some important exceptions (Dansereau 1957; Fosberg 1961; Krajina 1965; International Union for Conservation of Nature and Natural Resources 1973, 1974; United Nations Educational, Scientific, and Cultural Organization 1973; Ray 1975), resource classifications and classification schemes tend to be regional rather than continental and worldwide in their approach and applicability. Moreover, some recently developed wetland classification systems, while otherwise excellent, may be difficult to apply due to dependence on geologic and chemical criteria (Martin et al. 1953, Stewart and Kontrud 1971, Golet and Larson 1974, Cowardin et al. 1975, Zoltai et al. 1975).

Most classifications, moreover, are nonhierarchical or only partially hierarchical and, therefore, not readily subject to expansion and field modification (Wieslander 1935), Jensen 1947, Society of American Foresters 1954, Dansereau 1957, Garrison et al. 1974). This has resulted in resource management agencies combining and adapting various partial classification systems. The result is that no standardized system that is satisfactory is presently in effect within regions, much less throughout North America. In fact, there is as yet no agreement even on the basis for an evolutionarily derived system of classification. That the need exists is well known,² for example by the National

Environmental Policy Act of 1969 and the National Resource Planning Act of 1974 (also see Layser 1974, Pfister 1975).

Although botanists and zoologists have long recognized and utilized the natural order of hierarchical systematics based on evolutionary criteria, resource managers have yet to agree on an analogous, taxonomic hierarchy for a natural universal classification system for the also evolutionarily derived ecosystems; their taxonomic division into plant association units comparable to species has been long recognized and discussed (Gleason 1939).

The ecological hierarchy herein ranks vegetative communities in systematized natural sets. This system is formulated on natural criteria and recognizes the limiting influences of moisture and temperature minima as well as the evolution of structure and composition of vegetation in general. The system was originally developed for southwestern North America where its adaptability has been well demonstrated (Lowe 1961; Brown and Lowe 1973, 1974a, 1974b). Incorporated are contributions of resource planners and users, plant geographers, zoogeographers, wildlife biologists and ecologists, all of which are in general usage today (Shelford and Shreve 1926; Halliday 1937; Gentry 1942; Shreve 1942; Dice 1943; Munz and Keck 1949, 1950; Oosting 1956; Curtis 1959; Shelford 1963; Lowe 1964; Braun 1967; Daubenmire and Daubenmire 1968; Franklin and Dyrness 1973; Mueller-Dombois and Ellenberg 1974). It is a natural world system.

A digitized system facilitates overall land use classification, resource planning, inventory and assessment, the interpretation of environmental uses and limitations, the delineation and stratification of habitats, and other activities of those concerned with natural resource inquiry. It has proven especially useful for environmental analysis where the inventory, assessment, and comparison of environmental systems is desired or required by governmental, educational, scientific, architectural, engineering, and other organizations. In short, the system is of particular use for those interested in and/or requiring classification of areas for resource management, study, acquisition, and/or preservation as "natural areas" throughout the world.

The digitization of hierarchy in the system makes it computer compatible, for example as a system or subsystem for storing and retrieving general information and data within or parallel to an overall management system. This system as applied to the North American Southwest is currently in use in the RUN WILD program

²Driscoll, R. S., et al. 1976. MODIFIED ECOCLASS—A method for classifying ecosystems for the Rocky Mountain and Southwest Regions. U.S. Department of Agriculture, Forest Service, Rocky Mountain and Southwest Regions, and Rocky Mountain Forest and Range Experiment Station, ad hoc committee, mimeo, 117 p.

being developed for field unit use on remote terminals by the Southwestern Region and the Rocky Mountain Forest and Range Experiment Station, USDA Forest Service (Patton 1978). This classification is similarly incorporated in the State of Arizona Resources Inventory System. It is also currently used by industry in environmental analysis procedures, for example as required by the National Environmental Policy Act.

Also, the use of a hierarchical sequence allows for flexibility in mapping of those complex communities where intensive levels of mapping would be impractical or needlessly time consuming. The hierarchical sequence allows for mapping at any scale.

An important advantage of a hierarchical system based on biotic criteria is the meaningful assignment of plant and animal habitats. This classification not only recognizes plant components within an assigned ecological distribution, it tells the reader which wildlife species could be expected to

be present. As an example, the occurrence of nesting wood ducks (*Aix sponsa*) is expected in certain Temperate swampforests and riparian forests, as opposed to Tropical-Subtropical swampforests, expected in North America to be the nesting habitat of black-bellied whistling ducks (*Dendrocygna autumnalis*).

We present illustrated examples of the system at the second level (formation-type) to illustrate application on a world basis. Our fourth level (biome) illustrations and fifth level (series) examples for North America are representative and are presented to illustrate the reality, adaptability, and use of the classification system; they are not meant to be either a definitive or final classification. Examples of the use of the system to the sixth (association) level are given here for selected biomes within formation types (Rocky Mountain Montane Conifer Forest) and in previous publications relating to the North American Southwest (Lowe 1961; Brown and Lowe 1974a, 1974b) and North America (Brown et al. 1979).

A DIGITIZED HIERARCHY OF THE WORLD'S NATURAL ECOSYSTEMS

Where:

1,000 = Biogeographic (Continental) Realm

1,100 = Vegetation

1,110 = Formation-type

1,111 = Climatic (Thermal) Zone

1,111.1 = Regional Formation (Biome)

1,111.11 = Series (Community of generic dominants)

1,111.111 = Association (of specific dominants)

1,111.1111 = Composition-structure-phase

3000 Neotropical and
Antarctican

4000 Oriental

5000 Ethiopian

6000 Australian

7000 Oceanic

Continental South America, Central America, and most of Mexico south of the Tropic of Cancer. Antarctica.

Southeast Asia, the Indian sub-continent; the Philippines, Indonesia, etc.

Africa south of the Sahara, Madagascar, and parts of the Arabian peninsula.

Australia and Tasmania.

Oceanic islands possessing a high degree of endemism.

The number preceding the comma (e.g., 1,000) refers to the world's biogeographic realms (table 1). Origin and evolutionary history are recognized here as being of primary importance in the determination and classification of natural ecosystems. The mappable reality of the world's biogeographic realms is, of course, interpretive in part, for it is dependent on the criteria used. In those regions where the components of one realm merge gradually with those of another and the assignment of biogeographic origin is difficult, we include such transitional areas (wide ecotones) in both realms. The following seven realms are adapted from Wallace (1876), (see also Hesse et al. 1937, Darlington 1957, Dansereau 1957, Walter 1973, International Union for Conservation of Nature and Natural Resources 1974, DeLaubenfels 1975, Cox et al. 1976):

1000 Nearctic	Continental North America exclusive of the tropics and most highland areas south of the Tropic of Cancer. We include those tropic-subtropic regions in and adjacent to the North American Southwest and the Caribbean.
2000 Palaearctic	Eurasia exclusive of the tropics; Africa north of the Sahel.

FIRST LEVEL

The first digit after the comma (e.g., 1,100) refers to vegetation in one of four generalized types. Included are all plant communities that are presumed to be established naturally under existing climate and the cessation of artificially disruptive (human-caused) influences (table 1).

All existing and potential natural vegetation (PNV) is classified as belonging to uplands (1,100) or wetlands (1,200) as in table 1; or cultivated lands (1,300, 1,400). Only the first two are considered here. The important adaptation inherent in plants and animals of terrestrial (upland) as opposed to hydric (wetland) biotic communities is recognized by this dichotomy (Martin et al. 1953, Ray 1975). As discussed here, wetlands include those periodically, seasonally, or continually submerged biotic communities populated by species and/or life forms different from the immediately adjacent (upland) vegetation. Certain systems having both upland and wetland characteristics and components (e.g., riparian forests) could be properly considered as belonging to both divisions. They are included here in the wetlands division (1,200).

SECOND LEVEL

Second digit after the comma (1,110) refers to one of the following recognized ecological formations, which on a worldwide basis are the formation-types ("biome-types") (table 2). On continents, these are referred to as formations which are vegetative responses (functions) to integrated environmental factors, most importantly, available soil moisture.

Upland Formations

Tundra ³	Communities existing in an environment so cold that moisture is unavailable during most of the year, precluding the establishment of trees, and in which the maximum development is that of perennial herbaceous plants, shrubs, lichens, and mosses, with grasses poorly represented or at least not dominant (fig. 1).
Forest and Woodland Communities	
Forest	Communities comprised principally of trees potentially over 15 m in height, and frequently characterized by closed and/or multilayered canopies (fig. 2).
Woodland	Communities dominated by trees with a mean potential height usually under 15 m, the canopy of which is usually open (sometimes very open) ⁴ or interrupted and singularly layered (fig. 3).
Scrubland	Communities dominated by sclerophyll or microphyll shrubs and/or multitemmed trees, generally not exceeding 10 m in height, usually presenting a closed physiognomy, or if open, interspaced with other perennial vegetation (fig. 4).

³The holistic integrity of a "tundra" formation is not without serious question. Treated here, tundra may also be composed of grasslands, scrublands, marshlands (wet tundra), and desertlands in an Arctic-Boreal Climatic Zone (table 4) (Billings and Mooney 1968, Billings 1973).

⁴The "savanna" formation (Dyksterhuis 1957) is here recognized as an ecotone between woodland and grassland. Those homogeneous areas in which the crowns of trees normally cover less than approximately 15% of the ground space are classified as grasslands where grasses are actually or potentially dominant (=savanna-grassland). Mosaics of grasslands and smaller or larger stands of trees and shrubs are "parklands" and are composed of two or more ecologically distinct plant formations (Walter 1973).

Grassland	Communities dominated actually or potentially by grasses and/or other herbaceous plants (fig. 5).
Desertland	Communities in an arid environment (usually less than 300 mm precipitation per annum) in which plants are separated by significant areas devoid of perennial vegetation (fig. 6).

