

ECOLOGICAL REGIONS OF NORTH AMERICA

Toward a Common Perspective

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PROFILE OF THE CEC

In North America, we share vital natural resources, including air, oceans and rivers, mountains and forests. Together, these natural resources are the basis of a rich network of ecosystems, which sustain our livelihoods and well-being. If they are to continue being a source of future life and prosperity, these resources must be protected. This stewardship of the North American environment is a responsibility shared by Canada, Mexico and the United States.

The Commission for Environmental Cooperation (CEC) is an international organization whose members are Canada, Mexico and the United States. The CEC was created under the North American Agreement on Environmental Cooperation (NAAEC) to address regional environmental concerns, help prevent potential trade and environmental conflicts and promote the effective enforcement of environmental law. The Agreement complements the environmental provisions established in the North American Free Trade Agreement (NAFTA).

The CEC accomplishes its work through the combined efforts of its three principal components: the Council, the Secretariat and the Joint Public Advisory Committee (JPAC). The Council is the governing body of the CEC and is composed of the highest-level environmental authorities from each of the three countries. The Secretariat implements the annual work program and provides administrative, technical and operational support to the Council. The Joint Public Advisory Committee is composed of fifteen citizens, five from each of the three countries, and advises the Council on any matter within the scope of the Agreement.

MISSION

The CEC facilitates cooperation and public participation to foster conservation, protection and enhancement of the North American environment for the benefit of present and future generations, in the context of increasing economic, trade and social links among Canada, Mexico and the United States.

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1. International Working Group

Members of the original Trilateral Working Group and the CEC Working Group have been fairly consistent. The latter was composed of professionals from the CCEA, Environment Canada, British Columbia Ministry of Environment, Lands and Parks (BCMELP), Canadian Plains Research Centre (University of Regina) Environmental Protection Agency (US-EPA), Instituto Nacional de Ecología (INE), Instituto de Ecología, A.C. (IdeE), Instituto Nacional de Estadística, Geografía e Informática (INEGI) and the Instituto de Ecología of the Universidad Nacional Autónoma de México (IdeE, UNAM). Members of the CEC Working Group were:

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I. NORTH AMERICA FROM AN ECOLOGICAL PERSPECTIVE

North America is a continent rich in diversity. Climatic types range from the polar arctic to tropical forests. Topographically, the continent contains a valley with the lowest elevation on earth and also extensive chains of tall mountains. It is blessed with rich natural resources as well as an unmatched variety of scenic natural beauty. Possessed of great variety among its populations of native animals and plants, since before recorded history it has also seen the development of a rich diversity in human cultures.

Ecologically, North America is a mosaic. Many of its ecosystems possess unique natural features of worldwide significance and of great individuality. Traditionally, humans in Western society have viewed themselves and their activities as separate and isolated from these ecosystems but it is ever more apparent that human activities and the environment are highly

The science of ecology and its unit of study, "ecosystem," is vital for understanding and describing our environment. A compound of the prefix, "eco-," derived from the Greek word "oiko/oikos," meaning "house" or "habitation," and "system," referring to the relationships or connections between biological and physical parts, "ecosystem" is a dynamic complex of organisms (biota)—including humans—and their physical environment, which interact as a functional unit in nature. Ecosystems can vary greatly in size and range from completely natural, pristine conditions to those that have been heavily modified by humans (adapted from Government of Canada, 1996).

interrelated and will always be, no matter how far technological advancement proceeds, and that without healthy ecosystems, a high quality of human life and economic prosperity cannot be sustained. This view is central to what has become known as the "ecological perspective," which recognizes the

importance of viewing ourselves as part of, rather than separate from, the world's ecosystems.

Besides its ecological richness, North America also possesses many of the environmental problems characteristic of this century. In 1994, the Commission for Environmental Cooperation (CEC) was established by Canada, Mexico, and the United States to address environmental concerns common to the three countries. The CEC derives its formal mandate from the North American Agreement on Environmental Cooperation (NAAEC), the environmental side accord to the North American Free Trade Agreement (NAFTA). This accord represents a cornerstone of the overall agreement, and is a statement of the signatory countries' intent to examine more closely mutual environmental-economic relationships. That approach will necessitate purposeful actions to think, plan, and act in terms of ecosystems. But ecosystems know no political boundaries. The migration of birds, the ranging of animals, the distribution of flora, and defining geographical features transcend state or provincial, territorial, even national borders. Recognizing that environmental issues are complex and not restricted by such jurisdictional boundaries but are shared among nations, the three countries have thus accepted the need to move away from an emphasis on individual environmental and socio-economic concerns, and shift towards a more comprehensive, continental scale approach—one that includes not only assessments of trade, but also strives to foster cooperative work to protect the environment, to insure the sustainability of resources, and to study the effect of human activities on ecosystems.

Why is an ecological perspective important?

The ecosystems of North America are diverse and highly productive, containing valuable natural resources. The range of environmental conditions and of our social and economic activities attest to this fact, as our livelihood across the continent has been very much linked, historically and at present, to this inherent wealth. Ecosystems are dynamic, constantly changing over time. Humans, however, are now one of nature's foremost agents of change. Interventions by humans have impacted the continent in different ways, over local and large areas, and through different time periods. Recent signs of the widespread degradation of ecosystems, better knowledge of "cause and effect" relationships—especially those wrought by humans, concerns about sustaining basic life-support systems, and possible direct impacts on human health from ecosystem changes are among many factors that have

forced nations to re-examine policies and programs. Many questions arise: Will forestry as we know it remain sustainable? Will agricultural areas remain productive? Will wildlife species and habitats survive? Will aquatic ecosystems recover from pollution? Understanding the linkages and connections among human activities and the environment requires nations to “think, plan and act” strategically in terms of ecosystems.

It is essential that ecosystems do not become stressed beyond the threshold at which undesirable and irreversible changes will set in. We need to understand the diversity of ecosystems, their importance to a variety of human and non-human needs, and their condition and health over the long term. Failure to do so undermines our ability to assess their integrity and eventually could result in environmental degradation, impoverishing the economic wealth of nations.

The present volume and its accompanying maps represent a first attempt at holistically classifying and mapping ecological regions across all three countries of the North American continent. The study has been built upon efforts that had begun individually in all three countries. In 1993, a North American Workshop on Environmental Information was convened between Canada, Mexico, and the United States. Over eighty specialists from the three countries concurred that having a sound ecological perspective was essential for improved understanding and effective environmental management and planning. Work was supported by federal departments, universities, nongovernmental organizations (NGOs) and institutes in all three countries, and proceeded through a process of consultation, collaboration and compromise. Core support and funding were offered by the CEC, as the project goals were in keeping with its overall mission.

Concepts

Viewing people as parts of ecosystems

Like other organisms, human beings rely on specific geographical areas or spaces for our ability to provide basic needs like food, clothing and shelter. It is vital, therefore, that we have a geographic perspective as we plan and conduct our activities, and that we consider what impacts these may have on environmental resources.

Ecological regions define spaces in an ecologically meaningful way. They are effective for national and regional state of the environment reports, environmental resource inventories

and assessments, setting regional resource management goals, determining carrying capacity, as well as developing biological criteria and water quality standards. The development of a clear understanding of regional and large continental ecosystems is critical for evaluating ecological risk, sustainability and health.

If the concepts of holistic ecosystem classifications are now well documented, though, the data required for its application across Canada, Mexico, and United States are still of variable quality—ranging from good to poor. The experience in applying broader-based ecosystem classification has been more extensive in Canada and the United States; however, these principles had not yet been applied to Mexico in a thorough fashion and the importance of undertaking that research in this study cannot be overstated. For this study, a common analytical methodology was required for viewing in proper perspective the continental ecosystems shared by the three countries. This methodology examines North American ecology at multiple scales, from large continental ecosystems to subdivisions of these that correlate more detailed physical and biological settings with human activities on two levels of successively smaller units. The attached maps and following report represent the working group’s best consensus on the distribution and characteristics of major ecosystems on all three levels throughout the three North American countries.

The ecological perspective adopted for this study is predicated on:

- accepting that interactions between the environment (air, water, land and biota), and human activities (social, cultural and economic systems) are inseparable;
- realizing that humans are now the major driving force behind most ecological changes;
- recognizing environmental thresholds and their importance and linkage to human activities;
- incorporating the needs of current and future generations; and
- implementing a long-term perspective that is anticipatory, preventative and sustainable.

As an approach for information-gathering and reporting, an ecological perspective can improve our understanding of the conditions and trends that are shaping vital aspects of North American society and our environment. As a planning tool, an ecological perspective can ensure that a comprehensive, holistic approach is taken on environmental issues, rather than an

isolated or sector-by-sector analysis. It can assist in setting priorities for action that consider the unique and critical environmental assets found in North America.

Ecological Regions of North America, as presented here, is a view of continental ecological regions that has been developed to enhance the capability of both NGOs and governmental organizations to assess the nature, condition and trends of the major ecosystems in North America. It is offered for use to a wide range of professionals and the general public. The authors also hope that it will be seen as having educational utility, focusing on the sustainability and conservation of resources. By necessity, the notion of resources is broadly interpreted, embracing the traditional ideas of resources (i.e., timber, arable soils, water) but also including the ecosystems of which they are a part.

As resource inventories, species and environmental assessments, and general scientific knowledge have improved over the past decade, so too has the capability to see ecological perspectives on continental, national and regional levels. The growing interest in applying an ecological approach to environmental assessments, risk analysis and resource management has made these continuing improvements very timely. As examples intended to illustrate the value of this methodology in environmental description, case studies are included in Section IV. Although these analyses are founded on the broadest level of ecological regionalization, they provide valuable information that could be used in making policy decisions related to the environment, and are intended as examples of the kind of analysis that could also be applied on more detailed levels of ecological regionalization.

Ecological Characterization—Our Window on the Future

Widespread attention to environmental issues is, without any doubt, one of the most distinctive characteristics of the last two decades. The perception of impending environmental crisis held by many scientists and members of the public has led to a reconsideration of long-held tenets of biological ecology and related environmental studies. Chief among these is the realization that very close-range studies, while still important, no longer suffice because they so easily yield a picture that is too fragmented for analysis, description, and decision-making on a region-wide, continental or global level. This wider perspective is often lacking because our knowledge of ecosystems on a regional and global level is inadequate, and because

the development of a common language for a coherent classification system is still in its infancy.

In addition, the relation between human societies and nature, the practice of sustainable resource management, the environmental effects of different economic and trading systems, and the basic human need for a healthy environment are all concepts newly incorporated into the public consciousness. An orientation strictly based around the family, or on local or even national issues, important as they are, simply no longer suffices. We must see and understand local events and issues in terms of their wider impact.

The Commission for Environmental Cooperation is in the privileged position of being one of the very few environmental organizations whose mandate was initiated with a supra-national, region-wide purpose. It is concerned with the whole of North America, a continent notable for its great ecosystem, species and genetic richness, spanning political borders. The CEC recognizes that it must maintain a region-wide ecological perspective in order to contribute to the development of a healthier relationship between our societies and the natural world of which we are a part and upon which we closely depend.

This project of region-wide ecosystem characterization was intended to help address these issues. The sessions involved intense research and discussion between many experts of the three countries who, in attempting to balance the great significance political frontiers have had on the history of environmental change in North America, recognized fully the importance of transboundary effects that are derived from the inherent continuity of natural ecosystems. They also recognized the importance of evolving a common language in the classification systems in order to be able to treat ecological regions in a coherent, holistic fashion. The participating experts and organizations all had a deep commitment to the development of environmentally sound strategies, based on solid knowledge of natural processes.

The workshops, meetings and discussions held during this process were an achievement on their own. The maps and the report that have resulted attempt to describe the diversity and continuity of the ecosystems of this region, and it is hoped that they will bear fruit in facilitating communication between scientists, decision makers, environmentalists and anyone interested in the enormous ecological richness of this wide continent. However, a process so complex never really ends,

and the CEC and the project working group recognize that the maps will be refined by further knowledge. To the extent that the project continues to yield improvements in knowledge, communication, and the development of better environmental policies guaranteeing our environmental legacy for future generations, we will have succeeded.

II. ECOLOGICAL REGIONALIZATION IN NORTH AMERICA

Concepts of Ecological Classification

While the need for broad ecological regionalization has long been recognized, attempts at developing a North American ecological classification based on a holistic interpretation of ecosystems are relatively recent. Some of the earliest such studies between Canada and the United States were in response to such issues as acid rain and protected areas. The focus of the initial work lay along the 49th parallel, later moving north to the Yukon and Alaska. Ultimately, the entire area of each country was the focus. These studies arose from the need to have a common basis for state of the environment reporting, particularly one that would encourage the application and use of an ecological approach to sustainable resource use.

Ecological classifications have evolved considerably over the past thirty years. Early pioneering works in North America evolved from forest and climate classifications and were often climate driven (Hills 1961; Flores et al. 1971; CETENAL (now INEGI) 1976; Bailey 1976). The use of more holistic classifications is more recent. Several more broadly based regional ecological classifications emerged during this period (Oswald and Senyk, 1977; Lopoukhine et al. 1979; Strong and Leggart 1980; Hirvonen 1984). The first national compilations of ecological classifications emerged in the mid-1980s (Wiken, comp. 1986; Omernik 1987). These were holistic approaches that recognized the importance of considering a full range of physical and biotic characteristics to explain ecosystem regionality. Equally, they recognized that ecosystems of any size or level are not always dominated by one particular factor. In describing ecoregionalization in Canada, Wiken (1986) stated:

Ecological land classification is a process of delineating and classifying ecologically distinctive areas of the Earth's surface. Each area can be viewed as a discrete system which has resulted from the mesh and interplay of the geologic, landform, soil, vegetative, climatic, wildlife, water and human factors which may be present. The dominance of any one or a number of these factors varies with the given ecological land unit. This holistic approach to land classification can be applied incrementally on a scale-related basis from very site-specific ecosystems to very broad ecosystems.