Wetland Formations

Wet Tundra ⁵	Aquatic communities existing in an environment so cold that available plant moisture is unavailable during most of the year, precluding the establishment of trees and all but a low herbaceous plant structure in a hydric matrix.
Swamp-Forest; Riparian Forest	Aquatic communities possessing an overstory of trees potentially over 10 m in height, and frequently characterized by closed and/or multilayered canopies (fig. 7).
Swamp-Scrub; Riparian Scrub	Aquatic communities dominated by short trees and/or woody shrubs, generally under 10 m in height and often presenting a closed physiognomy (fig. 8).
Marshland	Aquatic communities, in which the principal plant components are herbaceous emergents which normally have their basal portions annually, periodically, or continually submerged (fig. 9).
Strand	Beach and river channel communities subject to infrequent but periodic submersion, wind-driven waves or spray. Plants are separated by significant areas devoid of perennial vegetation (fig. 10).
Submergents	Aquatic communities comprised entirely or almost entirely of plants mostly submerged or lacking emergent structures (fig. 11).

Some upland and wetland areas (e.g., dunes, lava flows, playas, sinks, etc.) are essentially without vegetation or are sparingly populated by simple organisms. For purposes of classification, these areas could be considered as belonging to a nonvascular formation-type (table 2).

⁵The holistic integrity of a "tundra" formation is not without serious question. Treated here, tundra may also be composed of grasslands, scrublands, marshlands (wet tundra), and desertlands in an Arctic-Boreal Climatic Zone (table 5) (Billings and Mooney 1968, Billings 1973).

THIRD LEVEL

Third digit beyond the comma (e.g., 1,111) refers to one of the four world climatic zones (Walter 1973, Ray 1975, Cox et al. 1976) in which minimum temperature remains a major evolutionary control of and within the zonation and formation-types (table 3).

Arctic—Boreal (Antarctic—Austrial)	Characterized by lengthy periods of freezing temperatures, with the coldest month isotherm -3°C (Koppen 1931), growing season of short duration (generally less than 100 days), occasionally interrupted by nights of below-freezing temperatures.
Cold Temperate	Freezing temperatures of short duration, although of frequent occurrence, during winter months. Potential growing season generally of from 100 to 200 days and confined to spring and summer when freezing temperatures are infrequent or absent.
Warm Temperate	Freezing temperatures of short duration but generally occurring every year during winter months. Potential growing season over 200 days with an average of less than 125-150 days being subject to temperatures lower than 0°C or chilling fogs.
Tropical-Subtropical	Infrequent or no 24-hour periods of freezing temperatures, chilling fogs, or wind.

FOURTH LEVEL

Fourth level (e.g., 1,111.1) refers to a subcontinental unit that is a major biotic community (= biome). These biomes are characterized by a distinctive evolutionary history—within a formation—and are centered in, but not necessarily restricted to, a biogeographic region or province possessing a particular precipitation pattern or other climatic regime (Pitelka 1941, Dice 1943, Odum 1945, Franklin 1977) (fig. 12). It is this and the fifth levels that have provided the most successful and useful mapping of states, provinces, and continents (Shantz and Zon 1924, Bruner 1931, Shreve 1951, Kuchler 1964, Franklin and Dyrness 1973, Brown 1973, Brown et al. 1977).

Biogeographic provinces and biomes are also the bases for the biosphere reserve program in the United States and elsewhere (International Union for Conservation of Nature and Natural Resources 1974, Franklin 1977). A partial summary of the biotic communities for Nearctic and adjacent Neotropical America is given in tables 4 and 5.

FIFTH LEVEL

Fifth level (e.g., 1,111.11) provides the principal plant-animal communities within the biomes, recognized and distinguished primarily on distinctive climax plant dominants (= series). These series, sometimes referred to as cover-types (Society of American Foresters 1954), are each composed of one or more biotic associations characterized by shared climax dominants within the same formation, zone, and biome (Oosting 1956, Lowe 1964, Franklin and Dyrness 1973, Pfister et al. 1977). For example, a ponderosa pine series would include those Rocky Mountain forest associations in which *Pinus ponderosa* was a dominant component (table 4). The diversity of tropical and subtropical climax dominants is often inherently more complex than in boreal and temperate communities.

It should be pointed out that some plants are highly facultative and the same species may be a dominant in more than one formation-type. As an extreme example, mesquite (*Prosopis juliflora*) may be the dominant life-form in certain woodland, scrubland, desertland, and even forest and disclimax grassland formations. The distribution of some plant dominants also span more than one climatic zone (e.g., mesquite, creosote (*Larrea tridentata*), and the introduced *Tamarix*). The plant and animal associates of these dominants usually differ when passing from one formation-type or climatic zone to another, however. Numerous generic dominants and some species are shared also by more than one biome (e.g., *Populus*, *Salix*, *Pinus*, *Quercus*, and *Larrea*). Closer investigation usually reveals that biomes do not normally share the same speciation within genera, and those that do may exhibit major genetic differences between biomes (Yang and Lowe 1970). For these reasons, the determination of fifth and sixth level communities will require interpretive revision and modification of the classification as field investigations accumulate.

SIXTH LEVEL

Sixth level (e.g., 1,111.111) refers to distinctive plant associations (and associates)⁶ based on the occurrence of particular dominant species more or less local (or regional) in distribution and generally equivalent to habit-types as outlined by Daubenmire and Daubenmire (1968), Layser (1974), and Pfister et al. (1977). While we demonstrate examples for certain communities within selected biomes (e.g., the Douglas-fir and Pine Series within the Rocky Mountain Montane Conifer Forest), the enormous numbers of sets preclude presentation here for the continental treatments in tables 4 and 5. These may be added at length for regional studies. Those communities judged to be seral or successional in nature may be preceded by an "s" at the seventh level.

⁶Includes associations (and successional associates) constituted by single species that are more precisely termed consociations (and successional consociates) (Weaver and Clements 1938).

SEVENTH LEVEL

Seventh level (e.g., 1,111.1111) accommodates detailed measurement and assessment of quantitative structure,

composition, density and other numerical determinations for dominants, understories, and other species. Implementation of this level in the system is designed for particular intensive studies for limited areas (Dick-Peddie and Moir 1979).

LITERATURE CITED

- Anderson, J. R. 1971. Land use classification schemes. *Photogrammetric Engineering* 37(4):379-387.
- Anderson, J. R., E. E. Hardy, and J. T. Roach. 1972. A land use classification system for use with remote sensor data. *Geological Survey Circular* 671, 15 p.
- Aubreville, A. 1958. Vegetation map of Africa south of the Tropic of Cancer. Oxford University Press, Oxford, England.
- Billings, W. D. 1973. Tundra grasslands, herblands and shrublands and the role of herbivores. In *Grassland ecology*. R. H. Kessel, editor. Louisiana State University Press, Baton Rouge.
- Billings, W. D., and H. A. Mooney. 1968. The ecology of arctic and alpine plants. *Biological Review* 43:481-629.
- Braun, E. L. 1967. Deciduous forests of eastern North America. 596 p. Hafner Publishing Co., New York, N.Y., and London, England.
- Braun-Blanquet, J. 1932. Plant sociology: The study of plant communities. (Translated by G. D. Fuller and H. S. Conrad) 439 p. McGraw-Hill Book Co., Inc., New York, N.Y.
- Braun-Blanquet, J. 1964. *Pflanzensoziologie*. 865 p. Third edition. Springer-Verlag, Vienna, Austria, and New York, N.Y.
- Brown, D. E. 1973. The natural vegetative communities of Arizona. (map, scale 1:500,000) State of Arizona, Arizona Resources Information System, Phoenix.
- Brown, D. E., and C. H. Lowe. 1973. A proposed classification for natural and potential vegetation in the Southwest with particular reference to Arizona. Arizona Game and Fish Department, Federal Aid Project Report W-53-R-22-WP-4-JL, 26 p.
- Brown, D. E., and C. H. Lowe. 1974. A digitized computer-compatible classification for natural and potential vegetation in the Southwest with particular reference to Arizona. *Journal of the Arizona Academy of Science* 9(2):1-11.
- Brown, David E., Charles H. Lowe, and Charles P. Pase. 1977. The biotic communities of the Southwest. (map, scale 1:1,000,000) USDA Forest Service General Technical Report RM-41, 1 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.
- Brown, D. E., C. H. Lowe, and C. P. Pase. 1979. A digitized classification system for the biotic communities of North America, with community (series) and association examples for the Southwest. *Journal of the Arizona-Nevada Academy of Science* 14(1):1-16.
- Bruner, W. E. 1931. The vegetation of Oklahoma. *Ecological Monographs* 1:99-188.
- Comision Tecnico Consultiva para la Determinacion Regional de los Coeficientes de Agostadero. 1974. Coeficientes de agostadero de la Republica Mexicana, Estado de Sonora. Secretaria de Agricultura y Ganaderia, Mexico D.F.
- Cowardin, L. M., V. Carter, F. C. Golet, and E. T. Laroe. 1975. Interim classification of wetlands and aquatic habitats of the United States. In *Proceedings of the national wetland classification and inventory workshop*. 110 p. U.S. Fish and Wildlife Service.
- Cox, B. C., I. N. Healy, and P. D. Moore. 1976. Biogeography, an ecological and evolutionary approach. 194 p. Second edition. Blackwell Science Publishing, Oxford and London, England; Edinburgh, Scotland; and Melbourne, Australia.
- Curtis, J. T. 1959. The vegetation of Wisconsin. 657 p. University of Wisconsin Press, Madison.
- Dansereau, P. 1957. Biogeography. 394 p. Ronald Press, New York, N.Y.
- Darlington, P. J., Jr. 1957. Zoogeography. 675 p. John Wiley and Sons, Inc., New York, N.Y.
- Dasmann, R. S. 1972. Towards a system for classifying natural regions of the world and their representation by National Parks and Reserves. *Biological Conservation* 4:247-255.
- Daubenmire, R. F. 1952. Forest vegetation of northern Idaho and adjacent Washington and its bearing on concepts of vegetation classification. *Ecological Monographs* 22:301-330.
- Daubenmire, R. F. 1969. Ecologic plant geography of the Pacific Northwest. *Madrono* 29:111-128.
- Daubenmire, R., and J. Daubenmire. 1968. Forest vegetation of eastern Washington and northern Idaho. Washington Agricultural Experiment Station Technical Bulletin 60, 104 p.
- DeLaubenfels, D. J. 1975. Mapping the world's vegetation. *Geographical Series* 4, 246 p. Syracuse University Press, N.Y.
- Dice, L. R. 1943. The biotic provinces of North America. 78 p. University of Michigan Press, Ann Arbor.
- Dick-Peddie, W. A., and W. H. Moir. 1970. Vegetation of the Organ Mountains, New Mexico. Colorado State University, Range Science Department Science Serial 4, 28 p.
- Driscoll, Richard S., John W. Russell, and Marvin C. Meier. 1978. Recommended national level classification system for renewable resource assessments. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo. 44 p. (mineo).
- Dyksterhuis, E. J. 1957. The savannah concept and its use. *Ecology* 38:435-442.

- Ellenberg, H., and D. Mueller-Dombois. 1967. Tentative physiognomic-ecological classification of plant formations of the earth. *Bericht Geobotanical Institute ETH, Stftg, Rubel, Zurich*, 37:21-55.
- Fittkau, E. J. 1969. The fauna of South America. In *Bio-geography and ecology in South America*. W. Junk, the Hague, Netherlands.
- Flores Mata, F., J. Jimenez Lopez, X. Madrigal Sanchez, F. Moncayo Ruiz, and F. Takaki Takaki. 1971. Memoria del mapa de tipos de vegetacion de la Republica Mexicana. Secretaria de Recursos Hidraulicos, Subsecretaria de Planeacion, Direccion de Agrologia, Mexico, D. F. (map, scale 1:2,000,000)
- Fosberg, F. R. 1961. A classification of vegetation for general purposes. *Tropical Ecology* 2:1-28.
- Franklin, J. F. 1977. The biosphere reserve program in the United States. *Science* 195:262-267.
- Franklin, J. R., and C. T. Dyrness. 1973. Natural vegetation of Oregon and Washington. USDA Forest Service General Technical Report PNW-8, 417 p. Pacific Northwest Forest and Range Experiment Station, Portland, Oreg.
- Garrison, George A., Ardell J. Bjugstad, Don A. Duncan, Mont E. Lewis, and Dixie R. Smith. 1977. Vegetation and environmental features of forest and range ecosystems. U.S. Department of Agriculture, Agriculture Handbook 475, 68 p. Washington, D.C.
- Gaussen, H. 1953. A proposed ecological vegetation map. *Surveying and Mapping* 13:168-173.
- Gaussen, H. 1955. Les divisions ecologiques du monde. Paris centre Natinal de la Recherche Scientifique, 59th International Colloquim, 1954.
- Gentry, H. S. 1942. Rio Mayo plants: A study of the flora and vegetation of the valley of the Rio Mayo in Sonora. Carnegie Institute of Washington Publication 527, 328 p.
- Gleason, H. A. 1939. The individualistic concept of the plant association. *American Midland Naturalist* 21:91-110.
- Golet, F. C., and J. S. Larson. 1974. Classification of freshwater wetlands in the glaciated Northeast. Bureau of Sport Fisheries and Wildlife Research Publication 116, 56 p.
- Halliday, W.E.D. 1937. A forest classification for Canada. Canada Department of Mines Research, Forest Service Bulletin 89, 189 p.
- Hesse, R., W. C. Allee, and K. P. Schmidt. 1937. Ecological animal geography. 597 p. Wiley and Sons, New York, N.Y.
- International Union for Conservation of Nature and Natural Resources. 1973. A working system for classification of world vegetation. Occasional Paper 5, 21 p.
- International Union for Conservation of Nature and Natural Resources. 1974. Biotic provinces of the world—Further development of a system for defining and classifying natural regions for purposes of conservation. Occasional Paper 9, 57 p.
- Jensen, H. A. 1947. A system for classifying vegetation in California. California Fish and Game Department 33:199-266.
- Krajina, V. J. 1965. Biogeoclimatic zones and biogeocoenoses of British Columbia. In *Ecology of western North America*. University of British Columbia, Department of Botany, Vancouver.
- Koppen, W. 1931. *Gundriss der Klimakunde*. Walter de Gruyter Co., Berlin, Germany.
- Kuchler, A. W. 1964. The potential natural vegetation of the conterminous United States. American Geographical Society Special Publication 361 (map).
- Kuchler, A. W. 1967. Vegetation mapping. 472 p. Ronald Press, New York, N.Y.
- Lactate, D. S. 1969. Guidelines for biophysical land classification. Department of Fisheries and Forestry, Canadian Forest Service Publication 1264, 61 p. Ottawa, Ontario, Canada.
- Layser, E. F. 1974. Vegetative classification: Its application to forestry in the northern Rocky Mountains. *Journal of Forestry* 72:354-357.
- Lowe, C. H. 1961. Biotic communities in the sub-Mogollon region of the inland Southwest. *Journal of the Arizona Academy of Science* 2:40-49.
- Lowe, C. H. 1964. Arizona's natural environment: Landscape and habitats. 136 p. University of Arizona Press, Tucson.
- Martin, A. C., N. Hotchkiss, F. M. Uhler, and W. S. Bourn. 1953. Classification of wetlands of the United States. U.S. Fish and Wildlife Service Special Science Report on Wildlife 20, 14 p.
- Mueller-Dombois, Dieter, and Heinz Ellenberg. 1974. Aims and methods of vegetation ecology. 547 p. John Wiley and Sons, New York, N.Y.
- Munz, P.A., and D. D. Keck. 1949. California plant communities. *El Aliso* 2:87-105.
- Munz, P. A., and D. D. Keck. 1950. California plant communities—Supplement. *El Aliso* 2:199-202.
- Odum, E. P. 1945. The concept of the biome as applied to the distribution of North American birds. *Wilson Bulletin* 57:191-201.
- Oosting, H. J. 1956. The study of plant communities. 440 p. Second edition. W. H. Freeman and Co., San Francisco, Calif.
- Patton, David R. 1978. RUN WILD: A storage and retrieval system for wildlife habitat information. USDA Forest Service General Technical Report RM-51, 8 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.
- Pfister, R. D. 1975. Land capability assessment by habitat types. In *America's renewable resource potential—The turning point*. Proceedings of the national convention of the Society of American Foresters.
- Pfister, R. D., B. L. Kovalchik, S. F. Arno, and R. C. Presby. 1977. Forest habitat types of Montana. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah.
- Pitelka, F. A. 1941. Distribution of birds in relation to major biotic communities. *American Midland Naturalist* 25:11-137.
- Ray, G. C. 1975. A preliminary classification of coastal and marine environments. International Union for Conservation of Nature and Natural Resources Occasional Paper 14, 26 p.
- Shantz, H. L., and R. Zon. 1924. Natural vegetation. U.S. Department of Agriculture, Atlas of American Agriculture Plot 1, Section E (map), Washington, D.C.
- Shelford, V. E. 1963. The ecology of North America. 610 p. University of Illinois Press, Urbana.

- Shelford, V. E., and F. Shreve, editors. 1926. Naturalists guide to the Americas. 761 p. Wilkins and Wilkins, Baltimore, Md.
- Shreve, F. 1942. The desert vegetation of North America. *Botanical Review* 8:195-246.
- Shreve, F. 1951. Vegetation and flora of the Sonoran desert. In Volume 1, Vegetation. Carnegie Institute of Washington Publication 591, 192 p.
- Society of American Foresters. 1954. Forest cover types of North America (exclusive of Mexico). Society of American Foresters, Washington, D.C.
- Stewart, R. E., and H. A. Konrud. 1971. Classification of natural ponds and lakes in the glaciated prairie region. Bureau of Sport Fisheries and Wildlife Research Publication 92, 57 p.
- United Nations Educational, Scientific, and Cultural Organization. 1973. International classification and mapping of vegetation. 38 p. Paris, France.
- Wallace, A. R. 1876. The geographical distribution of animals, with a study of the relations of living and extinct faunas and as elucidating the past changes of the earth's surface. MacMillan and Co., London, England.
- Walter, H. 1973. Vegetation of the earth in relation to climate and the eco-physiological conditions. 237 p. English University Press Limited, London, England.
- Weaver, J. E., and F. E. Clements. 1938. Plant ecology. 601 p. McGraw-Hill Book Co., New York, N.Y.
- Whittaker, R. H., editor. 1973. Ordination and classification of communities. 737 p. Dr. W. Junk, the Hague, Netherlands.
- Wieslander, A. E. 1935. A vegetation type map of California. *Madrono* 3:140-144.
- Yang, T. W., and C. H. Lowe. 1970. Chromosome variation in ecotypes of *Larrea divaricata* in the North American desert. *Madrono* 19:161-163.
- Zoltai, S. C., F. C. Pollett, J. K. Jeglum, and G. D. Adams. 1975. Developing a wetland classification for Canada. *Proceedings of the North American forest soils conference* 4:497-511.