The classification can be produced following various approaches. The two used for this project were:

1. opinions were sought from ecologists and other scientists on the relevant features for each region; and
2. a data matrix was produced that could be used to build each ecological level.

Because the underlying dynamics of the ecosystems produce complex, multiple patterns of correlation among the biotic, abiotic, and human factors, these two approaches tended to produce a converging depiction of regions.

The focus for this project was to develop ecological land classifications suitable for use in continental, national and regional/local environmental reporting and assessment. A similar hierarchical ecological classification of oceanic areas in Canada has been published (Hirvonen et al. 1994; CCEA 1995); however, integration of these with oceanic areas in the United States and Mexico has not yet taken place.

How Mapped Areas are Derived

Diagnostic criteria for individual mapped areas are based on "enduring" components of the ecosystems contained therein. These components are relatively stable, such as soil, landform, or major vegetation types: that is, features that do not change appreciably over ecological time. Climate is also considered but, unlike the other stable components, it needs to be assessed by looking at long-term records. Enduring components are attributes that can be determined, either visually (e.g., from aerial photographs or satellite imagery) or from pertinent field studies or resource sector maps. For any level of ecological generalization, the mosaic of components may vary from one ecological area to the next. Ecological classification is science-based, but, in a way, it is also an art because ecological cycles, characteristics and interactions are not readily apparent and need to be interpreted from soil, vegetation and landform characteristics or other factors. Thus a mapped area must be considered a partial abstraction of real ecosystems. Maps depict where major ecological areas exist as a result of major ecological interactions but they do not readily illustrate the more dynamic aspects of ecosystems. More intangible characteristics, like changing weather patterns, species dynamics and soil chemical processes, are all vital in understanding ecosystems.

Which parameter is initially used to define an area often depends on the background of the scientist doing the analysis

and on those indicators that person finds contribute most incisively to understanding the nature of the ecosystem. If vegetation serves this function, then vegetation types, forms and/or composition might initially be used. Ultimately, through the interpretive process, the broad range of ecological characteristics, including climate, soils, physiography and water bodies would be considered. Boundaries bisect transition areas, distinguishing one ecological area from another. When these transition areas are abrupt, delineation is relatively straightforward. At other times, the transition zone may be diffuse and extend for hundreds of kilometers. In these situations, boundary delineation becomes more subjective.

Current land use and other human influences are characteristics that have not been commonly accepted as useful for delineating ecological areas. However, in this study these attributes were found to be relevant and sometimes even essential to the description. In situations where human use has historically been pervasive, it may significantly and irreversibly influence the ecological processes and attributes of that area. Examples could be the Great Plains and the Temperate Sierras, where land use and human activities serve as an important interpretive parameter because they have largely transformed the regions. On the other hand, some of the larger ecosystems, like the Arctic, have not been significantly transformed by humans over long periods of time.

Key Points in Mapping Ecological Regions

- Ecological classification incorporates all major components of ecosystems: air, water, land, and biota, including humans.
- It is holistic (“the whole is greater than the sum of its parts”).
- The number and relative importance of factors that are helpful in the delineation process vary from one area to another, regardless of the level of generalization.
- Ecological classification is based on hierarchy—ecosystems are nested within ecosystems.
- Such classification integrates knowledge; it is not an overlay process.

One of the key features of ecosystems is their interaction with other ecosystems. Ecosystems can be viewed as part of a “nested hierarchy” in which smaller ecosystems are amalgamated into successively larger ones.

- It recognizes that ecosystems are interactive—characteristics of one ecosystem blend with those of another.
- Map lines depicting ecological classification boundaries generally coincide with the location of zones of transition.

The Ecological Regions of North America

“Ecological region” refers to any one of the ecological areas that were mapped and described in this project. In a technical sense, they represent many things: a concept, a mapped and classified area, and an area of land with distinctive biological, physical and human characteristics. Determining ecological regions at a continental level is a challenging task. It is difficult, in part, because North America is ecologically diverse and because a nation’s territorial boundaries are a strong hindrance to seeing and appreciating the perspectives across the land-mass of three countries.

Ecosystems vary in composition. The interactions that occur within and among them are many and complex. Mapped areas must reflect this complexity in a “workable” and understandable manner for planning and communication purposes. Delineating an ecological area serves to “capture” its general ecological composition as well as the links between the ecosystems it contains.

What the Maps Depict

For planning and reporting purposes, maps are essential. The level of generalization of delineated ecosystems respects different levels of planning and reporting needs. In the context of North America, ecological regions are depicted at three levels of mapping. All three levels depict the spatial distribution of ecosystems. In some cases these are simple and fairly homogeneous, but often they are heterogeneous aggregations. The actual processes underlying ecosystems are not easily reflected on maps, and nor are the specific characteristics themselves. The intent is to illustrate the net product of many interacting ecological processes and functions of living organisms. Accompanying descriptions and other supplementary information, as provided in this report, are required to depict more fully the dynamism and complexity, both spatial and temporal, of real-world ecosystems.

As an example, the Great Plains ecological region has characteristics that are easily defined in a geographic sense. They include expanses of prairie soils, plains, areas of cereal grain production and grassland communities. In contrast, other characteristics that have a major influence on prairie ecology may not readily be seen. For example, although weather and hydrological patterns may be reflected in the types of

vegetation and soil that are present, they require formal instrumentation and monitoring for their assessment and evaluation.

The names used for the level I and II ecological regions are generally those in standard use in the individual countries. This was done to maintain as much continuity in nomenclature as possible. However, the names of some of the transboundary regions were adapted to respect the broader geographical coverage of this study. Names were generally intended to describe the overall character of the regions but, in other cases, they reflect prominent biophysical features such as mountain ranges or forest types. Each region is identified by a unique color and numerical code on the accompanying maps.

LEVEL I

North America has been broken down into 15 broad, level I ecological regions. These highlight major ecological areas and provide the broad backdrop to the ecological mosaic of the continent, putting it in context at global or intercontinental scales.

Viewing the ecological hierarchy at this scale provides a context for seeing global or intercontinental patterns. Level I ecological regions are: Arctic Cordillera, Tundra, Taiga, Hudson Plains, Northern Forests, Northwestern Forested Mountains, Marine West Coast Forests, Eastern Temperate Forests, Great Plains, North American Deserts, Mediterranean California, Southern Semi-Arid Highlands, Temperate Sierras, Tropical Dry Forests and Tropical Humid Forests.

Brief narrative descriptions of each level I region can be found in Section III. These descriptions—each of which is divided into sections describing the physical setting, biological setting and human activities therein—provide an overview of the principal attributes of each region. The intent is to provide a sense of the ecological diversity, the human interactions taking place and how each region differs from adjacent ones.

Level I can be characterized as follows:

- number of ecological regions: 15
- scale of presentation: approximately 1:50 million
- continental perspectives
- determination of the areas composing the regions through satellite imagery and appropriate natural resource source maps at broad scales (approximately 1:40 million – 1:50 million)

LEVEL II

The 52 level II ecological regions that have been delineated are intended to provide a more detailed description of the large

ecological areas nested within the level I regions. For example, the Tropical Humid Forests of level I is the region covering coastal portions of the United States and Mexico, and is composed of six level II regions. Level II ecological regions are useful for national and subcontinental overviews of physiography, wildlife, and land use

Three level I regions (Hudson Plains, Marine West Coast Forests and Mediterranean California) have no level II delineations. The Great Plains, Tropical Dry Forests and Tropical Humid Forests level I regions, on the other hand, each have six level II subdivisions. The table on the reverse of the level II map provides a synopsis of the major physical and biological attributes along with human activities associated with each of the level II ecological regions.

Level II can be characterized as follows:

- number of ecological regions: 52
- scale of presentation: 1:30 million
- nested within level I regions
- national/regional perspectives
- determination of the areas composing the regions through satellite imagery and appropriate natural resource source maps at broad scales (approximately 1:20 million – 1:30 million)

LEVEL III

Level III mapping, which is now in process, describes smaller ecological areas nested within level II regions. These smaller divisions will enhance regional environmental monitoring, assessment and reporting, as well as decision-making. Because level III regions are smaller, they allow locally defining characteristics to be identified, and more specifically oriented management strategies to be formulated.

Level III can be characterized as follows:

- number of ecological regions: approximately 200
- scale of presentation: approximately 1:5 – 1:10 million
- nested within level II regions
- regional perspective
- determination of the areas composing the regions through remote sensing techniques and appropriate regional natural resource source maps (at scales of approximately 1:2 – 1:4 million)

Level IV, which, like level III, will not be addressed in this report or its accompanying maps, would be nested in level III regions and should allow very localized monitoring, reporting, and decision making. In working on this level, of course,

it is very important that the larger, region-wide perspective be kept in mind.

The Next Steps

We have much to learn about ecosystems. While an ecosystem perspective is a logical and practical route for achieving sustainability goals, it has not been a working principle in most organizations and departments. This perspective has not been reflected in basic inventories, research, databases or assessments and thus, this ecological portrayal of North America had to be built initially from a variety of information sources and advice from different professionals. Many of the agencies that have traditionally looked at individual component parts of ecosystems (i.e., soils, water, wildlife, land use) are expanding their efforts to collect a broader range of information or to work more cooperatively with other resource agencies. The extension of these initiatives are strategic for environmental management and planning. For instance, region-wide cooperation, as is needed for the conservation and protection of migratory species and for the solution of transboundary environmental issues such as pollutant dispersion, should be based on the ecosystem/ecological region perspective.

The next step should be to engage specialists from the three nations to refine further what we know of these ecological regions. The construction of an ecosystem information base

could be followed by projects that will enhance the analytical capabilities of researchers and decision-makers. The CEC is already involved in the creation of such a tool, the North American Integrated Information System, which functions on both a broad, regional scale and a much smaller municipality-oriented one to produce maps of the continent or selected regions within it. The user can overlay data that combine physical features, such as land and water, with such other ecological elements as forests and wildlife, and information on economic and social issues, to analyze the environmental impacts of selected physical, socioeconomic, and ecological variables. The maps (levels I, II, and III), as well as the North American Integrated Information System, will be made available on the Internet.

Such tools will allow questions of local to continental significance to be examined. This kind of analytical process requires integrating skills from different professionals and organizations, including many that do not normally work together. Such a multi-disciplinary integration process is complex, but it is the only way to approach the very involved environmental issues confronting North America today.

III. ECOLOGICAL REGIONS OF NORTH AMERICA



Level I Regions

- | | | |
|----------------------------|--|--|
| 1 Arctic Cordillera | 6 Northwestern Forested Mountains | 11 Mediterranean California |
| 2 Tundra | 7 Marine West Coast Forests | 12 Southern Semi-Arid Highlands |
| 3 Taiga | 8 Eastern Temperate Forests | 13 Temperate Sierras |
| 4 Hudson Plains | 9 Great Plains | 14 Tropical Dry Forests |
| 5 Northern Forests | 10 North American Deserts | 15 Tropical Humid Forests |

Population: 1,050
Surface Area: 218,225 km²

ARCTIC CORDILLERA

This ecological region occupies the northeastern fringe of the Northwest Territories and Labrador and contains the northernmost mountainous area in North America. The eastern Arctic mountains have some of the most spectacular alpine glacial scenery in the world. The harsh climate, rugged terrain and low biological productivity are among its distinguishing characteristics. With a population of approximately 1,050, this is the least populated level I ecological region in North America.

Physical setting

The vast mountain chain of deeply dissected Precambrian crystalline rocks forms the spine of this ecological region. It runs along the northeastern flank of Baffin Island, northward over eastern Devon Island and Ellesmere Island, as far as Bache Peninsula and southward to the Torngat Mountains in Labrador. Elevations range from sea level to over 2,000 m above sea level. Massive ice caps and valley glaciers mask many of the rugged mountains. The northwestern section takes in ice-covered Grantland and Axel Heiberg mountains, consisting mainly of long ridges of folded Mesozoic and Paleozoic strata, with minor igneous intrusions. To the northwest, these mountains pass abruptly into a narrow, seaward-sloping plateau, and to the east, with decreasing ruggedness, into the elevated dissected edge of Eureka Upland. Ice fields and nunataks are common. The ranges and ridges are interspersed with numerous steep-walled valleys, glaciers and fjords. Valley glaciers extend over much of the higher elevations and often extend to the foot of the mountains. The U-shaped valleys and deep fjords extend many kilometers inland. The valley walls are rocky or covered with colluvial and morainal debris. Almost 75 percent of the landscape is ice or exposed bedrock. As a consequence of continuous permafrost conditions, frozen soils prevail, with surface thawing taking place during the short summer.

The climate is extremely cold and dry in the north, while it is somewhat milder and more humid in the southernmost portions of the region. The mean summer temperature ranges from -6°C to -2°C. Summers are short and cool, and the growing season is enhanced by long periods of daylight. The mean winter temperature ranges from -35°C in the mountains of Ellesmere Island to -16°C in northern Labrador. Precipitation varies from 200 mm in the north to over 600 mm in Labrador.

Biological setting

Because of the extremely cold, dry climate, along with the ice-fields and lack of soil materials, the high and mid-elevations are largely devoid of significant populations of plants and animals. In the more sheltered valleys at low elevations and along coastal margins, the vegetative cover is more extensive, consisting of herbaceous and shrub-type communities. Isolated "oases" of biological activity include sheltered stream banks and coastlines, and south-facing slopes watered by late melting snow. Lichens are associated with rock fields throughout.