TABLES

Table 1.—Summary for the natural vegetation of the world to the first level

Biogeographic realm	1. Upland vegetation	2. Wetland vegetation
1,000 Nearctic	1,100	1,200
2,000 Palaearctic	2,100	2,200
3,000 Neotropical—Antarctican	3,100	3,200
4,000 Oriental	4,100	4,200
5,000 Ethiopian	5,100	5,200
6,000 Australian	6,100	6,200
7,000 Oceanic	7,100	7,200

Table 2.—Summary for the natural upland and wetland vegetation of the world to the second level (formation-type)

Biogeographic realm	Formation-type					
	1. Tundra	2. Forest and Woodland	3. Scrub-land	4. Grassland	5. Desertland	6. Non-vascular
UPLAND						
1,000 Nearctic	1,110	1,120	1,130	1,140	1,150	1,160
2,000 Palaearctic	2,110	2,120	2,130	2,140	2,150	2,160
3,000 Neotropical—Antarctican	3,110	3,120	3,130	3,140	3,150	3,160
4,000 Oriental	4,110	4,120	4,130	4,140	4,150	4,160
5,000 Ethiopian	5,110	5,120	5,130	5,140	5,150	5,160
6,000 Australian	6,110	6,120	6,130	6,140	6,150	6,160
7,000 Oceanic	7,110	7,120	7,130	7,140	7,150	7,160
	1. Wet tundra	2. Forest*	3. Swamp-Scrub	4. Marshland	5. Strand	6. Submergent
WETLAND						
1,000 Nearctic	1,210	1,220	1,230	1,240	1,250	1,260
2,000 Palaearctic	2,210	2,220	2,230	2,240	2,250	2,260
3,000 Neotropical—Antarctican	3,210	3,220	3,230	3,240	3,250	3,260
4,000 Oriental	4,210	4,220	4,230	4,240	4,250	4,260
5,000 Ethiopian	5,210	5,220	5,230	5,240	5,250	5,260
6,000 Australian	6,210	6,220	6,230	6,240	6,250	6,260
7,000 Oceanic	7,210	7,220	7,230	7,240	7,250	7,260

*Swamp-forests, bog forests, and riparian forests.

Table 3.—Summary for the natural upland and wetland vegetation of Nearctic and adjacent Neotropical North America to the third level

Formation	Climatic (thermal) zone			
	1. Arctic—Boreal	2. Cold Temperate	3. Warm Temperate	4. Tropical—Subtropical
UPLAND				
1,110 Tundra	1,111			
1,120 Forests and Woodland	1,121	1,122	1,123	1,124
1,130 Scrubland	1,131	1,132	1,133	1,134
1,140 Grassland	1,141	1,142	1,143	1,144
1,150 Desertland	1,151	1,152	1,153	1,154
1,160 Nonvegetated	1,161	1,162	1,163	1,164
WETLAND				
1,210 Wet Tundra	1,211			
1,220 Forest*	1,221	1,222	1,223	1,224
1,230 Swamp-Scrub	1,231	1,232	1,233	1,234
1,240 Marshland	1,241	1,242	1,243	1,244
1,250 Strand	1,251	1,252	1,253	1,254
1,260 Submergent	1,261	1,262	1,263	1,264

*Swamp-forests, bog forests, and riparian forests.

Table 4.—Nomenclature of upland biotic communities (fourth level) of Nearctic and adjacent Neotropical North America with some community (series) and association level examples

1,100 Nearctic Upland Vegetation	122.313 <i>Pseudotsuga menziesii</i> —Mixed Conifer (<i>Abies concolor</i> , <i>Pinus flexilis</i> , <i>Acer glabrum</i> , <i>Populus tremuloides</i> , <i>Pinus ponderosa</i>) Association*
1,110 Tundra Formation	122.314 <i>Populus tremuloides</i> subclimax Association*
1,111 Arctic Tundras	122.32 Pine Series*
1,111.1 Polar (High Arctic) Tundra	122.321 <i>Pinus ponderosa</i> Association*
1,111.11 Sedge—Moss (Meadow) Series*	122.322 <i>Pinus ponderosa</i> —Mixed Conifer Association*
1,111.12 Cushion Plant—Lichen Series*	122.323 <i>Pinus ponderosa</i> — <i>Quercus gambelii</i> Association*
1,111.2 Alaskan (Low Arctic) Coastal Tundra (fig. 13)	122.324 <i>Pinus ponderosa</i> — <i>Quercus arizonica</i> Association*
1,111.21 Sedge—Grass—Moss Series*	122.325 <i>Pinus ponderosa</i> — <i>Juniperus deppeana</i> Association*
1,111.22 Heath—Avens Series*	122.326 <i>Populus tremuloides</i> subclimax Association*
1,111.3 Canadian (Barren Ground = Low Arctic) Tundra	122.327 <i>Pinus flexilis</i> Association*
1,111.31 Heath—Lichen Series*	122.328 <i>Pinus ponderosa</i> — <i>Abies concolor</i> Association*
1,111.4 Arctic Alpine Tundra	122.33 Gambel Oak Series*
1,111.41 Heath—Lichen Series*	122.331 <i>Quercus gambelii</i> Association*
1,111.5 Rocky Mountain Alpine Tundra*** (fig. 14)	122.4 Great Basin Conifer Woodland (fig. 25)
1,111.51 Lichen—Moss Series*	122.41 Pinyon—Juniper Series*
1,111.52 Mixed Herb Series*	122.5 Sierran—Cascade Montane Conifer Forest (fig. 26)
1,111.53 Avens—Sedge Series*	122.51 Mixed Conifer Series*
1,111.54 Woodrush Series*	122.52 Red Fir Series*
1,111.6 Sierran—Cascade Alpine Tundra	122.53 Pacific Silver Fir Series*
1,111.61 Lichen—Moss Series*	122.54 White Fir Series*
1,111.62 Mixed Herb Series*	122.55 Pine Series*
1,111.7 Adirondack—Appalachian Alpine Tundra	122.56 Black Oak Series*
1,111.71** Lichen—Moss Series*	122.6 Madrean Montane Conifer Forest
120 Forest and Woodland Formation	122.61 Douglas-fir—Mixed Conifer Series*
121 Boreal Forests and Woodlands	122.62 Pine Series*
121.1 Canadian Subarctic Conifer Forest and Woodland (North American Taiga) (figs. 15 and 16)	123 Warm Temperate Forests and Woodlands
121.11 White Spruce—Balsam Fir Series*	123.1 Southeastern Mixed Deciduous and Evergreen Forest (figs. 27 and 28)
121.12 Black Spruce Series*	123.11 Pine Series*
121.2 Appalachian Subalpine Conifer Forest (fig. 17)	123.12 Mixed Mesophytic Series*
121.21 Red Spruce—Balsam Fir Series*	123.13 Mixed Hardwood Hammock Series*
121.3 Rocky Mountain Subalpine Conifer Forest and Woodland***	123.2 Californian Mixed Evergreen Forest (fig. 29)
121.31 Engelmann Spruce—Alpine Fir Series* (fig. 18)	123.21 Mixed Mesophytic Series*
121.32 Bristlecone Pine—Limber Pine Series* (fig. 19)	123.22 Big-cone Spruce Series*
121.4 Sierran—Cascade Subalpine Conifer Forest (fig. 20)	123.3 Californian Evergreen Woodland (fig. 30)
121.41 Limber Pine—Lodgepole Pine Series*	123.31 Encinal (Oak) Series*
121.42 Whitebark Pine Series*	123.32 Walnut Series*
121.43 Mountain Hemlock Series*	123.33 Oak—Pine Series*
121.5 Madrean Subalpine Conifer Forest	123.4 Madrean Evergreen Forest and Woodland (fig. 31)
121.51 Pine—Religious Fir Series*	123.41 Encinal (Oak) Series*
122 Cold Temperate Forests and Woodlands	123.42 Oak—Pine Series*
122.1 Northeastern Deciduous Forest (fig. 21)	123.5 Relict Conifer Forest and Woodland (figs. 32 and 33)
122.11 Oak—Hickory Series*	123.51 Closed-cone Pine Series*
122.12 Oak—Chestnut Series*	123.52 Cypress Series*
122.13 Beech—Maple Series*	124 Tropical—Subtropical Forests and Woodlands
122.14 Oak—Pine Series*	124.1 Caribbean Montane Rain Forest (fig. 34)
122.15 Maple—Basswood Series*	124.11 Palm Series*
122.16 Hemlock—White Pine—Hardwood Series*	124.12 Tabenuco—Palocolorado Series*
122.2 Pacific Coastal (Oregonian) Conifer Forest (figs. 22 and 23)	124.2 Caribbean Cloud Forest
122.21 Coast Redwood Series*	124.21 Ocotea—Roble de Sierra Series*
122.22 Douglas-fir Series*	124.3 Caribbean Evergreen Forest (figs. 35 and 36)
122.23 Western Hemlock Series*	124.31 Pine Series*
122.24 Sitka Spruce Series*	124.32 Tabebuia—Gallo Series*
122.25 Grand Fir Series*	124.4 Caribbean Deciduous Forest
122.3 Rocky Mountain (= Petran) Montane Conifer Forest (fig. 24)	124.41 Mixed Short Tree Series*
122.31 Douglas-fir—White fir (= Mixed Conifer) Series*	124.5 Tamaulipan Semideciduous Forest (fig. 37)
122.311 <i>Pseudotsuga menziesii</i> Association*	124.51 Mixed Short Tree Series*
122.312 <i>Pseudotsuga menziesii</i> — <i>Abies concolor</i> Association*	124.6 Sinaloan Deciduous Forest (fig. 38)
	124.61 Mixed Short Tree Series*
	130 Scrubland Formation
	131 Arctic—Boreal Scrublands
	131.1 Alaskan (Low Arctic) Coastal Scrub (fig. 39)
	131.11 Crowberry Series*
	131.12 Birch—Willow Series*

*Examples only.

**The first "1" (in front of comma and representing the Nearctic realm) is understood and dropped for tabular convenience only from this point onward.