The upper elevations are largely devoid of large terrestrial mammals. Polar bears are common in some coastal areas where biological productivity is much higher. Arctic hare, Arctic fox, ermine and the collared lemming are among the few species found throughout the area in limited numbers. Usually sheltered areas provide productive plant habitats. The adjacent marine environment is typified by walrus, ringed and bearded seals, narwhal, bowhead, and other species of whale. Large concentrations of seabirds congregate in the warmer coastal margins, including the northern fulmar, thick-billed murre, black-legged kittiwakes, common ringed plover, hoary redpoll and snow bunting.



Photo: Ed Wiken



Photo: CEC file



Photo: Ed Wiken



Photo: Ed Wiken



Photo: Ed Wiken

1 Coastal mountains and fjords in the Arctic Cordillera.

2 Tundra vegetation in an Arctic valley.

3 Arctic fox live in limited numbers throughout the region.

4 Pond Inlet, one of the few settlements in this region.

5 Ice-capped mountains and glaciers dominate the landscape.

Population: 26,000
Surface Area: 2,856,850 km²

TUNDRA

This is the largest Arctic level I ecological region on the continent. It covers northern Alaska, Yukon, the Arctic islands of Canada, portions of the mainland of the Northwest Territories, and northern Québec. The region has a reputation of being a desolate, cold, dry and desert-like setting but in reality, the landscape is diverse, ranging from vast grassland-like plains to stark, bold mesas; from ice covered lakes to snow-free uplands; and the climate ranges from long, dark, cold winters to short, cool summers with long periods of daylight. Spring and summer bring a sudden greening of the landscape. This ecological region is sparsely populated with 26,000 people. Major activities include hunting, fishing and trapping.

This region experiences long, cold winters and short, cool summers. Mean annual temperature ranges from -17°C in the northern islands to -7°C in northern Quebec. Summer mean temperatures range from -1.5°C in the north to 6°C in the south, producing a short growing season. The short summer growing season is enhanced by long periods of daylight. Winters pass in darkness. The mean winter temperature ranges from -31°C in the north to -17.5°C in northern Quebec. The annual precipitation varies from 100 mm to 500 mm, the lowest in Canada. Snow may fall any month of the year and usually persists on the ground for at least 10 months (September to June).

Biological setting

This ecological region represents a major area of transition between the Taiga forest to the south and the treeless Arctic tundra to the north. It is characterized by dwarf shrubs that decrease in size moving north, with very low and flattened plants being most characteristic of the northern and central locales. Major river valleys support scattered clumps of stunted spruce trees. Typical shrubs include dwarf birch, willows, and heath species commonly mixed with various herbs and lichens. Wetlands are common in the low-lying areas, mainly supporting sedge and moss covers.

A wide variety of mammals thrive in this ecological region. The region includes the major summer range and calving grounds for Canada's largest caribou herds, the barren ground caribou in the west and the woodland caribou in the east. The Peary caribou are found only in the high Arctic islands. Other mammals include grizzly bear, musk ox, Arctic fox, Arctic hare, polar bear, wolf, moose, Arctic ground squirrel and lemming. The area is also a major breeding and nesting ground for a variety of migratory birds. Representative species include snow, Brant and Canada geese; yellow-billed, Arctic, and red-throated loons; whistling swans; oldsquaw ducks; gyrfalcons; willow and rock ptarmigan; red-necked phalarope; parasitic jaeger; snowy owls; hoary redpoll and snow bunting. In the adjacent marine environment, typical species include walrus, seal, beluga whale and narwhal. In the summer months, California gray whales migrate here to feed.

Human activities

Hunting, trapping and fishing remain important activities in the local economy. Some areas targeted for hydrocarbon development and several mining enterprises are active. Construction and some tourism, as well as the management and delivery of government services, are the other principal activities. Inuit form about 80 percent of the sparse population of 26,000. Iqaluit on Baffin Island is the largest center, with a population of 3,600. Other major centres include Baker Lake, Cambridge Bay, Pangnirtung, Tuktoyaktuk, Rankin Inlet and Coppermine.



Photo: CEC file

Physical setting

The Arctic islands circumscribe a variety of oceanic conditions. In the far north, the waters are ice-fast, even through the summer periods. Towards the south, open waters are more common in the summer, but pack ice usually persists offshore. The permafrost is continuous and may extend to depths of several hundred metres. Mostly underlain by Precambrian granitic bedrock with some areas of flat-lying Palaeozoic and Mesozoic sedimentary bedrock, the terrain consists largely of broadly rolling uplands and lowlands. Much of it is mantled by discontinuous shallow and deep morainal deposits, except near the coasts, where fine-textured marine sediments occur. Strung out across the landscape are long, sinuous eskers, reaching lengths of 100 km in places. The undulating landscape is studded with innumerable lakes and wetlands in the Canadian Shield section of the ecological region. Soils are frozen, with a shallow and wet thaw layer in the summer.

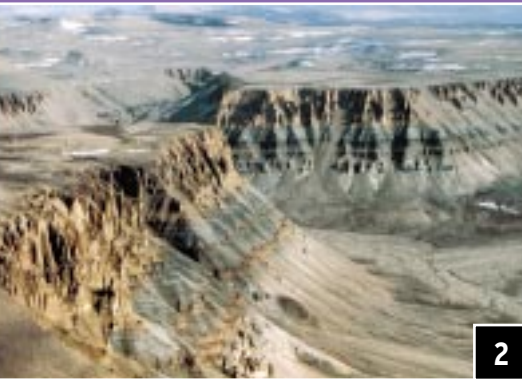


Photo: Ed Wiken



Photo: Ed Wiken



Photo: Ed Wiken



Photo: Ed Wiken



Photo: Ed Wiken

1 The Pangnirtung Pass on Baffin island.

2 Plateaus like these are common on Devon Island and northeastern parts of Baffin Island.

3 Coastal area showing rocky hills and vegetated lowlands.

4 Musk oxen are one of the largest herbivores in the far north.

5 Moss campion surrounded by lichen on Brodeur Peninsula, Baffin Island.

6 A docking area near Arctic Bay on Baffin Island for Nanisivik Mines, Ltd.

Population: 55,000
Surface Area: 2,799,230 km²

TAIGA

This ecological region lies on both sides of Hudson Bay. The eastern segment occupies the central part of Quebec and Labrador, while the western segment covers portions of northern Manitoba, Saskatchewan, Alberta and British Columbia as well as the southern Northwest Territories. Overall, it encompasses much of Canada's northern boreal forest and is underlain by the ancient bedrock of the Canadian Shield. With a population of 55,000, hunting, fishing and trapping are the major activities. Locally, forestry, and oil and gas exploration are taking place.



1 Photo: Ed Wiken

Physical setting

Most of this ecological region consists of broadly rolling uplands and lowlands. Precambrian bedrock outcrops and discontinuous shallow and deep deposits of hummocky to ridged moraine are the main surface materials. The western portion is underlain by horizontal sedimentary rock—limestone, shale and sandstone—creating a nearly level to gently rolling plain covered with organic deposits, hummocky moraines and lacustrine deposits. Thousands of lakes and wetlands occupy glacially carved depressions. Strung across the landscape is the largest concentration of long, sinuous eskers in Canada. Lowlands are covered with peatlands and permafrost is widespread, with patterned ground features being common. Nutrient-poor forest soils are dominant in the southern portion and permafrost soils occur in the northern portion.

The subarctic climate is characterized by relatively short summers with prolonged periods of daylight and cool temperatures; winters are long and very cold. Mean annual temperatures range from -10°C in the Mackenzie Delta to 0°C in parts of Labrador. The cold, south-flowing Labrador current reduces the moderating effect of the Atlantic Ocean on the climate of the eastern portion of this region. Mean summer temperatures range between 6°C and 14°C , winter temperatures between -26°C and -11°C . Mean annual precipitation ranges from 200 to 500 mm west of Hudson Bay. East of Hudson Bay it ranges from 500 to 800 mm, except near the Labrador coast where it can exceed 1,000 mm a year. Snow and freshwater ice persist for six to eight months annually.

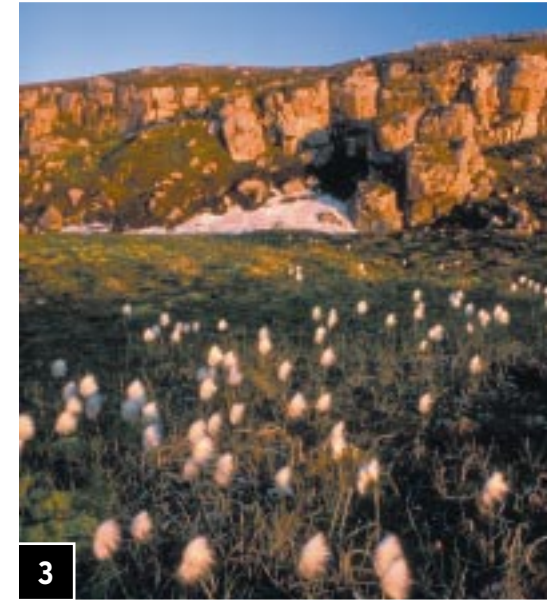
Biological setting

The pattern is one of innumerable lakes, bogs, other wetlands and forests interwoven with open shrublands and sedge meadows more typical of the tundra. From south to north, forests become open and form woodlands with a characteristic groundcover of lichens, which merge into areas of tundra. Along the northern edge of this ecological region the latitudinal limits of tree growth are reached. In the transition zone, dwarf birch, Labrador tea, willow, bearberry, mosses, and sedges are dominant. Further south, the region contains open stands of stunted black spruce and jack pine accompanied by alder, willow and tamarack in the fens and bogs. Mixed wood associations of white and black spruce, lodgepole pine, trembling aspen, balsam poplar and white birch are found on well-drained and warm upland sites, as well as along rivers and streams. Along the nutrient-rich alluvial flats of the larger rivers, white spruce and balsam poplar grow to sizes comparable to the largest in the boreal forests to the south.

Characteristic mammals include moose, woodland caribou, wood bison, wolf, black bear, marten, lynx, snowshoe hare, Arctic fox and Arctic ground squirrel. Barren ground caribou over-winter in the northwest corner of the ecological region. Overall, there are about 50 species of mammals that inhabit the region. The abundance of water attracts hundreds of thousands of birds (e.g., ducks, geese, loons and swans) which come to nest, or rest and feed on their way to Arctic breeding grounds. The Mackenzie Valley forms one of North America's most travelled migratory corridors for waterfowl breeding along the Arctic coast. Common bird species include the common redpoll, gray jay, common raven, red-throated loon, northern shrike, sharp-tailed grouse and fox sparrow. Fish-eating raptors include the bald eagle, peregrine falcon and osprey. In the marine environment, representative species include walrus and seal.

Human activities

The population of this ecological region is approximately 55,000. The major communities include Yellowknife, Fort Nelson, Inuvik, Hay River, Fort Smith, Fort Simpson, Labrador City, Uranium City and Churchill Falls. Hunting, trapping and fishing are the primary subsistence activities in the local economy. Mining, oil and gas extraction, and some forestry and tourism are the main commercial activities.



3 Photo: CEC file



2 Photo: Ed Wiken



4 Photo: I. Pisanty

- 1 Caribou in the Northern Yukon.
- 2 A view of the open boreal forest typical of the southern portion of this ecological region.

- 3 Cotton grass, a common species found in wet areas.
- 4 Sluice gates at the James Bay hydroelectric project.

Population: 10,000
Surface Area: 334,530 km²

HUDSON PLAINS

The Hudson Plains ecological region is centered in northern Ontario and extends into north-eastern Manitoba and western Quebec. Wetlands cover 90 percent of this ecological region, making it the largest wetland-dominated area of North America. In fact, this region contains the longest stretch of shallow, emergent wetland shoreline on Earth. The population of 10,000 is largely aboriginal. Hunting, fishing and trapping with some tourism are the major activities.

The climate is strongly influenced by the cold and moisture-laden Hudson Bay low-pressure and polar high-pressure air masses. The short, cool summers and very cold winters reflect a cold continental climate. Mean annual temperatures range from -7°C to -2°C . Mean summer temperatures range from 11°C to 14°C but mean annual winter temperatures range between -19°C and -16°C . Precipitation annually ranges from 400 mm in the northwest to 800 mm in the southeast.

Biological setting

Vegetation types consist of tundra and transitional boreal forests. The poorly drained areas support dense sedge/moss/lichen covers, and the less frequent and better-drained sites support woodlands of black spruce and tamarack. The raised beaches present a striking pattern of successive black spruce-covered ridges alternating with depressions, bogs and fens.

Characteristic mammals include woodland caribou, white-tailed deer, moose and black bear. The ecological region is an important habitat for breeding waterfowl, particularly Canada geese. Ducks common to this region include eiders, mergansers, scoters and black. The adjacent marine environment includes harbor and ringed seals, as well as bowhead whales in the summer.

Human activities

The resources utilized in this region have historically related to aboriginal hunting, trapping and fishing and, in many ways, continue that way. Large-scale hunting and trapping took place from the late 1600s, when the Hudson's Bay Company began to establish stockaded trading posts on the shores of Hudson Bay—an on-going venture until the 1900s. Today, commercial trapping is minimal. Economic activity is now concentrated on localized sport fishing and tourism. The largest center, Churchill, serves as a major port for ocean transport of wheat and potash from the Prairies to overseas destinations. Other major communities include Fort Severn, Attawapiskat and Moosonee, resulting in an overall regional population of 10,000.



1

Photo: Ed Wiken

Physical setting

This lowland plain is underlain by flat-lying Paleozoic and Proterozoic sedimentary rocks, which slope gently towards the Hudson and James bays. Elevations rarely exceed 500 m above sea level. The surface is characterized by extensive wetlands, including peatlands (largely bogs and fens) and shallow open waters less than two meters deep. Isostatic rebound is considerable along the coast of Hudson and James bays, where the land rises approximately one meter per century. Some 7,500 years ago, this region was covered with sea water as part of a much larger Hudson Bay. Well-drained, raised beach strands, coastal marshes and tidal flats currently typify this coastline. Organic soils predominate. Young, poorly-developed saline soils occur on silty to clayey marine sediments along the coastal shore. The permafrost ranges from continuous in the northwest to isolated patches in the southeast.



2

Photo: CEC file



3

Photo: Ed Wiken



4

Photo: Ed Wiken

1 Beach lines and wetlands along the coast of Hudson Bay.

2 Polar bears range throughout the Hudson Plains and other northern ecological regions.

3 Wetlands and forests of the Hudson Plains.

4 Fishermen on the beach in northern Ontario.

Population: 4,000,000
Surface Area: 2,363,825 km²

NORTHERN FORESTS

This ecological region is broad and crescent-shaped, extending from northern Saskatchewan east to Newfoundland and south to Pennsylvania—lying to the north of the Eastern Temperate Forests region. It is distinguished by extensive boreal forests and a high density of lakes situated on the Canadian Shield. Despite having many urban areas, highways, railways, roads and airports, much of this ecological region remains a relative wilderness. With a population of 4 million, this is a core area for forest and mining activities. Commercial fishing is extensive on its east coast.



1

Photo: Ed Wiken

Physical setting

This region is associated with hilly terrain. Precambrian granitic bedrock outcrops are interspersed with shallow-to-deep deposits of moraine. The bedrock of the Canadian Shield is among the oldest on Earth, having been formed between 2.5 and 3.6 billion years ago. Morainal deposits date from the retreat of the last glaciers, which took place 10,000 to 12,000 years ago. Some fluvial material (including numerous eskers) and colluvium are present. Soils derived from these materials are generally coarse-textured and nutrient-poor. Limited areas of fine-textured silts and clays occur. Peatlands are extensive in central Manitoba, northwest Ontario, northern Minnesota and Newfoundland. The landscape is dotted with numerous lakes. The ecological region includes the headwaters of numerous large drainage basin systems.

The climate is characterized by long, cold winters and short, warm summers. The continental climate is influenced by maritime conditions in coastal areas and by cold arctic air masses from the north. The mean annual temperature ranges between -4°C in northern Saskatchewan to 5.5°C in the Avalon Peninsula of Newfoundland. Mean summer temperatures range between 11°C to 18°C . Mean winter temperatures range between -20.5°C in the west to -1°C in the east. Mean annual precipitation varies from 400 mm in northern Saskatchewan to 1,000 mm in eastern Quebec and Labrador. The maritime influence on Newfoundland results in a higher level of precipitation, ranging between 900-1600 mm. The Great Lakes have a moderating effect on the climate of adjacent lands, warming them in winter and cooling them in summer.

Biological setting

Over 80 percent forested, the ecological region generally supports closed stands of conifers, largely white and black spruce, jack pine, balsam fir and tamarack. Towards the south and the Maritimes, there is a wider distribution of white birch, trembling aspen, balsam poplar and white and red pine, sugar maple, beech, red spruce and various species of oak. Areas of shallow soils and exposed bedrock are common and tend to be covered with a range of plant communities, dominated by lichens, shrubs and forbs.

Characteristic mammals include woodland caribou, white-tailed deer, moose, black bear, raccoon, marten, fisher, striped skunk, lynx, bobcat and eastern chipmunk. Representative birds include boreal and great horned owl, blue jay and evening grosbeak.

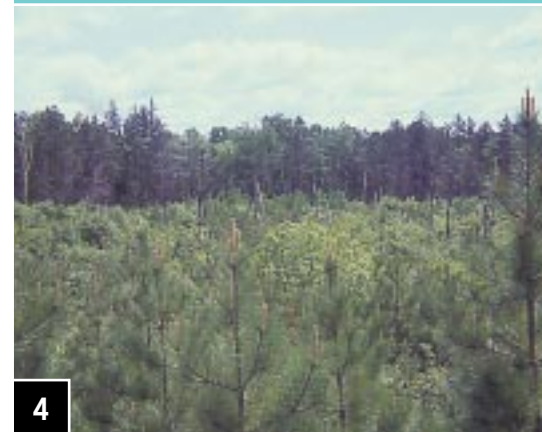
Human activities

Aboriginal peoples were the sole human dwellers within this ecological region until some 400 years ago when Europeans entered the coastal bays and the Gulf of St. Lawrence to explore and search for furs. In subsequent years, coastal towns and cities were developed for military or commercial fishing purposes. Inland trading posts were established as the fur trade expanded. As the inherent timber and mining resources of the Canadian Shield became evident, exploitation followed and mining- and forestry-based towns became established throughout the region. Today, forestry, mining and the coastal fishery remain major economic pursuits. In addition, hydroelectric power and tourism have blossomed as key economic activities. Agriculture is locally important, involving activities such as dairy and vegetable farming. Orchards are prevalent in local valleys, such as the Annapolis Valley of Nova Scotia, where the soil quality and micro-climate are suitable. The total population of the ecological region is 4 million. Almost 60 percent live in larger urban centres, including St. John's, Halifax, Bangor, Sudbury, Thunder Bay, Sault Ste. Marie and Duluth



3

Photo: Ed Wiken



4

Photo: Douglas Kirk



5

Photo: Ed Wiken

1 A typical vista in the Northern Forests.

2 Fall colors in Nova Scotia.

3 Vegetable and dairy farming are limited but important.

4 A red pine plantation on a clear-cut area in northern Minnesota.

5 Fishing boats anchored near Lunenburg, Nova Scotia.

Population: 800,000
Surface Area: 1,788,950 km²

NORTHWESTERN FORESTED MOUNTAINS

This ecological region extends from Alaska south through southern Yukon, interior British Columbia and the Alberta foothills, through northern California and over into Nevada. It contains the highest mountains of North America and some of the continent's most diverse mosaics of ecosystem types, ranging from alpine tundra to dense conifer forests to dry sagebrush and grasslands. There are major river systems, including the headwaters to both the Fraser and Columbia rivers. The basis for aggregating all this diversity into one ecological region is topographic—the chains of mountains that traverse its whole length. This region of 800,000 people is a major tourist area for skiing, hiking and other outdoor recreational pursuits. Substantial forestry and mining activity occur throughout.

The climate is subarid to arid and mild in southern lower valleys, humid and cold at higher elevations within the central reaches, and cold and subarid in the north. Moist Pacific air and the effect of orographic rainfall control the precipitation pattern such that both rain shadows and wet belts are generated, often in close geographic proximity to each other. The rain shadow cast by the massive coast mountains results in a relatively dry climate. The Rocky Mountains also impede the westward flow of cold, continental Arctic air masses. Mean annual temperatures range between -6°C in the north to 7°C to 10°C in south. Mean summer temperatures range from 10°C to 21°C, whereas mean winter temperatures range from -23°C to 0°C. Annual precipitation varies with elevation, from 2,600 mm in the Cascade mountains to the north, to 400 mm in other mountainous areas, to between 250–500 mm in the valleys.

Biological setting

Vegetative cover is extremely diverse: alpine environments contain various herb, lichen and shrub associations; whereas the subalpine environment has tree species such as lodgepole pine, subalpine fir, silver fir, grand fir, and Engelmann spruce. With decreasing elevation, the vegetation of the mountainous slopes and rolling plains turns into forests characterized by ponderosa pine; interior Douglas fir; lodgepole pine and trembling aspen in much of the southeast and central portions; and western hemlock, western red cedar, Douglas fir and western white pine in the west and southwest. White and black spruce dominate the plateaus of the north. Shrub vegetation found in the dry southern interior includes big sagebrush, rabbit brush and antelope brush. Most of the natural grasslands that existed in the dry south have vanished, replaced by urban settlement and agriculture.

Characteristic mammals include mule deer, elk, moose, mountain goat, California bighorn sheep, coyote, black and grizzly bear, hoary marmot and Columbian ground squirrel. Typical bird species include blue grouse, Steller's jay and black-billed magpie.

Human activities

Commercial forest operations have been established in many parts, particularly in the northern interior sections. Mining, oil and gas production, and tourism are the other significant activities. In the eastern Rocky and Columbia mountains, however, national and provincial parks have been established for recreational use or as reserves for wildlife habitat. It is mainly in the valleys that areas have been improved for range or are farmed. The southern valleys are important for their orchards and vineyards. More than half of the region's 800,000 people live in cities and towns. The larger cities include Whitehorse, Prince George, Kamloops, Banff, Thedford, South Lake Tahoe, LaGrande, Kalispell, Steamboat Springs and Jackson.

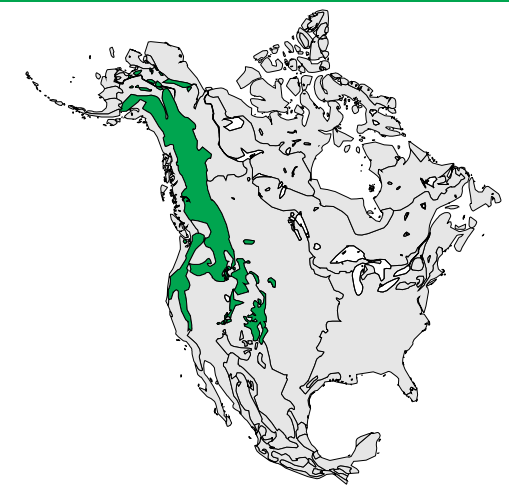


Photo: Douglas Kirk

Physical setting

This ecological region consists of extensive mountains and plateaus separated by wide valleys and lowlands. Most of these plains and valleys are covered by moraine and, to some degree, fluvial and lacustrine deposits, whereas the mountains consist largely of colluvium and rock outcrops. Numerous glacial lakes occur at higher elevations. Soils are variable, encompassing shallow soils of alpine sites and nutrient-poor forest soils of the mountain slopes, as well as soils suitable for agriculture and those rich in calcium that support natural dry grasslands.



Photo: US EPA



Photo: CEC file

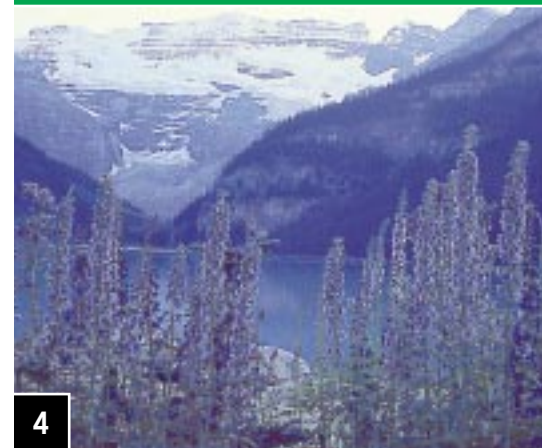


Photo: Douglas Kirk

1 Jacques Lake in Jasper National Park epitomizes the wilderness beauty of the Canadian Rockies.

2 Remnants of the old-growth forest are the primary habitat of the Spotted Owl.

3 Mule deer in the Eastern Cascade slopes.

4 Lake Louise in Banff National Park is one of North America's most frequented scenic locales.

Population: 6,500,000
Surface Area: 692,970 km²

MARINE WEST COAST FORESTS

This ecological region covers the mainland and offshore islands of the Pacific Coast from Alaska south to northern California. The wettest climates of North America occur in this area. It is characterized by mountainous topography bordered by coastal plains, and contains all of the temperate rain forests found in North America. These forests are among the most productive in North America, making forestry the major resource activity. Major commercial fisheries occur offshore. The large population of 6.5 million is concentrated in coastal cities and towns.

Physical setting

Mountainous topography dominates, cut through by numerous fjords and glacial valleys, and bordered by coastal plains along the ocean margin. Igneous and sedimentary rocks underlie most of the area. Colluvium and morainal deposits are the main surface materials. The soils are largely leached, nutrient-poor forest soils. The Queen Charlotte Islands and the part of

The nearness of the Pacific Ocean profoundly moderates the climate. This maritime influence is responsible for a high level of precipitation, long growing season and moderate temperatures. Mean annual temperatures range from 5°C in the north to 9°C in northern California. The mean summer temperature ranges from 10°C in the north to 16°C in the south, whereas mean winter temperatures range from -1°C to -3°C. The annual precipitation ranges from as little as 600 mm in the gulf and San Juan islands to over 5,000 mm along the north coast of British Columbia and Alaska. Overall, the windward slopes typically receive between 1,500 to 3,000 mm of precipitation per year.

Biological setting

Variations in altitude create widely contrasting ecological zones within the region. They range from mild, humid coastal rain forest to cool boreal forests and alpine conditions at higher elevations. The temperate coastal forests are composed of mixtures of western red cedar, yellow cedar, western hemlock, Douglas fir, amabilis fir, Sitka spruce, California redwood and red alder. Many of these trees reach very large dimensions and live to great age, forming ancient or old growth. In the drier rain-shadow areas, Garry oak and Pacific madrone occur with Douglas fir. Sub-alpine forests are characterized by mountain hemlock and amabilis fir. Alpine tundra conditions are too severe for growth of most woody plants except in dwarf form. This zone is dominated by shrubs, herbs, mosses and lichens.