***Further consideration may warrant separation of this biotic community into Rocky Mountain and Great Basin units.

Table 4.—Continued

- 131.2 Canadian (Low Arctic, Barren Ground) Subpolar Scrub
 - 131.21 Birch—Willow Series*
 - 131.22 Alder Series*
- 131.3 Alaskan Alpine and Subalpine Scrub (fig. 40)
 - 131.31 Willow—Birch Series*
- 131.4 Adirondack—Appalachian Alpine and Subalpine Scrub
 - 131.41 Hobblebush Series*
- 131.5 Rocky Mountain Alpine and Subalpine Scrub (fig. 41)
 - 131.51 Willow Series*
 - 131.52 Spruce Elfinwood Series*
 - 131.53 Bristlecone Pine Elfinwood Series*
- 131.6 Sierran—Cascade Alpine and Subalpine Scrub
 - 131.61 Limber Pine—Lodgepole Pine Elfinwood Series*
 - 131.62 Whitebark Pine Elfinwood Series*
- 132 Cold Temperate Scrublands
 - 132.1 Great Basin Montane Scrub (fig. 42)
 - 132.11 Oak—Scrub Series*
 - 132.12 Mountainmahogany Series*
 - 132.13 Maple—Scrub Series*
 - 132.14 Serviceberry Series*
 - 132.15 Bitterbush Series*
 - 132.16 Mixed Deciduous Series*
 - 132.2 Sierran—Cascade Montane Scrub
 - 132.21 Manzanita Series*
 - 132.22 Mixed Scrub Series*
 - 132.3 Plains Deciduous Scrub (fig. 43)
 - 132.31 Oak—Scrub Series*
 - 132.32 Sumac Series*
 - 132.33 Mixed Deciduous Series*
- 133 Warm Temperate Scrublands
 - 133.1 Californian Chaparral (fig. 44)
 - 133.11 Chamise Series*
 - 133.12 Scrub Oak Series*
 - 133.13 Manzanita Series*
 - 133.14 Ceanothus Series*
 - 133.15 Mixed Evergreen Sclerophyll Series*
 - 133.2 Californian Coastal Scrub (fig. 45)
 - 133.21 Sage Series*
 - 133.22 Mixed Shrub Series*
 - 133.3 Interior Chaparral (fig. 46)
 - 133.31 Scrub Oak Series*
 - 133.32 Manzanita Series*
 - 133.33 Ceanothus Series*
 - 133.34 Mountainmahogany Series*
 - 133.35 Silktassel Series*
 - 133.36 Mixed Evergreen Sclerophyll Series*
 - 133.4 Southeastern Maritime Scrub
 - 133.41 Scrub Oak Series*
- 134 Tropical—Subtropical Scrublands
 - 134.1 Caribbean Thorn Scrub
 - 134.11 Mixed Deciduous Series*
 - 134.2 Tamaulipan Thorn Scrub (fig. 47)
 - 134.21 Mixed Deciduous Series*
 - 134.3 Sinaloan Thorn Scrub (fig. 48)
 - 134.31 Mixed Deciduous Series*
 - 134.32 Mesquite Disclimax Series*
- 140 Grassland Formation
 - 141 Arctic—Boreal Grasslands
 - 141.1 Alaskan (Low Arctic) Coastal Grassland (fig. 49)
 - 141.11 Cottongrass Series*
 - 141.2 Canadian (Low Arctic) Grassland
 - 141.21 Bunchgrass Series*
 - 141.3 Appalachian Subalpine (Balds) Grassland (fig. 50)
 - 141.31 Oatgrass—Herb Series*
 - 141.4 Rocky Mountain Alpine and Subalpine Grassland (fig. 51)
 - 141.41 Bunchgrass Series*
 - 141.42 Sedge—Forb—Grass Series*
 - 141.5 Sierran—Cascade Alpine and Subalpine Grassland
 - 141.51 Bunchgrass Series*
 - 141.52 Sedge—Forb—Grass Series*
 - 141.6 Madrean Alpine and Subalpine Grassland
 - 141.61 Bunchgrass Series*
 - 142 Cold Temperate Grasslands
 - 142.1 Plains Grassland
 - 142.11 Bluestem "tall-grass" Series* (fig. 52)
 - 142.12 Grama Series* (fig. 53)
 - 142.13 Buffalo-grass Series*
 - 142.14 Mixed "short-grass" Series*
 - 142.15 Shrub—Grass Disclimax Series*
 - 142.2 Great Basin Shrub—Grassland
 - 142.21 Wheatgrass Series*
 - 142.22 Mixed Bunchgrass Series* (fig. 54)
 - 142.23 Ricegrass Series*
 - 142.24 Sacaton Series*
 - 142.25 Cheatgrass Disclimax Series*
 - 142.3 Pacific Coastal (Oregonian) Grassland
 - 142.31 Mixed Bunchgrass Series*
 - 142.4 Rocky Mountain Montane Grassland (fig. 55)
 - 142.41 Mixed Meadow Series*
 - 142.42 Rush Series*
 - 142.43 Fern Series*
 - 142.44 Iris Disclimax Series*
 - 142.5 Sierran—Cascade Montane Grassland
 - 142.51 Mixed Meadow Series*
 - 142.52 Rush Series*
 - 143 Warm Temperate Grasslands
 - 143.1 Scrub—Grassland (Semidesert Grassland) (fig. 56)
 - 143.11 Grama Grass—Scrub Series*
 - 143.12 Tobosa Grass—Scrub Series*
 - 143.13 Curley-mesquite Scrub Series*
 - 143.14 Sacaton—Scrub Series*
 - 143.15 Mixed Grass—Scrub Series*
 - 143.16 Shrub—Scrub Disclimax Series*
 - 143.2 Californian Valley Grassland (fig. 57)
 - 143.21 Annual Disclimax Series*
 - 144 Tropical—Subtropical Grasslands
 - 144.1 Caribbean Savanna Grassland (fig. 58)
 - 144.21 Beardgrass Series*
 - 144.2 Gulf Coastal (Tamaulipan) Grassland (fig. 59)
 - 144.21 Beardgrass Series*
 - 144.3 Sonoran Savanna Grassland (fig. 60)
 - 144.31 Mixed Perennial Grass Series*
 - 144.32 Grama Series*
 - 144.33 Three-awn Series*
- 150 Desertland Formation
 - 151 Arctic—Boreal Desertlands
 - 151.1 Polar Desert-Scrub (fig. 61)
 - 151.11 Moss—Lichen Series*
 - 152 Cold Temperate Desertlands
 - 152.1 Great Basin Desertscrub (fig. 62)
 - 152.11 Sagebrush Series*
 - 152.12 Shadscale Series*
 - 152.13 Blackbrush Series*
 - 152.14 Rabbitbrush Series*
 - 152.15 Winterfat Series*
 - 152.16 Mixed Scrub Series*
 - 152.17 Saltbush Series*
 - 153 Warm Temperate Desertlands
 - 153.1 Mohave Desert-Scrub (fig. 63)
 - 153.11 Creosotebush Series*
 - 153.12 Blackbrush Series*
 - 153.13 Mesquite Series*
 - 153.14 Bladdersage Series*
 - 153.15 Joshua tree Series*
 - 153.16 Catclaw Series*
 - 153.17 Saltbush Series*

Table 4.—Continued

153.2 Chihuahuan Desert-Scrub (fig. 64)	154.1 Sonoran Desert-Scrub (fig. 65)
153.21 Creosotebush—Tarbush Series*	154.11 Creosotebush—Bursage ("Lower Colorado Valley" et al.) Series*
153.22 Whitethorn Series*	154.12 Paloverde—Mixed Cacti ("Arizona Upland") Series*
153.23 Sandpaperbush Series*	154.13 Brittlebush—Ironwood ("Plains of Sonora") Series*
153.24 Mesquite Series*	154.14 Copal—Torote ("Central Gulf Coast") Series*
153.25 Succulent Series*	154.15 Agave—Bursage ("Vizcaino") Series*
153.26 Mixed Scrub Series*	154.16 Paloblanco—Agria ("Magdalena") Series*
153.27 Saltbush Series*	154.17 Saltbush Series*
154 Tropical—Subtropical Desertlands	

Table 5.—Nomenclature of wetland biotic communities (fourth level) of Nearctic and adjacent Neotropical North America with some community (series) and association level examples for the North American Southwest