Characteristic mammals include the black-tailed deer, black and grizzly bear, elk, wolf, otter and raccoon. Bird species unique to this area include California and mountain quail and chestnut-backed chickadee. Many seabirds are prevalent, including marbled murrelets, and several species of cormorants, gulls, mures, petrels and puffins. Other representative birds are northern pygmy-owls, Steller's jays, and northwestern crows. Adjacent marine environments are typified by large numbers of whales (including the killer whale), sea lions, seals and dolphins. Salmon, steelhead and associated spawning streams are located throughout this area. Coastal up-welling and freshwater discharge from coastal rivers into ocean waters stimulate the occurrence of abundant marine life.

Human activities

Currently, most land use is linked to forest harvesting. Forest productivity is high and the commercial forest industry is of major economic importance to both Canada and the United States. The lowlands of the Puget Sound, Willamette Valley, Fraser Valley and the southeastern tip of Vancouver Island possess the area's main expanse of highly productive agricultural soils, as well as urban lands. Fishing, tourism and transportation are other major activities. The total population is about 6.5 million; Anchorage, Vancouver, Victoria, Seattle and Portland are the principal cities of the region.



2

Photo: US EPA



1

Photo: Douglas Kirk

Vancouver Island that escaped glaciation are unique because they now contain many endemic species: that is, ones that are peculiar to those habitats. Ice-free coastal waters are associated with the narrow continental shelf and slope. The region has some of the most productive rivers for salmon production and there are many important estuaries.



3

Photo: US EPA



4

Photo: Douglas Kirk



5

Photo: Douglas Kirk

- 1 The close proximity of the Pacific Ocean moderates the climate of the Marine West Coast Forests.
- 2 Chinook and coho salmon spawn in coastal streams and rivers.
- 3 Pasture and dairy farms characterize many of the coastal lowlands and river valleys.

- 4 The majestic redwood forests make up only a small portion of the original Marine West Coast Forests that settlers found in the nineteenth century.
- 5 Old growth Douglas fir can take up to 250 years to replace.

Population: 160,000,000
Surface Area: 2,578,435 km²

EASTERN TEMPERATE FORESTS

This ecological region extends from the Great Lakes in the north to the Gulf of Mexico in the south. From the Atlantic Coast, it extends westward approximately 620 km into eastern Texas, Oklahoma, Missouri, Iowa and Minnesota. The region is distinguished by its moderate to mildly humid climate, its relatively dense and diverse forest cover, and its high density of human inhabitants that approximates 160 million. Urban industries, agriculture and some forestry are major activities.



Photo: US EPA

Physical setting

A variety of geologic materials and landforms are present. Younger-age sedimentary coastal plains in the south and east abut the older, folded and faulted sedimentary, metamorphic and igneous rocks of the Appalachian Mountains that reach elevations over 2,000 m. A mixed limestone-dolomite terrain of plains and hills dominate much of the central part of the region, with other sedimentary rock found on the plateaux and plains in the north and west. Glacially derived materials and landforms and areas of glacial lake deposits shape the landscape in the north. Soils are mostly leached, being nutrient-poor to calcium-rich. Surface waters are characterized by an abundance of perennial streams, small areas with high densities of lakes, a diversity of wetland communities and a rich array of maritime ecosystems.

The climate is generally warm, humid and temperate, although there is a latitudinal gradient from cool, continental temperatures to those that are subtropical. Summers are hot and humid, and winters are mild to cool. The average daily minimum temperature in winter is -12°C in the north and 4°C in the south. Average daily maximum summer temperatures are 27°C to 32°C. Precipitation amounts of 1,000-1,500 mm per year are relatively evenly distributed throughout the year, with most areas having either a summer or spring maximum.

Biological setting

The Eastern Temperate Forests form a dense forest canopy consisting mostly of tall broadleaf, deciduous trees and needle-leaf conifers. Beech-maple and maple-basswood forest types occur widely especially in the eastern reaches of this region, mixed oak-hickory associations are common in the Upper Midwest, changing into oak-hickory-pine mixed forests in the south and the Appalachians. These forests have a diversity of tree, shrub, vine and herb layers. While various species of oaks, hickories, maples and pines are common, other wide-ranging tree species include ashes, elms, black cherry, yellow poplar, sweet gum, basswood, hackberry, common persimmon, eastern red cedar and flowering dogwood. A key tree species, the American chestnut, was virtually eliminated from the Eastern Temperate Forests in the first half of the twentieth century by an introduced fungus.

Two essentials for wildlife—food and shelter—are relatively abundant in the Eastern Temperate Forests. Because it is a significant evolutionary area for the continent's fauna, the region contains a great diversity of species within several groups of animals. Mammals of the region include the white-footed mouse, gray squirrel, eastern chipmunk, raccoon, porcupine, gray fox, bobcat, white-tailed deer and black bear. The region has extremely diverse populations of birds, fish, reptiles and amphibians.

Human activities

In the past, woodland indigenous cultures incorporated a mixture of hunting, gathering and agricultural activities. Food sources included deer, small mammals, fish, shellfish, wild fruits and vegetables, and crops such as corn, beans, squash and tobacco were grown. Annual or occasional fires were used to clear the forest understory for ease of travel, preparation of cropland, or to encourage growth of forage plants for both wild game and human consumption. The shift from Indian to European dominance led to more extensive forest clearing, burning, and conversion to pasturage and cropland.

Several valley and plain areas continue today as rich, productive cropland, while other cleared areas have reverted to mixed forest. Pine plantations for pulp and paper are common in the South. With a historical concentration of the continent's political, economic and industrial power, the region's landscape was also transformed by extensive manufacturing and urbanization. This urban population occupies the mid-Atlantic megalopolis from Boston to Washington, DC; the large urban areas near the Great Lakes such as Chicago, Detroit, Toronto and Montreal; and hundreds of smaller cities and towns. Approximately 160 million people, more than 40 per cent of North America's population, live in this region.



Photo: Cameron Davidson, Avian Science and conservation Centre



Photo: Alan Woods, Dynamac Corporation



Photo: CEC file



Photo: CEC file

- 1 White-tailed deer are abundant in some areas.
- 2 An abundance of perennial streams and rivers typify this ecological region.
- 3 The forests contain a wide variety of trees, here red oak and beech, with staghorn sumac as a frequently encountered shrub.

- 4 The bald eagle is native to certain regions in the Eastern Temperate Forests.
- 5 Open-pit coal mining is common in some areas, affecting vegetation cover and water quality.

Population: 34,000,000
Surface Area: 3,543,875 km²

GREAT PLAINS

The Great Plains ecological region is found in the central part of the continent and extends over the widest latitudinal range of any single North American ecological region. It is a relatively continuous and roughly triangular area covering about 3.5 million square kilometers. The North American prairies extend for about 1,500 km from Alberta, Saskatchewan and Manitoba in Canada, south through the Great Plains of the United States to southern Texas and adjacent Mexico, and approximately 600 km from western Indiana to the foothills of the Rockies and into northeastern Mexico. This ecological region is distinguished particularly by the following characteristics: relatively little topographic relief; grasslands and a paucity of forests; and sub-humid to semiarid climate.

Physical setting

The Prairies range from smooth to irregular plains. In Canada they are generally flat to slightly rolling plains. Sizable portions in the United States are hilly or classified as tablelands with moderate relief (100-175 m). The Mexican landscape alternates flat areas and low hills. The landscape of the Canadian Prairies (as well as the northern prairies of the United States) has been shaped by a variety of glacial deposits consisting mostly of undulating and kettled glacial till, and level to gently-rolling lacustrine deposits. These landforms are associated with intermittent sloughs and ponds. Surficial geology in the remainder of the Great Plains ecological region is varied. Major portions are eolian, others are stream deposits, and much of the region is comprised of thin residual sediments. The Mexican portion is underlain by Cenozoic sedimentary rocks with recent continental deposits, mainly in the coast. In the northern and central Great Plains, most of the rivers have their origins in the Rockies, where rainfall, snowmelt and glacial runoff in the north contribute to their formation. The soils are commonly deep and throughout most of the region were originally highly fertile. Today, soils of agricultural potential throughout the Great Plains face problems of reduced nutrient potential, increasing salinity and susceptibility to wind and water erosion. The climate is dry and continental, characterized in the north by short, hot summers and long, cold winters. High winds are an important climatic factor in this ecological region. It is also subject to periodic, intense droughts and frosts.

Biological setting

The Great Plains ecological region was once covered with natural grasslands that supported rich and highly specialized plant and animal communities. The interaction of climate, fire and grazing influenced the development and maintenance of the Great Plains. Rainfall increases from west to east, defining different types of native prairies. Short-grass prairie occurs in the west, in the rain shadow of the Rocky Mountains, with mixed-grass prairie in the central Great Plains and tall-grass prairie in the wetter eastern region. In the Mexican Great Plains, prickly scrub vegetation dominates the landscape, in transition between the desert conditions and the warmer and wetter conditions of the Prickly Tropical Forest (warm-dry jungles). Because of the suitability of the Great Plains for agricultural production, many native prairie vegetation types have been radically transformed. The short-, mixed- and tall-grass prairies now correspond to the western rangelands, the wheat belt and the corn/soybean regions, respectively, to the central and eastern Great Plains. In the northern Canadian Prairies, the remaining natural vegetation is dominated by spear grass, wheat grass and blue grama grass, where local saline areas feature alkali grass, wild barley, greasewood, red samphire and sea blite. Drier northern sites are home to yellow cactus and prickly pear, with sagebrush also abundant.

The Aspen Parkland, the northern transition zone to the boreal forest, has expanded south into former grasslands since settlement effectively stopped prairie fires. In the United States, native prairie vegetation ranges from grama grass, wheatgrass and bluestem prairie in the north to different shrub and grassland combinations (e.g., mesquite-acacia savanna and mesquite-live oak savanna) and grassland and forest combinations (e.g., juniper-oak savanna and mesquite-buffalo grass) in the south. There are also patches of blackland prairie, bluestem-scachuista and southern cordgrass prairie in the southern United States. The eastern border of the region, stretching from central Iowa to Texas, shows patterns of grassland and forest combinations mixed with oak-hickory forest. Throughout the remainder of the Great Plains there are few native deciduous trees that occur, except in the eastern regions or in very sheltered locations along waterways or at upper elevations. In Mexico, the characteristic natural vegetation consists of prickly scrubs, with dominant species including mesquite, acacia, paloverde, silverleaf, hackberry, Texas olive, barreta, corbagallina, and ocotillo. Salt-tolerant communities are common in the lower portions of the Mexican Great Plains near the Laguna Madre.

Wetland concentrations are generally greatest in the glaciated, subhumid northern grasslands and adjacent aspen parkland of the northern Great Plains, where up to half of the land is wetland. Significant wetlands are also found in the Nebraska Sandhills and a large area of playas is located in the southwestern United States. During winter, the Mexican bodies of water provide habitat for numerous migrant waterfowl from Canada and the United States. Prairie wetlands provide major breeding, staging and nesting habitat for migratory waterfowl using the central North American flyway. Prior to European settlement, the Great Plains supported millions of bison, pronghorn antelope, elk and mule deer, plains grizzly bears and plains wolves. Today, the Great Plains is home to a disproportionately high number of rare, threatened, vulnerable and endangered species. The draining of wetlands and conversion of wildlife habitat for agriculture, industry and urban development are significant issues in this ecological region.

Human activities

The Great Plains is currently a culturally-molded ecosystem. The first European settlers began moving westward into the northern and central Great Plains from the eastern forest regions. At first, settlers considered the prairies to be infertile, so they stayed where trees persisted. But soon, settlers realized that the prairie soil was one of the most productive soils in the world. Today, the prairie grasslands are among the largest farming and ranching areas of the Earth. Agriculture is the most important economic activity as well as the dominant land use and the main stressor for this ecological region.

Crop types vary from north to south with differences in growing seasons and temperatures. Spring wheat and other grain crops such as barley and oats are common in the north. Corn is grown along the eastern, more moist northern and central portions, whereas winter wheat and sorghum predominate in the central and southern parts. While agricultural activities dominate the rural landscape, population is centered in urban areas and rural depopulation is a continuing trend in Canada and the United States.

There is a general trend in Canada and the United States away from small and medium-sized farms to large agribusiness operations. The change to a more complex economic structure in this region, influenced by international market forces, is also reflected in an increasing service sector. Mining as well as gas and oil extraction are also important activities. In the southern Great Plains, irrigation agriculture along the Rio Grande is very important, as it is in the southern portion of the Mexican Great Plains. The main cultivated crops are sorghum, corn, sunflowers, canola and beans. In the undulating and drier land of open scrub vegetation in the northwest, extensive cattle and goat ranching is very important. In portions of the region, scrub vegetation has been replaced by hay meadow. The Rio Grande crosses this region, acting both as an international border for 650 km and as an area of extensive commercial activity. Overall, approximately 34 million people live within this ecological region, with some 32 million alone occupying the portion occurring within the United States.



Photo: Canadian Plains Research Center



Photo: F. Takaki



Photo: Canadian Plains Research Center



Photo: Canadian Plains Research Center

1 Rolling plains and mixed-grass prairies are typical in the northern Great Plains.

2 Scrubland vegetation in southern portions of the region is a contrast to the prairies.

3 Open grassland and coulees provide a habitat for pronghorn antelope.

4 Crop production dominates many areas of the Great Plains.

Population: 8,000,000
Surface Area: 2,027,460 km²

NORTH AMERICAN DESERTS

The North American Deserts ecological region extends from eastern British Columbia in the north, to Baja California and north central Mexico in the south. The region is distinguished from the adjacent forested mountain ecological region by its aridity, its unique shrub and cactus vegetation with a lack of trees, and generally lower relief and elevations. Population centers have historically been small, but several urban areas like Las Vegas have recently experienced rapid growth.

Physical setting

The North American Deserts are comprised of a mix of physiographic features but, in general, the area consists of plains with hills, plains with mountains, and tablelands of high relief. In the north, the flat to rolling topography of the Columbia/Snake River Plateau consists of loess and volcanic ash deposits on basaltic plains. The Great Basin and its adjacent mountains contain hundreds of north-south trending fault-block mountain ranges separated by broad valleys; the valley floor elevations are often over 900 m above sea level and many of the ranges exceed 3,100 m. To the south, the mountain ranges are smaller and less regularly oriented and rise from lower base levels. The lowest basin point, Death Valley, is 86 m below sea level. Within the basin are found many dry lake beds, or playas, with alluvial fans and bajadas at the margin slopes. Sand dunes occur in some areas. The spectacular landscapes of the Colorado Plateau occur on uplifted and deeply dissected sedimentary rocks. Wind and water erosion has left impressive canyons, cliffs, buttes and mesas. Soils of the region are dry—generally lacking organic material and distinct soil profiles—and are high in calcium carbonate.

This ecological region has a desert and steppe climate: arid to semi-arid, with marked seasonal temperature extremes. This aridity is the result of the rain shadow of the Sierra Nevada, Cascade Mountains and Sierra Madre ranges as they intercept the wet winter air masses brought by the westerly and easterly winds. The Rocky Mountains also block some moist Gulf Coast air masses that cross the Great Plains. The Mezquital and Tehuaen Valleys occupy the southernmost region of the North American deserts. The climatic condition in this region is the result of the rain shadow produced by the Eastern Sierra Madre and the Neovolcanic Ridge. Average annual precipitation ranges from about 130 mm to 380 mm. The southern deserts have higher average temperatures and evaporation rates, with record-high temperatures in Death Valley reaching 57°C. Some southern areas, such as the Sonoran and Chihuahuan deserts, are dominated by a more episodic summer rainfall pattern, while the northern deserts tend toward a winter moisture regime with some precipitation falling as snow.

Biological setting

In this ecological region of altitudinal, latitudinal and landform diversity, there is a variety of vegetation types but low growing shrubs and grasses predominate. In the northern, Palouse area, grasslands and sagebrush steppes were once common. However, most of these northern grasslands have been converted to agriculture and, in some areas, the sagebrush steppe is being invaded by western juniper and cheatgrass. The Great Basin is characterized by sagebrush, with shadscale and greasewood on more alkaline soils. Creosote bush is common in the Mojave desert, a desert that also contains areas of the distinctive Joshua tree. The Sonoran desert has greater structural diversity in its vegetation than the other North American deserts that are dominated by low shrubs. Paloverde-cactus shrub vegetation includes various types of cacti, such as saguaro, cholla and agave. Plants of the Chihuahuan desert scrub are often shorter with sparser foliage than similar plants of the Sonoran or Mojave deserts. Tarbush and creosote bush are dominant shrubs, and grasses are intermixed throughout much of the Chihuahuan desert. The bajadas and hills include ocotillo, Joshua tree, lechuguilla and prickly pear.

Larger mammals are not abundant in the deserts area, but include mule deer, pronghorn antelope, coyotes, bobcats and badgers. Feral burros and feral horses are also found. Jackrabbits, cottontail rabbits, ground squirrels, kangaroo rats, mice and bats are the most common mammals. Birds include golden eagles, several western hawk species, ravens, roadrunners, mourning doves and black-throated sparrows. Some birds are characteristic of the sagebrush communities such as the sage thrasher, sage sparrow and sage grouse, while others are restricted to the southern warmer deserts, e.g., Gambel's quail, scaled quail, Gila woodpecker, Costa's hummingbird and curve-billed thrasher. Reptiles include the gopher snake, various species of rattlesnake, sagebrush lizard, horned lizard, geckos, Gila monster and desert tortoise. Due to human modifications of aquatic habitat, many of the listed species of threatened or endangered animals are fish. These include the bonytail chub, humpback chub, Sonora chub, Chihuahuan chub, beautiful shiner, Pecos bluntnose shiner, razorback sucker, Colorado squawfish, Pyramid Lake cui-ui and Lahontan cutthroat trout.

Human activities

Aboriginal hunter-gatherer populations in these desert areas were small, and their impacts on the environment were slight. Some Native American cultures in the southwestern deserts practised intensive agriculture locally, employing canal irrigation, terraces, and checkdams. Irrigation was also conducted by Spanish settlers in the southern part of the region, and by Mormon settlers in Utah from the mid-1800s.

Today, large-scale irrigated agriculture is found in parts of the Columbia Plateau, Snake River plain, Wasatch piedmont, upper Rio Grande, Salt and Gila valleys, Imperial Valley, Mexicali Valley, and river valleys such as the Rio Sonora, Rio Yaqui, and Rio Fuerte in southern Sonora and northern Sinaloa. In the north central Chihuahuan Desert, there are important irrigated areas such as Rio Conchos Valley and La Laguna region. Although only a small fraction of the region's land is in agriculture, it is the largest user of water resources, which originate largely outside the ecological region. Salinization, sedimentation, toxic pesticides and sufficient water quantity and quality for aquatic biota are concerns in these areas. Crops in the north include wheat, dry peas, lentils, potatoes, hay, alfalfa, sugar beets, apples and hops, while southern irrigated areas grow cotton, alfalfa, grapefruit, dates, lettuce and other vegetables. The economy of the region has historically been based on primary production, especially from irrigated agriculture, livestock raising (sheep and beef) and mining. The introduction of domestic livestock grazing in the mid- to late-nineteenth century has had significant ecological and hydrological effects. Cattle grazing is common throughout the North American Deserts ecological region, as well as in many of the surrounding mountainous upland regions.

Mining in the area has led to the appearance and abandonment of many small towns devoted to tapping mineral resources such as copper, gold, silver, iron, coal, uranium and salts. Today, tourism and recreation are becoming increasingly important contributors to local and regional economies. Human population density in the region remains relatively low. The cities are few and scattered, but are growing rapidly. The largest urban areas are Phoenix, El Paso-Ciudad Juarez, Salt Lake City, Las Vegas, Tucson, Mexicali, Albuquerque, Spokane, Hermosillo, Chihuahua and Torreon. Total population amounts to 8 million. Much of the land in the US portion of the region is in public domain. A checkerboard pattern of land ownership among federal, state, Indian and private land owners complicates land and resource management.

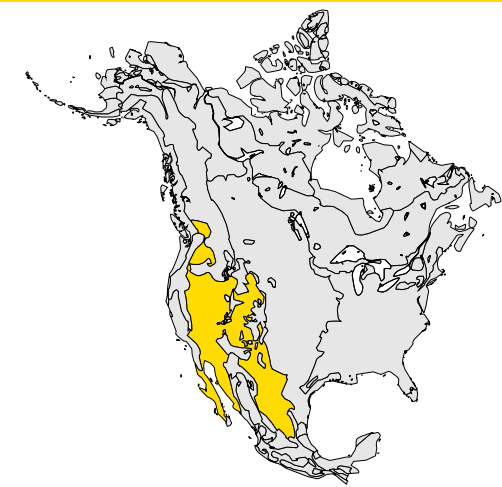


Photo: F. Takaki



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Photo: P. Rissler, National Biological Service



3

Photo: F. Takaki

1 Cirio (*Fouquieria columnaris*) in the Baja California desert.

2 Reptiles, such as this collared lizard, are important inhabitants of desert ecosystems.

3 Semi-permanent crop (alfalfa) in a valley near Cuatrociénegas, Coahuila.

Population: 30,000,000
Surface Area: 198,975 km²

MEDITERRANEAN CALIFORNIA

This relatively small ecological region extends 1,300 km from Oregon in the north to Baja California Norte state in the south. It abuts the Pacific Ocean on the west and the Sierra Nevada and deserts to the east. It is distinguished by its warm and mild Mediterranean climate, its shrubland vegetation of chaparral mixed with areas of grassland and open oak woodlands, its agriculturally productive valleys and its high population (30 million) in extensive urban agglomerations.

Physical Setting

The ecological region is comprised of a mixture of mountains, hills, tablelands and plains. It occupies an area of tectonic instability at the interface of the North American and Pacific tectonic plates and contains a variety of active faults. The coastal ranges contain a series of linear mountain ranges with crests averaging 600–1,200 m with interspersed valleys. The central valley is a broad trough containing the Sacramento and San Joaquin rivers that drain into the delta area and San Francisco Bay. The flat valley is filled with large quantities of silt, sand and gravel washed down from surrounding mountains. In Southern California, the rugged transverse ranges form the northern border of the Los Angeles Basin, and include the highest peak in the region, Mount San Geronio at 3,506 m. The peninsular ranges have peaks of 1,500–3,000 m and include the San Jacinto, Santa Ana and Laguna mountains of Southern California, and the Sierra Juárez and Sierra San Pedro Martir of Baja California. Lower hills, valleys and coastal terraces parallel the coast, and there are several islands across the Santa Barbara and San Pedro channels. Soil patterns are complex, mostly dry, and weakly developed with high calcium concentrations.

This ecological region occupies the only portion of the continent with a dry summer mediterranean climate. This climate is characterized by hot, dry summers and mild winters, with precipitation associated with winter frontal storms from the Pacific Ocean. The average summer temperatures are above 18°C and average winter temperatures are above 0°C. Annual precipitation is 200–1,000 mm depending on elevation and latitude, and falls mostly from November to April. San Diego and Tijuana receive about 250 mm, while San Francisco gets about 500 mm. There is a great annual variability of total precipitation, and extreme droughts are not uncommon. Coastal fog is common, particularly from May through July. The frost-free period ranges from 250 days in the north and on uplands to 350 days along the southern coast.

Biological setting

The Mediterranean California region is characterized by a mostly evergreen shrub vegetation called chaparral, plus patches of oak woodland, grassland, and some coniferous forest on upper mountain slopes. The chaparral has a thickened, hardened foliage resistant to water loss, and forms a cover of closely spaced shrubs 1 to 4 m tall. Common shrubs include chamise, buckbrush or ceanothus, and manzanita. Coastal sagebrush, summer-deciduous plants that tolerate more xeric, or dry, conditions than the evergreen chaparral, are found at lower elevations. About 80 percent of the presettlement coastal sage scrub in southern California has been displaced, primarily by residential development. Two listed endangered species and 53 candidate species occur in the coastal sage scrub community. To the north, the chaparral is less continuous, occurring in a mosaic with grassland, as well as broadleaf and coniferous forests. A blue oak-digger

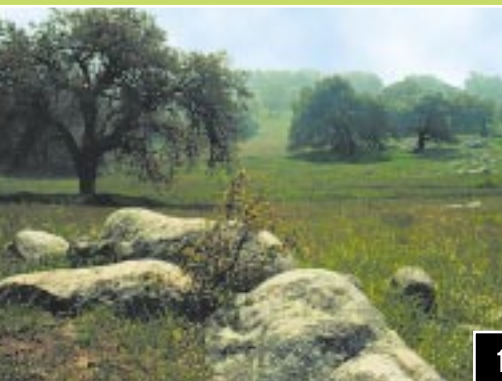
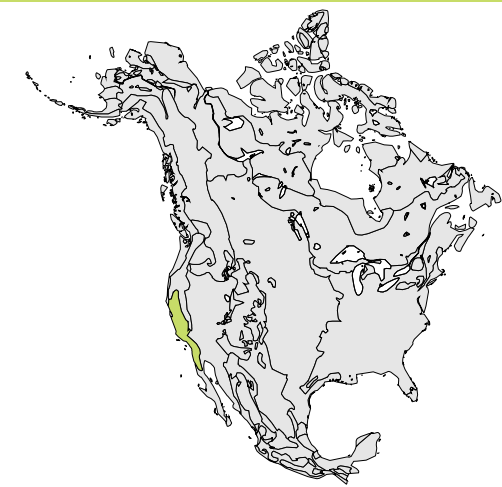
pine woodland community forms a ring around the Central Valley, which itself once had extensive grasslands and riparian forests. The southern oak woodland extends into the transverse and peninsular ranges and includes California walnut and Engelmann oak. Endemic tree species also include Monterey cypress, Monterey pine and Torrey pine.

Endangered or threatened animal species of the Mediterranean California include the California condor, Clapper rail, least tern, Bell’s vireo, California gnatcatcher, Smith’s blue butterfly, several species of kangaroo rats, salt-marsh harvest mouse, San Joaquin kit fox, blunt-nosed leopard lizard, San Francisco garter snake, Santa Cruz long-toed salamander, tidewater goby, green sea turtle, southern sea otter and Guadalupe fur seal.

Human activities

Indigenous people in this region were hunter-gatherers without much agriculture, who were dependent on seafood, seeds and nuts. The pre-European population often depended on acorns, the fruit of the oak, as a dietary staple, and today’s landscape includes more than 150 California city names that incorporate the word “oak.” The savanna-like oak rangelands were used by the early Spanish ranchers and missions for livestock grazing, agriculture and fuel wood. Settlement patterns were established by the Spanish missions, presidios and pueblo systems developed in the late 1700s and early 1800s, the Mexican ranchos of the early to mid-1800s, and commercial activities in the late 1800s. Millions of people moved to California in several waves, from the gold rush of the late 1840s, the land boom of 1880s, the Dust Bowl migration in the 1930s, and the post World War II boom and defense-related boom of the 1950s and 1960s. Today’s ethnically diverse population of more than 30 million is concentrated in the Southern California megalopolis, stretching from Tijuana to Santa Barbara, the San Francisco Bay area metropolis, and the growing urban areas of the Central Valley. More than 90 percent of the population lives in cities. Within Mexico, Tijuana is one of the fastest-growing cities, having doubled its population in less than 15 years.