1,200 Nearctic Wetland Vegetation	224 Tropical—Subtropical Swamp, Riparian, and Oasis Forests
1,210 Wet Tundra Formation	224.1 Caribbean Interior Swamp and Riparian Forests
1,211 Arctic Wet Tundras	224.11 Mixed Evergreen Series*
1,211.1 Polar (High Arctic) Wet Tundra	224.12 Palm Series*
1,211.11 Sedge—Moss Series*	224.2 Caribbean Maritime Swamp-Forest (fig. 71)
1,211.12 Rush Series*	224.21 Mangrove Series*
1,211.2 Greenlandian Wet Tundra	224.3 Tamaulipan Interior Swamp and Riparian Forests
1,211.21 Sedge—Moss Series*	224.31 Mixed Evergreen Series*
1,211.3 Alaskan (Coastal) Wet Tundra (fig. 66)	224.32 Palm Series*
1,211.31 Sedge—Moss Series*	224.4 Sinaloa Interior Swamp and Riparian Forests (fig. 72)
1,211.4 Canadian (Low Arctic) Wet Tundra	224.41 Mixed Evergreen Series*
1,211.41 Sedge—Grass—Moss Series*	224.42 Palm Series*
1,211.42** Rush Series*	224.5 Sonoran Riparian and Oasis Forests
220 Forest Formation	224.51 Palm Series* (fig. 73)
221 Boreal Swamp and Riparian Forests	224.52 Mesquite Series* (fig. 74)
221.1 Canadian Swamp Forest (fig. 67)	224.53 Cottonwood—Willow Series*
221.11 Black Spruce—Tamarack Series*	
221.12 Willow—Alder Series*	230 Swamp-Scrub Formation
222 Cold Temperate Swamp and Riparian Forests	231 Arctic—Boreal Swamp-Scrubs
222.1 Northeastern Bog, Swamp, and Riparian Forests (fig. 68)	231.1 Polar (High Arctic) Swamp-Scrub
222.11 White Cedar Series*	231.11 Willow Series*
222.12 Cottonwood—Willow Series*	231.2 Greenlandian Swamp-Scrub
222.13 Ash—Maple Series*	231.21 Willow Series*
222.2 Plains and Great Basin Riparian Deciduous Forest	231.3 Alaskan Swamp-Scrub
222.21 Cottonwood—Willow Series*	231.31 Willow Series*
222.3 Rocky Mountain Riparian Deciduous Forest	231.4 Canadian Swamp-Scrub (fig. 75)
222.31 Cottonwood—Willow Series*	231.41 Willow Series*
222.32 Mixed Broadleaf Series*	231.42 Leatherleaf Series*
222.4 Sierran—Cascade Riparian Deciduous Forest	231.5 Adirondack—Appalachian Alpine and Subalpine Swamp and Riparian Scrub
222.41 Cottonwood—Willow Series*	231.51 Willow Series*
222.42 Mixed Broadleaf Series*	231.6 Rocky Mountain Alpine and Subalpine Swamp and Riparian Scrub (fig. 76)
222.5 Pacific Coastal (Oregonian) Riparian Deciduous Forest	231.61 Willow Series*
222.51 Cottonwood—Willow Series*	231.7 Sierran—Cascade Alpine and Subalpine Swamp and Riparian Scrub
223 Warm Temperate Swamp and Riparian Forests	231.71 Willow Series*
223.1 Southeastern Swamp and Riparian Forest (fig. 69)	232 Cold Temperate Swamp and Riparian Scrubs
223.11 Tupelo—Cypress Series*	232.1 Northeastern Deciduous Swamp-Scrub
223.12 Southern White Cedar Series*	232.11 Willow Series*
223.13 Mixed Hardwood (Bottomland) Series*	232.12 Sweet Gale Series*
223.14 Cottonwood—Willow Series*	232.13 Buttonbush Series*
223.2 Southwestern Riparian Deciduous Forest and Woodland (fig. 70)	232.14 Cranberry Series*
223.21 Cottonwood—Willow Series*	232.15 Mixed Narrowleaf Series*
223.22 Mixed Broadleaf Series*	232.2 Plains and Great Basin Riparian Scrub (fig. 77)
223.3 Californian Riparian Deciduous Forest and Woodland	232.21 Willow Series*
223.31 Cottonwood—Willow Series*	232.22 Saltcedar Disclimax Series*
223.32 Mixed Broadleaf Series*	232.3 Rocky Mountain Riparian Scrub (fig. 78)
	232.31 Willow—Dogwood Series*
	232.4 Sierran—Cascade Riparian Scrub
	232.41 Willow Series*
	232.5 Pacific Coastal (Oregonian) Swamp and Riparian Scrub
	232.51 Willow Series*
	232.52 Mixed Narrowleaf Series*

*One or more examples only are given for the fifth level.

**The first "1" (in front of comma and representing the Nearctic realm) is understood and dropped for tabular convenience only from this point onward.

Table 5.—Continued

- 233 Warm Temperate Riparian and Swamp Scrubs
 233.1 Southeastern Mixed Deciduous and Evergreen Swamp Scrub
 233.11 Mixed Broadleaf Series*
 233.2 Interior Southwestern Swamp and Riparian Scrub (fig. 79)
 233.21 Seepwillow Series*
 233.22 Saltcedar Disclimax Series*
 233.3 Californian Deciduous Swamp and Riparian Scrub
 233.31 Mixed Narrowleaf Series*
- 234 Tropical—Subtropical Swamp and Riparian Scrub
 234.1 Cribbean Interior Swamp Scrub
 234.11 Mixed Evergreen Series*
 234.2 Caribbean Maritime Swamp-Scrub
 234.21 Mangrove Series*
 234.3 Tamaulipan Interior Swamp and Riparian Scrub
 234.31 Mixed Evergreen Series*
 234.4 Tamaulipan Maritime Swamp-Scrub
 234.41 Mangrove Series*
 234.5 Sinaloan Interior Swamp and Riparian Scrub
 234.51 Mixed Evergreen Series*
 234.6 Sinaloan Maritime Swamp-Scrub (fig. 80)
 234.61 Mangrove Series*
 234.7 Sonoran Deciduous Swamp and Riparian Scrub (fig. 81)
 234.71 Mixed Scrub Series*
 234.72 Saltcedar Disclimax Series*
- 240 Marshland Formation
 241 Arctic—Boreal Marshlands
 241.1 Polar (High Arctic) Marshland
 241.11 Sedge Series*
 241.12 Rush Series*
 241.2 Greenlandian Marshland
 241.21 Sedge Series*
 241.22 Rush Series*
 241.3 Alaskan Maritime (Coastal) Marshland
 241.31 Sedge Series*
 241.32 Rush Series*
 241.4 Canadian Interior Marshland (fig. 82)
 241.41 Sedge Series*
 241.42 Rush Series*
 241.5 Canadian Maritime (Coastal) Marshland
 241.51 Sedge Series*
 241.6 Adirondack—Appalachian Alpine and Subalpine Marshland
 241.61 Sedge Series*
 241.62 Rush Series*
 241.7 Rocky Mountain Alpine and Subalpine Marshland
 241.71 Rush Series*
 241.72 Manna Grass Series*
 241.8 Sierran—Cascade Alpine and Subalpine Marshland
 241.81 Rush Series*
- 242 Cold Temperate Marshlands
 242.1 Northeastern Interior Marshland
 242.11 Sedge Series*
 242.12 Rush Series*
 242.13 Bur-reed Series*
 242.14 Cattail Series*
 242.15 Bulrush Series*
 242.16 Arrow-arum Series*
 242.17 Water Lily Series*
 242.18 Reed Canarygrass Series*
 242.2 Northeastern Maritime (Coastal) Marshland
 242.21 Saltgrass Series*
 242.3 Plains Interior Marshland (fig. 83)
 242.31 Rush Series*
 242.32 Bur-reed Series*
 242.33 Cattail Series*
 242.34 Bulrush Series*
 242.4 Rocky Mountain Montane Marshland
 242.41 Rush Series*
- 242.5 Great Basin Interior Marshland
 242.51 Rush Series*
 242.52 Saltgrass Series*
 242.6 Sierran—Cascade Montane Marshland
 242.61 Rush Series*
 242.7 Pacific Coastal (Oregonian) Interior Marshland
 242.71 Rush Series*
 242.8 Pacific Coastal (Oregonian) Maritime Marshland
 242.81 Saltgrass Series*
 242.82 Glasswort Series*
- 243 Warm Temperate Marshlands
 243.1 Southeastern Interior Marshland
 243.11 Cattail Series*
 243.2 Southeastern Maritime Marshland (fig. 84)
 243.21 Saltmarshgrass Series*
 243.3 Chihuahuan Interior Marshland
 243.31 Saltgrass Series*
 243.4 Mohavian Interior Marshland
 243.41 Rush Series*
 243.42 Saltgrass Series*
 243.5 Madrean Marshland
 243.51 Rush Series*
 243.6 Californian Interior Marshland
 243.61 Cattail Series*
 243.7 Californian Maritime Marshland
 243.71 Cordgrass Series*
 243.72 Glasswort Series*
- 244 Tropical—Subtropical Marshland
 244.1 Caribbean Interior Marshland
 244.11 Cattail Series*
 244.12 Giant Reed Series*
 244.13 Sawgrass Series*
 244.2 Caribbean Maritime Marshland
 244.21 Saltgrass Series*
 244.3 Tamaulipan Interior Marshland
 244.31 Cattail Series*
 244.32 Giant Reed Series*
 244.4 Gulf Coast Maritime Marshland
 244.41 Saltgrass Series*
 244.5 Sinaloan Interior Marshland
 244.51 Cattail Series*
 244.6 Sinaloan Maritime Marshland
 244.61 Glasswort Series*
 244.7 Sonoran Interior Marshland (fig. 85)
 244.71 Cattail Series*
 244.72 Giant Reed Series*
 244.73 Bulrush Series*
 244.74 Threesquare Series*
 244.8 Sonoran Maritime Marshland
 244.81 Saltgrass Series*
 244.82 Glasswort Series*
- 250 Strand Formation
 251 Arctic—Boreal Strands
 251.1 Polar Maritime Strand***
 251.2 Greenlandian Strand***
 251.3 Alaskan Maritime Strand***
 251.4 Canadian Interior (Stream and Lake) Strand***
 251.5 Canadian Maritime Strand***
 251.6 Adirondack—Appalachian Alpine and Subalpine Stream and Lake Strand***
 251.7 Rocky Mountain Alpine and Subalpine Stream and Lake Strand***
 251.8 Sierran—Cascade Alpine and Subalpine Stream and Lake Strand***

***Our incomplete knowledge of these biotic communities precludes presentation of representative fifth (series) level examples.