Major economic activities involve a variety of manufacturing and service industries, including electronics, clothing, and computers, agriculture and food processing, aerospace and defense industries, the television and motion picture industry, tourism, petroleum and automotive-related industries, health care, and finance. The fertile soil, abundant sunshine, long growing season and irrigation water result in high yields of high-value crops. Central Valley produces rice, almonds, apricots, peaches, cherries, olives, sugar beets, wheat, hay, prunes, cattle, milk, grapes and cotton. In the Salinas Valley, artichokes, lettuce and brussel sprouts are common, while the southern portion of the region grows vegetables, citrus fruits, avocados, flowers and nursery products. Breathable air and adequate water quantity and quality have been common concerns for many urban areas of the region, which is dependent on an elaborate engineering delivery system to bring much of its water from distant sources. Contentious debates continue over how this resource will be allocated among agricultural, urban, industrial and environmental concerns.



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Photo: Sharon G. Johnson, University of California, Berkeley



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Photo: F. Takaki



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Photo: CEC file.



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Photo: F. Takaki

1 Pasture land and scattered oaks are common elements in Mediterranean California.

2 Hills with chaparral, between Tecate and Ensenada, Baja California.

3 Coyotes are still a common sight in the California foothills.

4 Vineyard in Valle de Guadalupe, near Ensenada, Baja California.

Population: 10,000,000
Surface Area: 270,340 km²

SOUTHERN SEMI-ARID HIGHLANDS

This region extends over part of the states of Arizona and New Mexico in the United States, and southward over several states in northern, western and central Mexico. In Mexico, this region is bounded on the west by the Temperate Sierras and on the east by the North American Deserts ecological region. The landscape is composed of hills, bottom valleys and plains. In general, the vegetation within this region is dominated by grasslands and in the transition zones by various scrublands and forests.

Physical setting

This region is formed of alluvial sediments and conglomerates from the volcanic sierras: the Western Sierra Madre and the Neovolcanic system. The elevation above sea level ranges from 1,100 to 2,500 m. There are two major types of soils, those that are relatively dry and moderately deep, and those that are shallow, clay soils. The climate is semi-arid, with 300-600 mm of annual rainfall and mean temperatures ranging from 12 to 20°C. In winter, frosts are common, as are periodic droughts.

Biological setting

The characteristic natural vegetation, which presently is very diminished or altered, consists of grasslands and combinations of grasslands with scrublands and forests in the transition zones. Certain species of grasses are dominant, particularly blue-stemmed, threeawn, galleta, and muhly grass. Among the shortgrasses, blue grama is an important species in the region at the foot of the Western Sierra Madre in the states of Chihuahua, Durango and Zacatecas. Among the shrubs and trees, in some locales, Agave, mesquite, acacia and other plants, it is very common to see mesquite and acacia associated. Oak and western juniper are common at the foot of the sierras. On deep clay soils, mesquite groves are the most conspicuous plant community. Over igneous hills in the Bajío region, where the climate is warmer, one finds subtropical scrublands, with species like cahuahuate or palo bobo, copalillos, acacia, prickly pear, jonote and pochote.

Wildlife includes quail, pigeons, doves, hares, jackrabbits, coyote, gray fox, mule deer, white-tailed deer and pronghorn antelope.

Human activities

The population in this region is about 10 million. This amounts to 8 percent of the population of Mexico. Raising livestock (cattle, horses and goats) has always been a very important activity in this region. Overgrazing has degraded the original plant and wildlife communities, with a serious reduction in plant cover and species composition along with changes in the structure of the plant community, mainly through shrub species invasion and soil erosion. Flatlands are used for irrigated agriculture. The main crops include beans, corn, sorghum, garlic, onion, hot peppers, vegetables, nuts, apples and peaches. There are several agro-industries, most notably those relating to milk and dairy products. Important mining activities include silver, gold, lead, copper and iron extraction. Several industrial and economically important cities have also developed.

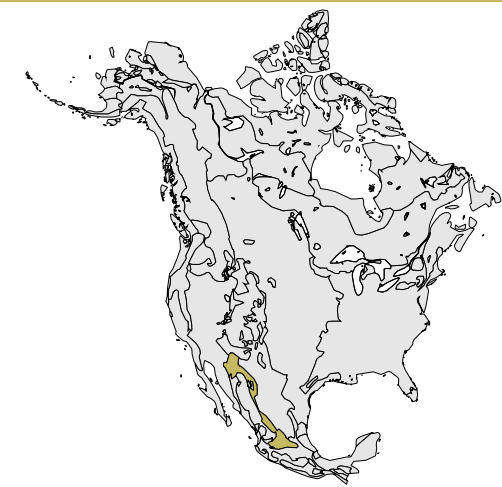


Photo: CEC file



Photo: F. Takaki



Photo: F. Takaki

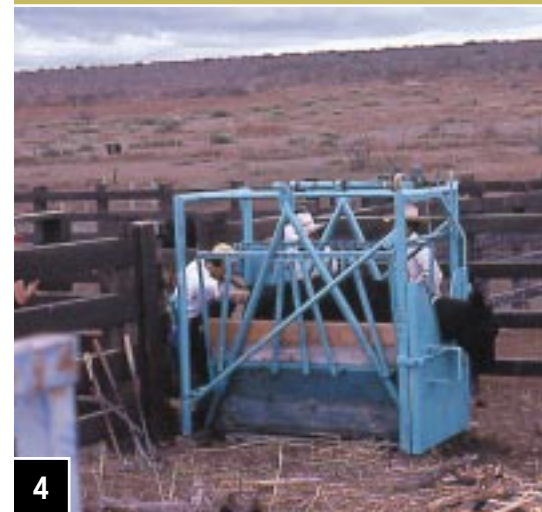


Photo: F. Takaki

- 1 Grassland with sparse evergreen oaks south of Fresnillo, Zacatecas.
- 2 Black-tailed jackrabbits inhabit the grassland and scrubland of the region.

- 3 Cattle grazing in grassland in Northern Mexico.
- 4 Cattle health inspection in southern Chihuahua, Mexico.

Population: 40,000,000
Surface Area: 634,485 km²

TEMPERATE SIERRAS

This ecological region comprises the major Mexican mountains including the Western Sierra Madre, the Eastern Sierra Madre, the Nudo Mexteco in western Oaxaca and Chiapas. Overall, the region covers approximately 25 percent of the land area of Mexico. Many of the major cities of the country are located here, including Mexico, Guadalajara, Morelia, Toluca and Puebla. Approximately 40 million people inhabit this region of intensive agricultural and industrial use.

Physical setting

The bedrock is a mix of igneous (Neovolcanic belt and Western Sierra Madre), metamorphic (Southern Sierra Madre) and sedimentary (Eastern Sierra Madre) rock. Mountains, canyons and foothills are dominant. The Western Sierra Madre is one of the largest volcanic ranges of the world, being some 1,250 km long and ranging from 125 to 300 km wide, with elevations up to 3,000 m above sea level. Major ranges include: Sierra Tarahumara, Papasquiario Tepehuanes, Sombrerete. Predominant drainage is toward the Pacific Ocean. The Conchos River and the inner basin of Nazas-Aguanaval are also important in the hydrological system.

The Eastern Sierra Madre chain, from 60 to 200 km wide, attains a height of 3,900 m above sea level and stretches for 1,000 km. It consists of mountains and folded hills, as well as valleys and plains. The most prominent mountains include: Arteaga, Gorda and La Huasteca. The Neovolcanic Belt, stretching from the Pacific Ocean to the Mexican Gulf, is 880 km long and 130 km wide. It includes the highest peaks of Mexico, including Pico de Orizaba, Iztaccíhuatl and Popocatépetl (more than 5,000 m high), and contains a number of active volcanoes. An intricate drainage system is found throughout the region, of which the Lerma-Santiago system is the largest component. Major lakes include Pátzcuaro, Chapala and Cuitzeo.

Biological setting

Vegetation can be evergreen or deciduous, primarily being composed of conifers and oaks. They grow from 10 to 30 m, sometimes reaching 50 m. This vegetative cover may comprise from one to three tree layers, one or two shrub layers and a herbaceous stratum. A mountain cloud forest occurs in places. This forest community is characterized by about 3,000 vascular plant species, 30 percent of which are endemic to Mexico. Mexican beech is a relict in Mexico. There are about 40 species of pine and more than 150 species of oak in Mexico—more than anywhere else in the world.

The mountain cloud forest is very rich in the diversity of vertebrate species. However, of the 298 species that inhabit these forests, 15 are endangered. Due to the reduced available cover (about 3 percent of the Mexican surface) and the high rates of deforestation to which this system has been subjected, it is probable that many other species with a restricted distribution are also close to extinction.

Of all the species of Mesoamerican vertebrates, 23 percent live in the coniferous forests of this region. Six percent of these species inhabit only these forests. From a total of 294 vertebrate species, 20 are officially listed as endangered. Mammals on this list include: wolf, coyote, cougar, squirrels, rats and mice. Listed birds include hummingbirds and woodpeckers. In the south of Mexico and Central America above elevations of 1,000 m, amphibians are more prevalent than reptiles.

Human activities

This ecological region has been particularly affected by human activities, such as agriculture and industry. It produces 80 percent of Mexico's wood supply. In terms of agriculture, common crops are corn, beans, barley, wheat and oatmeal. The prominent fruit trees are peach, apple and avocado, and, in some parts, coffee. Other important crops are potatoes, prickly pear and vegetables like squash and broad beans. Overall, this region accounts for 20 percent of Mexican agriculture. Specifically, it has 8 percent of the country's cattle, 64 percent of the corn crop, as well as 19 percent of the bean and 63 percent of the barley crops. These crops occupy 70 percent of the agricultural surface of the region. Besides cattle-raising, sheep and goat farming is prevalent.

The region's coniferous forests are threatened because of inappropriate forest harvesting and management practices. Fires are part of the natural process of forest regeneration. Nevertheless, in Mexico, fire is widely used as a tool for converting land from one use to another. This results in upsetting natural cycles of fire and an increase in the frequency of fire. About 40 percent of the region has been transformed. As a result, species such as Chiapas pine and Mexican piñon are close to extinction.

Culturally, the region has a long history associated with the Aztec, Zapotec, Mixtec, Purépecha and Otomí peoples. With the Spanish arrival, the region became a center for colonial development. More than 2 million inhabitants are indigenous. Twenty percent of this population is engaged in agricultural activities.

The Metropolitan area of Mexico City, one of the most populous urban areas in the world, is inhabited by about 20 million people and, with the other large cities in this region, adds up to about 40 million (almost 40 percent of the total Mexican population). This populace represents a huge demand for goods and services that must be satisfied with products imported from other regions. The high concentration of industries and commerce attract people to the city from other parts of the country. This migration has resulted in unequal economic growth which, in turn, has caused major social problems.

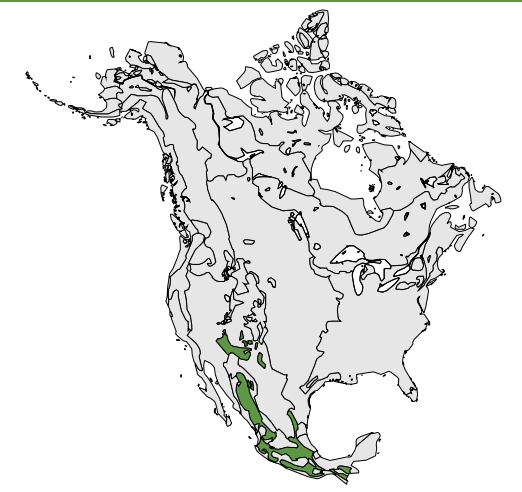


Photo: F. Takaki



Photo: F. Takaki



Photo: F. Takaki



Photo: J. Stoub

1 High altitude pine forest on the slopes of the Popocatépetl volcano in Mexico.

2 Pine forest in the Neovolcanic Belt.

3 Temperate cloud forest in the Eastern Sierra Madre.

4 Taxco, one of the many colonial mining towns established in the Temperate Sierras.

Population: 13,000,000
Surface Area: 246,260 km²

TROPICAL DRY FORESTS

This ecological region stretches in a narrow and interrupted strip from Eastern Sonora and Southeastern Chihuahua to Chiapas; at Michoacán it includes the Balsas Basin. In the Tehuantepec isthmus, it splits to embrace the Central Chiapas Depression where it stretches along the Pacific to Central America and the northern extreme of South America. It also occupies the Northern Gulf Coastal Plain, the north of the Yucatán Peninsula and the southern tip of the Baja California Peninsula, covering almost 13 percent of Mexico.



1

Photo: Marcelo Aranda

Physical setting

This region occupies an altitudinal range between 200 and 1,000 m above sea level. Average annual temperatures vary between 20°C and 29°C. This tropical climate is characterized by intense episodes of rainfall, especially during summer. Overall, average annual precipitation is between 600 and 1,600 mm. The dry season varies from 5 to 8 months. Soils are weakly developed, mainly from calcareous, metamorphic and volcanic rocks. They have a variable depth from shallow to deep. Textures are also variable, from clayey to sandy, depending on the nature of the underlying bedrock. Steep relief occurs over 75 percent of the region.

The Pacific Coastal Plain and the Western Sierra Madre emerged in Paleozoic times. The Coastal Plain is a flat region dipping gently to the sea, interrupted by eroded hills surrounded by extended alluvial cones. Detritic material from Pleistocene and recent times cover the surface. A number of rivers traverse the plain as they drain toward the Pacific Ocean.

The Balsas Basin emerged at the end of the Mesozoic period, and it is formed by mid-Cretaceous limestone; it is demarked by mountains of steep slopes. The Balsas Mezcala River and its tributaries dominate the surface waters of this basin.