Table 5.—Continued

252 Cold Temperate Strands	261.72 Pondweed Series*
252.1 Northeastern Interior (Stream and Lake) Strand***	261.8 Sierran—Cascade Alpine and Subalpine Submergents (fig. 90)
252.2 Northeastern Maritime Strand	261.81 Phytoplankton Series*
252.21 Sandreed Series*	261.82 Pondweed Series*
252.3 Plains Interior (Stream and Lake) Strand	
252.31 Annual Series*	262 Cold Temperate Submergents
252.4 Rocky Mountain Montane Stream and Lake Strand	262.1 Northeastern Inland Submergents
252.41 Annual Series*	262.11 Pondweed Series*
252.5 Great Basin Interior Strand	262.2 Northeastern Marine Submergents
252.51 Annual Series*	262.21 Ruppia Series*
252.6 Sierran—Cascade Interior Strand	262.22 Eelgrass Series*
252.61 Annual Series*	262.3 Plains Inland Submergents
252.7 Pacific Coastal (Oregonian) Interior Strand***	262.31 Pondweed Series*
252.8 Pacific Coastal (Oregonian) Maritime Strand (fig. 86)	262.4 Rocky Mountain Montane Submergents
252.81 Sandreed Series*	262.41 Pondweed Series*
	262.5 Great Basin Inland Submergents
253 Warm Temperate Strands	262.51 Pondweed Series*
253.1 Southeastern Interior Strand***	262.6 Sierran—Cascade Montane Submergents
253.2 Southeastern Maritime Strand*** (fig. 87)	262.61 Pondweed Series*
253.3 Chihuahuan Interior Strand	262.7 Pacific Coastal (Oregonian) Inland Submergents
253.31 Annual Series*	262.71 Pondweed Series*
253.4 Mohavian Interior Strand	262.8 Pacific Coastal (Oregonian) Marine Submergents
253.41 Annual Series*	262.81 Ruppia Series*
253.42 Mixed Scrub Series*	262.82 Eelgrass Series*
253.5 Madrean Stream and Lake Strand	262.83 Brown Kelp Series*
253.51 Annual Series*	
253.6 Californian Interior Strand	263 Warm Temperate Submergents
253.61 Annual Series*	263.1 Southeastern Inland Submergents
253.7 Californian Maritime Strand	263.11 Pondweed Series*
253.71 Mixed Scrub Series*	263.2 Southeastern Marine Submergents
253.72 Sea-grass Series*	263.21 Ruppia Series*
253.73 Green Algae Series*	263.3 Chihuahuan Inland Submergents
253.74 Brown Algae Series*	263.31 Pondweed Series*
253.75 Red Algae Series*	263.4 Mohavian Inland Submergents
	263.41 Pondweed Series*
254 Tropical—Subtropical Strands	263.5 Madrean Inland Submergents
254.1 Caribbean Interior Strand***	263.51 Pondweed Series*
254.2 Caribbean Maritime Strand***	263.6 Californian Inland Submergents
254.3 Tamaulipan Interior Strand***	263.61 Pondweed Series*
254.4 Gulf Coast (Tamaulipan) Maritime Strand***	263.62 Milfoil Series*
254.5 Sinaloa Interior Strand	263.7 Californian Marine Submergents
254.51 Annual Series*	263.71 Ruppia Series*
254.6 Sinaloa Maritime Strand	263.72 Eelgrass Series*
254.61 Mixed Scrub Series*	263.73 Giant Kelp Series*
254.7 Sonoran Interior Strand (fig. 88)	263.74 Feather-boa Kelp Series*
254.71 Mixed Scrub Series*	263.75 Southern Sea Palm Series*
254.72 Annual Series*	
254.8 Sonoran Maritime Strand (fig. 89)	264 Tropical—Subtropical Submergents
254.81 Mixed Scrub Series*	264.1 Caribbean Inland Submergents
	264.11 Pondweed Series*
260 Submergent Vegetation	264.2 Caribbean Marine Submergents
261 Arctic—Boreal Submergents	264.21 Green Algae Series*
261.1 Polar Marine Submergents	264.3 Tamaulipan Inland Submergents
261.11 Phytoplankton Series*	264.31 Pondweed Series*
261.2 Greenlandian Inland Submergents	264.4 Gulf Coastal Marine Submergents
261.21 Phytoplankton Series*	264.41 Ruppia Series*
261.3 Alaskan Marine Submergents	264.5 Sinaloa Inland Submergents
261.31 Phytoplankton Series*	264.51 Pondweed Series*
261.4 Canadian Inland Submergents	264.6 Sinaloa Marine Submergents
261.41 Phytoplankton Series*	264.61 Phytoplankton Series*
261.5 Canadian Marine Submergents	264.7 Sonoran Inland Submergents
261.51 Phytoplankton Series*	264.71 Pondweed Series*
261.6 Adirondack—Appalachian Alpine and Subalpine Submergents	264.72 Milfoil Series*
261.61 Phytoplankton Series*	264.8 Sonoran Marine Submergents
261.7 Rocky Mountain Alpine and Subalpine Submergents	264.81 Ruppia Series*
261.71 Phytoplankton Series*	264.82 Eelgrass Series*

FIGURES

Figure 1.—Tundra Formation (5,110.) Alpine zone of Mt. Kilimanjaro in equatorial Africa.
(Photo by G. Burrows)

Figure 2.— Forest Subformation (1,120.) Mature sitka spruce and hemlock forest on Admiralty Island, Alaska. (USDA Forest Service photo 396402)

Figure 3.—Woodland Subformation (3,120.) *Nothofagus* woodland in Patagonia, South America. (Time-Life photo)

Figure 4.—Scrubland Formation (5,130.) *Acacia—Themeda—Pennisetum* thorn scrub in East Africa, Nairobi National Park.

Figure 5.—Grassland Formation (1,140.) The southern Great Plains in Texas. (USDA Soil Conservation Service photo)

Figure 6.— Desertland Formation (5,150.) Bronzed chenopod community in the Arabian Desert.
(Time-Life photo)

Figure 7.—Swamp Forest Formation (1,220.) Live oak and bald cypress in Osceola National Forest, Florida. (Photo by B.W. Muir)

Figure 8.—Swampscrub Formation (1,230.) A recently burned community of the introduced saltcedar (*Tamarix chinensis*) along the Gila River in Arizona. (Photo by R.L. Todd)

Figure 9.—Marshland Formation (1,240.) Freshwater cattail marsh on the Colorado River between California and Arizona. (Photo by R.L. Todd)

Figure 10.—Strand Formation (1,250.)

Figure 11.—Submergents (1,260.) Kelp beds and sea otters off west coast of North America.
(Sierra Club photo)

Figure 12.—Biogeographic provinces of Nearctic and adjacent Neotropical North America as used in the classification system.

Figure 13.—Alaskan coastal tundra (1,111.2). Caribou in sedge—grass—moss community in Mt. McKinley National Monument, Alaska. (USDI National Park Service photo)

Figure 14.—Rocky Mountain alpine tundra (111.5) in Rio Grande National Forest, Colorado.
(USDA Forest Service photo 449546)

Figure 15.—Canadian subarctic conifer forest (121.1). Aerial view of taiga near Old Crow, Yukon. Forest, woodland, scrubland, tundra, and various wetland formations are all present in this Arctic—Boreal environment. (USDI Fish and Wildlife Service photo)

Figure 16.—Canadian subarctic conifer forest (121.1). A “Great Lakes” fasciation of a virgin black spruce—feather moss community in Big Falls Experimental Forest in Minnesota. (USDA Forest Service photo 519898)

Figure 17.—Appalachian subalpine conifer forest (121.2). Virgin stand of red spruce in West Virginia. (USDA Forest Service photo 403775)

Figure 18.—Rocky Mountain subalpine conifer forest (121.31). Engelmann spruce—alpine fir community in Arapaho National Forest, Colorado. (USDA Forest Service photo 222452)

Figure 19.—Rocky Mountain subalpine conifer woodland (121.32). An open woodland of bristlecone pines on San Francisco Mountain in the Coconino National Forest, Arizona.

Figure 20.—Sierra—Cascade subalpine conifer forest (121.4). Mt. Olympus in Olympic National Park. (USDI National Park Service photo)

Figure 21. — Northeastern deciduous forest (122.1). Beech — maple community in Bartlett Experimental Forest, New Hampshire. (USDA Forest Service photo 373307)

Figure 22. — Pacific coastal (Oregonian) conifer forest (122.2). Hemlock — sitka spruce community in Tongass National Forest, Alaska. (USDA Forest Service photo 447467)

Figure 23.—Pacific coastal (Oregonian) conifer forest (122.2). Coast redwood community in Del Norte County, California. (USDA Forest Service photo 506455)

Figure 24.—Rocky Mountain montane conifer forest (122.3). Mature ponderosa stand, Apache-Sitgreaves National Forest, Arizona. (USDA Forest Service photo 482934)

Figure 25.—Great Basin conifer woodland (122.4). Pinyon—juniper community in Coconino National Forest, Arizona. (USDA Forest Service photo 19433A)

Figure 26.—Sierran—Cascade montane conifer forest (122.5). Red fir community in Tahoe National Forest, California. (USDA Forest Service photo 309484)

Figure 27.— Southeastern mixed deciduous and evergreen forest (123.1). An almost pure stand of longleaf pine on Croatan National Forest, North Carolina. (USDA Forest Service photo 471023)

Figure 28.—Southeastern mixed deciduous and evergreen forest (123.1). Mixed deciduous forest in Shenandoah National Park, Virginia. (USDI National Park Service photo)

Figure 29.— Californian mixed evergreen forest (123.2). Mixed mesophytic community on the University of California's Hastings Reservation in Carmel Valley, California. (Photo by R.J. Gutierrez)

Figure 30.— Californian evergreen woodland (123.3). Encinal (oak) community or California live oaks (*Quercus agrifolia*) near San Antonio in Baja California Norte. (Photo by M.D. Robinson)

Figure 31.—Madrean evergreen woodland (123.4) Encinal (oak) community of Mexican blue (*Quercus oblongifolia*) and Emory oaks (*Q. emoryi*) in the Coronado National Forest, Arizona. (USDA Forest Service photo 418611)

Figure 32.—Relict conifer forest (123.5). A postclimax community of Arizona cypress at 1,760 m on north-facing slope on Coronado National Forest, Arizona. Such forests are restricted to north-facing slopes and draws at mid-elevations from sub-Mogollon encinal woodlands and interior chaparral in Arizona southeastward to Nuevo Leon, Mexico.

Figure 33. — Relict conifer woodland forest (123.5). Community of Monterey cypress (*Cupressus macrocarpa*) in Monterey County, California, in 1903. (USDA Forest Service photo 48662).

Figure 34. — Caribbean rain forest (124. 1). Palm forest in Luquillo Experimental Forest, Puerto Rico. (USDA Forest Service photo 516441)

Figure 35.—Caribbean evergreen forest (124.3). Hicaco Valley, Caribbean National Forest, Puerto Rico. (USDA Forest Service photo 449380)

Figure 36.—Caribbean evergreen forest (124.3). Conifer forest of Honduras pine, hibiscus, and Australian pine near Taro Perez, Luquillo Experimental Forest, Puerto Rico. (USDA Forest Service photo 515427)

Figure 37.—Tamaulipan semideciduous forest (124.5). Mixed short tree community in Bensten State Park, Texas.

Figure 38.—Sinaloan deciduous forest (124.6). Mixed short tree community near Alamos, Sonora.

Figure 39.—Alaskan coastal scrub (131.1). Katmai National Monument, Alaska. (USDI National Park Service photo)

Figure 40.—Alaskan alpine scrub (131.3). Aniakchak Crater, Alaska. (USDI National Park Service photo)

Figure 41.—Rocky Mountain alpine scrub (131.5). Shrub willows dominate this site in San Juan National Forest, Colorado.

Figure 42.—Great Basin montane scrub (132.1). Oak brush (*Quercus gambelii*) in Uncompahgre National Forest, Colorado (USDA Forest Service photo 382283)

Figure 43.—Plains deciduous scrub (132.3). Mottes of midget or shinnery oak (*Quercus havardii*) on dunes near the New Mexico-Texas border. (USDA Soil Conservation Service photo)

Figure 44.—Californian chaparral (133.1). Los Padres National Forest, California.

Figure 45.—Californian coastal scrub (133.2). Mixed community near vicinity of Dana Point, Orange County, California.

Figure 46.—Interior chaparral (133.3). Sierra Ancha Experimental Forest, Arizona.

Figure 47.—Tamaulipan thorn-scrub (134.2) northwest of Laredo, Tex.

Figure 48.—Sinaloan thorn-scrub (134.3) near Opodepe, Sonora.

Figure 49.—Alaskan coastal grassland (141.1). Grizzly bear in Mt. McKinley National Park.
(USDI National Park Service photo)

Figure 50.—Appalachian subalpine grassland (141.3). Gregory "Bald" in Great Smokey National Park in 1934. (Photo by C.C. Campbell)

Figure 51.— Rocky Mountain subalpine grassland (141.4) in Fishlake National Forest, Utah.
(USDA Forest Service photo 508423)

Figure 52.—Plains grassland (142.11). Bluestem community (midgrass prairie) on the Bluett Wildlife Management Area, Roosevelt County, New Mexico.

Figure 53.—Plains grassland (142.12). Shortgrass prairie of blue grama, buffalo grass, and plains prickly pear near Boyers, Colo. (USDA Forest Service photo 382244)

Figure 54.—Great Basin grassland (142.22). Wheatgrass community near Kalotus, Wash.
(USDA Soil Conservation Service photo)

Figure 55.—Rocky Mountain montane grassland (142.4). Thurber fescue dominates a rich mixture of forbs and grasses in extensive open parks on Black Mesa, Colorado.

Figure 56.—Scrub—grassland (semidesert grassland) (143.1) in Sulphur Springs Valley, Arizona.

Figure 57.—California valley grassland (143.2) in Stanislaus County, California,
(USDA Forest Service photo 378227)

Figure 58. — Caribbean savanna grassland (144.1). Caribbean National Forest, Villalba, Puerto Rico. (USDA Forest Service photo 449364)

Figure 59. — Gulf coastal grassland (144.2) near Henrietta, Tex. (USDA Soil Conservation Service photo)

Figure 60.—Sonoran savanna grassland (144.3) near Benjamin Hill, Sonora.
(Photo by R.E. Tomlinson)

Figure 61.—Polar desert-scrub (151.1). The desertland aspect of certain tundra communities is shown here within a Rocky Mountain alpine tundra formation, Arapaho National Forest, Colorado. (USDA Forest Service photo 449580)

Figure 62.—Great Basin desert scrub (152.1). Shadscale—winterfat community on the Desert Experimental Range, Utah. (USDA Forest Service photo 468710)

Figure 63.—Mohave desert-scrub (153.1). *Yucca*—*Larrea tridentata* association in Clark County, Nevada.

Figure 64.—Chihuahuan desert-scrub (153.2). *Larrea*—*Flourensia* association near Sanderson, Tex.

Figure 65.—Sonoran desert-scrub (154.1). Central Gulf Coast community near Libertad, Sonora.

Figure 66.—Alaskan wet tundra (211.3) on the Cille River Delta, Alaska. (USDI Fish and Wildlife Service photo)

Figure 67.— Canadian swampforest (221.1) of alders, willows, and black spruce near Bearhead Lake, Manitoba, Canada. (USDI Fish and Wildlife Service photo)

Figure 68.—Northeastern riparian forest (222.1). A cottonwood—maple community along the Des Moines River in Iowa. (USDA Forest Service photo 437131)

Figure 69. — Southeastern swamp-forest (223.1) in North Carolina dominated by bald cypress (*Taxodium distichum*). (USDA Forest Service photo (395087))

Figure 70.—Southwestern riparian deciduous forest and woodland (223.2). Mixed broadleaf community along Beaver Creek in the Coconino National Forest, Arizona.

Figure 71.—Caribbean maritime swamp-forest (224.2) of mangrove (*Rhizophora mangle*) in the Virgin Islands. (USDA Forest Service photo 518630)

Figure 72.—Sinaloan riparian evergreen forest (224.4). A forest of Mexican blue palms (*Sabal uresana*) growing mostly in a box canyon in the Sierra Babiso, Sonora.

Figure 73.—Sonoran oasis forest (224.51). A linear community of California fan palms (*Washingtonia filifera*) within the Sonoran Desert in Arizona growing along a narrow spring-fed drainage.

Figure 74.—Sonoran riparian deciduous woodland (224.52). A mesquite “bosque” community along the Verde River in Arizona.

Figure 75.—Canadian bog swamp-scrub (231.4). Leatherleaf (*Chamaedaphne calyculata*) community in Massachusetts. The forest in background is composed of black spruce (*Picea mariana*), tamarack (*Larix laricina*), and red maple (*Acer rubrum*). (USDI Fish and Wildlife Service photo)

Figure 76.—Rocky Mountain alpine riparian scrub within tundra (231.6). Shrub willows dominate these drainages in the Arapaho National Forest, Colorado. (USDA Forest Service photo 449579)

Figure 77.—Great Basin deciduous riparian scrub (232.2) along Little Colorado River near Springerville, Apache County, Ariz.

Figure 78.—Rocky Mountain riparian scrub (232.3). Thinleaf alder—willow—dogwood community on the Apache-Sitgreaves National Forest, Arizona. (USDA Forest Service photo 437368)

Figure 79.—Interior southwestern riparian scrub (233.2). Pioneer community of *Baccharis glutinosa*, *Chilopsis linearis*, and *Senecio* sp. on flood plain, Santa Cruz County, Arizona.

Figure 80.—Sinaloan maritime swamp-scrub (234.6) of mangroves (*Avicennia germinans*) near Boca del Yaqui, Sonora.

Figure 81.—Sonoran riparian scrub (234.7). A mixed community of saltcedar (*Tamarix chinensis*, *T. aphylla*), quailbush (*Atriplex lentiformis*), dondia (*Suaeda torreyana*), arrowweed (*Pluchea sericea*), and cottonwood (*Populus fremonti*) along the Colorado River near Yuma, Ariz. (Photo by H. Shaw)

Figure 82.—Canadian interior marshland (241.4) in Minnesota. Rush community in foreground; spruce—tamarack forest (221.1) in background. (USDA Forest Service photo 62051)

Figure 83.—Plains interior marshland (242.3), Arrowwood National Wildlife Refuge, North Dakota. (USDI Fish and Wildlife Service photo)

Figure 84.— Southeastern maritime (intertidal) marshland (243.2) at mouth of Satilla River, Georgia. (USDI Fish and Wildlife Service photo)

Figure 85.—Sonoran interior marshland (244.7) of giant reed (*Phragmites communis*) along Colorado River in Arizona. (Photo by R.L. Todd)

Figure 86.—Pacific coastal (Oregonian) (intertidal) strand (252.8) near Port Angeles, Wash.
(USDI National Park Service photo)

Figure 87.— Southeastern maritime (intertidal) strand (253.2), Assateague Island, Virginia.
(USDI National Park Service photo)

Figure 88.—Sonoran interior strand (254.7). Desert wash within the Sonoran Desert in Arizona. Periodically scoured, these “desert” environments are nonetheless true wetland environments.

Figure 89.—Sonoran maritime strand (254.8) near Cruz Piedra, Sonora.

Figure 90.—Sierran—Cascade alpine submergent vegetation (261.8) in the form of phytoplankton is the only vegetation in this glacial pool—home of the golden trout. (USDI National Park Service photo)

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An increasing need for careful husbandry of the earth's natural resources has renewed interest in the classification and mapping of ecosystems. The inventory of our remaining biotic entities is particularly urgent because the increased aspirations of a constantly growing world population are placing ever greater stress on these generous, but finite, living resources.

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Rocky
Mountains

Southwest

Great
Plains

U.S. Department of Agriculture
Forest Service

Rocky Mountain Forest and Range Experiment Station

The Rocky Mountain Station is one of eight regional experiment stations, plus the Forest Products Laboratory and the Washington Office Staff, that make up the Forest Service research organization.

RESEARCH FOCUS

Research programs at the Rocky Mountain Station are coordinated with area universities and with other institutions. Many studies are conducted on a cooperative basis to accelerate solutions to problems involving range, water, wildlife and fish habitat, human and community development, timber, recreation, protection, and multiresource evaluation.

RESEARCH LOCATIONS

Research Work Units of the Rocky Mountain Station are operated in cooperation with universities in the following cities:

Albuquerque, New Mexico
Bottineau, North Dakota
Flagstaff, Arizona
Fort Collins, Colorado*
Laramie, Wyoming
Lincoln, Nebraska
Lubbock, Texas
Rapid City, South Dakota
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*Station Headquarters: 240 W. Prospect St., Fort Collins, CO 80526