This ecological region only occupies the northwest corner of the Yucatán Peninsula, which is formed of Cretaceous sedimentary rocks, overlain by tertiary formations. The karst plains lack surficial flows.

Biological setting

A diverse flora is present, particularly in the tree and bush layers that are dominant in most of this area. Southern floristic elements are prominent, along with numerous endemic genera in the Mexican Pacific side. Low deciduous and sub-deciduous forests dominate. This implies a marked seasonal pattern and a physiognomic difference between dry and humid seasons. These forests are from 4 to 15 m tall and have three distinct strata. The low deciduous forests contain about 6,000 vascular plant species, of which 40 percent are endemic to Mexico. In its composition, legumes are predominant, and the floristic richness decreases from southeast to northwest. In the Balsas Basin, a large number of endemic species occurs, and it is the most significant region for the family of copales (papelillos), trees that are harvested for commercial and ritualistic uses. Other species of economic importance include parota, cuéramo, Mexican red cedar, palo de rosa, sabcicú, jabin and henequen (false sisal).

Fauna include hare, squirrel, deer, lynx, ocelot and coati. Of the 253 vertebrates associated with Tropical Dry Forests, eight are endangered. Thirteen species of vertebrates associated with the sub-deciduous forests are also close to extinction.

Human activities

About 40 percent of the land area of this region has been converted to agriculture over the past few years. Total population is close to 13 million people, of whom 8 percent are indigenous. Twenty-nine percent of this population works in the agricultural sector. A third of Mexico's agricultural products are produced in this ecological region, including 10 percent of the cattle and 65 percent of the total sorghum. Other important crops include wheat, sesame, henequen, cane, sunflower and corn. The region also contributes 45 percent of the pork production, 31 percent of chicken production and 20 percent of Mexico's eggs.

Economic planning and development within the region has been haphazard. A few decades ago a development program was implemented to distribute large pieces of land within the Balsas Watershed and Apatzingán-Tepalcatepec. The objective was to promote production of basic grains. However, because of low returns, a switch to other crops took place. At the beginning, cotton was introduced. This crop soon caused considerable damage because of the abuse in associated agrochemicals which adversely affected flora and fauna. Cotton was abandoned when its international price dropped and was replaced by commercially valuable cash crops such as melon and mangoes. However, cultivation of these crops continues under the same intensive use of chemicals.

In the southeast, the Yucatán's northern forests have been under human influence since the Prehispanic epoch. Slash-and-burn systems prevail in corn cultivation. In this century, sugar cane cultivation first, and henequen later, promoted a huge transformation of land use. During the mid-1970s, the failure of the henequen crop provoked abandonment of large areas that now are in different stages of afforestation. Backyard gardening and small-scale vegetable cultivation complement the low yields of corn production. Almost all production is intended for self-consumption. The city of Mérida and the port of Yucalpetén have become centers of economic activity and thus have attracted labourers from the entire Yucatán Peninsula.



2

Photo: F. Takaki



3

Photo: F. Takaki



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Photo: F. Takaki

1 Cougars were once abundant in the Tropical Dry Forests.

2 Hill near Tehuantepec, Oaxaca, that supports a tropical deciduous forest.

3 Hills and canyons of the Balsas River basin in Michoacán.

4 Cattle and other livestock are raised in open areas of this region.

Population: 20,400,000
Surface Area: 311,070 km²

TROPICAL HUMID FORESTS

This ecological region includes the southern tip of the Florida Peninsula in the United States. Within Mexico, it encompasses the Gulf Coastal Plain, the western and southern part of the Pacific Coastal Plain, most of the Yucatán Peninsula and the lowlands of the Chiapas Sierra Madre, which continue south to Central and South America.

Approximately 20.4 million inhabitants live in this ecological region. Of this, over 16 million live in the Mexican portion, an area that has seen a 30 percent increase in population since 1980. The greatest number of indigenous peoples who are descendants of the great cultures, such as the Maya, live in this region.

Physical setting

Geologically, the region is mainly composed of folded and metamorphic hills, covered by thin alluvium. The sedimentary bedrock dates from the Precenozoic periods when waters of the Mexican Gulf covered much of this region. This Gulf of Mexico Plain contains an extensive network of rivers, including the Pánuco, Papaloapan, Coatzacoalcos, Grijalva and Usumacinta, which flow to the Mexican Gulf. The rivers on the Pacific side are short and numerous. In the Yucatán Peninsula, calcareous rocks dominate karstic relief. Soils have formed largely from the alluvial deposits or through in situ erosion.

The region spans from sea level to 1,000 m of altitude. It consists largely of tropical rain forest with year-round temperatures averaging between 20°C and 26°C. The average annual precipitation range is 1,500 to 3,000 mm, and in some areas may attain totals of more than 4,000 mm. The number of dry months is generally less than three.

Biological setting

Evergreen and semideciduous forests are the most characteristic plant communities of this region which, in terms of flora and fauna, is doubtless one of the richest zones in the world. Forest stands are typically of mixed ages with a great abundance of air plants (epiphytes): bromeliads, ferns, and orchids among others. The mature tree layer may attain heights of 30 to 40 m or more. Typical species include paque, allspice tree, palms, sombreroete, breadnut, and copai-yé wood.

Phytogeographically, this region is a northern extension of similar vegetation found in Central and South America. The number of vascular plant species approximates 5,000. From this total, 5 percent are endemic to Mexico. The diversity of tree species found in this tropical region is four times that of the northern temperate forests. Important plants include members of pea, mulberry, avocado, sapote and madder families. Areas connecting the greatest number of tropical tree endemisms are Los Tuxtlas in Chiapas and Uxpanapa in Veracruz, Tuxtepec in Oaxaca, Los Chimalapas (southeastern Oaxaca at the boundary with Veracruz and Chiapas), the Lacandon Forest (Chiapas), and the southern Yucatán Peninsula. Forests that are better preserved are located in Calakmul which connects in the south with the Petén, stretching into Guatemala.

In the extension of this region in the Florida peninsula, flooded marshes and swamps (both salt-water and freshwater) are widespread, with a very characteristic mangrove vegetation found in the Everglades.

The origin of most mammals is neotropical although some are of holarctic origin. A great abundance and variety of bats and marsupials is present. Common species include the armadillo, squirrel, lynx, peccary and tapir. Common birds include pheasant, macaos, parrots and toucans. Amphibians and reptiles are abundant including toads, frogs, arboreal frogs, caimans and crocodiles. Of 217 endemic vertebrate species that inhabit tropical evergreen forests, 14 are endangered.

Human activities

The forests have been widely exploited for precious woods like mahogany and red cedar, and in the states of Campeche and Quintana Roo, dyeing stick was extracted intensively by the English until the beginning of the 20th century, when a major harvest of chicle began. In the 1950s, barbasco was heavily harvested for diosgenin, which is an ingredient of contraceptive products.

Agriculture and forestry, which occupy 30 percent of the labor force, are the major activities. Here, the greatest proportion of indigenous population of Mexico is concentrated (more than 18 percent of the total), represented by 23 ethnic groups and 1.5 million inhabitants. Mayas, Totonacos, Chinantecos and Lacandones are prominent, among others.

Since prehispanic times, the region has been a producer of goods of great commercial value, and an entrance port to national and international trade. With the arrival of the Spanish, sugar cane and chile plantations were established and precious wood extraction increased. Regional economic growth occurred in a disorganized way, creating great economic and social disparities.

In the 1960s, in the framework of development programs, the region was affected by the opening of large areas for agriculture and cattle, such as Chontalpa, Balancan-Tenosique and Uxpanapa. Large forested areas were cleared for the planting of corn, beans, sugar cane and rice, and to serve as induced or cultivated pasture for extensive cattle production. The region has become the main producer of meat for national consumption.

Major products are fodder, sugar cane, oranges, coffee, cacao, bananas, sesame, green alfalfa, cotton and green pepper. One of the dominant activities, especially since the mid-twentieth century, is petrochemistry, which has been established in the Gulf Plain, mainly in Veracruz and Tabasco and the Sonda de Campeche. Important industrial complexes here have caused considerable ecological damage, irreversible in some cases. Both the sugar cane industry and cellulose production also contribute pollution, but to a minor degree. The Pánuco, Papaloapan and Coatzacoalcos rivers collect important flows of domestic and industrial wastes, including those coming from Mexico City.

On the Caribbean Mexican Coast and in Miami, in the Florida peninsula, an important touristic development has taken place. Offshore from the Yucatán Peninsula is found the world's second largest coral reef. However, the lack of regulations concerning tourist activities has resulted in substantial negative ecological impacts.



Photo: F. Takaki



Photo: F. Takaki



Photo: F. Takaki



Photo: F. Takaki

1 Evergreen high forest on the slopes of the San Martín volcano.

2 Mangrove swamp in Sontecomapan, Veracruz.

3 Milpa corn farm in a clearing made in the Lacandona forest.

4 Pineapples are one of the many important but lesser-known crops of this region.

IV. APPLICATIONS OF THE METHODOLOGY: CASE STUDIES

THE NORTH AMERICAN TEMPERATE RAIN FOREST

A Rare Forest Ecosystem

Globally, coastal temperate rain forests are scarce, covering 30 to 50 million ha, an area that is just 2 percent of the total remaining tropical rain forest, or less than 0.2 percent of the Earth’s land surface. Their original extent included western North America and parts of New Zealand, Tasmania, Chile and Argentina, as well as portions of Japan, northwest Europe and the Black Sea coast of Turkey and Georgia. Today, the largest undeveloped tracts of coastal temperate rain forests are found in South America and North America. Within North America, a significant amount occurs within the Marine West Coast Forests ecological region.

Ecological Setting

The Marine West Coast Forests ecological region provides the broad ecological context for the temperate rain forest. Oceans, mountains and lots of precipitation are common physical attributes that define the temperate rain forests of the world. These forests are an integral component of the surrounding mosaic of ecosystems, both forested and non-forested, that one must study in order to understand the rain forest. The methodology of the present study attempts to provide this context by considering the extension of these forests across political boundaries (Alaska, British Columbia, Washington, Oregon and California), and putting them in perspective within the broad continental-level ones, providing a link for ecological assessments ranging from the regional to the continental in scope. It is this mosaic of major mountainous forest ecosystems, along with non-forested wetlands, alpine tundra and prevailing patterns of land use, that comprises the Marine West Coast Forest ecological region. Within North America, temperate rain forests occur generally in association with high elevation forests, consisting primarily of mountain hemlock, amabilis fir and subalpine fir with lesser amounts of yellow cedar. Under rainshadow conditions, coastal Douglas fir, bigleaf maple and red alder become prevalent.

The Marine West Coast Forests ecological region results from the interaction of major climatic and ecological influences of the waters of the Pacific Ocean on the adjacent mountainous coastal lands in the mid-northerly latitudes. The mountains provide a barrier to moisture-laden westerly air currents,

resulting in heavy orographic precipitation patterns. This, coupled with the moderating effect on temperature of the Pacific Ocean, creates a year-round growing season for most plant species in the temperate rain forest ecosystem. Both altitude and rain-shadow conditions delimit the boundaries of this ecosystem. With altitude, temperatures decrease and suitable soils become infrequent as the rain forest gives way to subalpine forests and, at the highest altitudes, to alpine conditions. Certain mountain valleys as well as the Gulf and San Juan islands fall within the rain shadow of the coastal mountains. Relatively low levels of rainfall limit growth of rain forest species.

Current Status

North American temperate rain forests are characteristically wet ecosystems receiving annual precipitation up to 5,000 mm and more. Tree and biomass growth is rapid. In fact, these North American forests produce more biomass than nearly any other forest on Earth—including tropical rain forests. They extend southward from the western coast of Alaska through coastal British Columbia, Washington and Oregon down to northern California, originally covering over 25 million hectares (ha). Alaska contains 6.6 million and British Columbia another 10.6 million ha. To the south, Washington has 3 million, Oregon 3.4 million and California 1.4 million ha. Of these 25.1 million ha, 39 percent has been developed, as can be seen in the following table.

Where the forest has not been disturbed by logging or land clearing, the North American temperate rain forest is primarily an older-aged forest. Because wildfires are rare, the domi-

HISTORICAL AND CURRENT DISTRIBUTION OF THE COASTAL TEMPERATE RAIN FOREST OF NORTH AMERICA*

State or Province	Area of Original Coastal Temperate Rain Forest (million ha)	Percentage Developed of Original Coastal Temperate Rain Forest	Percentage Undeveloped of Original Coastal Temperate Rain Forest
Alaska	6.65	11	89
British Columbia	10.63	29	71
Washington	2.95	63	37
Oregon	3.44	85	15
California	1.43	90	10
Total	25.1	39	61

Source: Ecotrust, Portland, Oregon.

*Note: All of the coastal temperate rain forests of North America occur within the Marine West Coast Forests ecological region.

nant trees commonly survive for 300 to 800 years and some veterans reach ages of 1,000 years and older. Over time they can develop into some of the world's tallest and most massive trees, sometimes attaining heights of 95 m. The potential threat of harvesting these remaining old-growth stands has become an increasing worldwide concern.

Logging and Old Growth

Logging and land clearing have had an impact on the current extent and structural composition of the North American temperate rain forest. The portion of these forests within Alaska and British Columbia represents a large percentage of the unlogged coastal temperate rain forest of the world. In this area, 55 to 60 percent of the forest is over 250 years old. Recent data for British Columbia indicate that 29 percent of the coastal rain forest of that province has been logged. Only 11 percent of these forests within Alaska has been logged. A different situation occurs for Washington and Oregon, where extensive logging has taken place and only 15 and 10 percent, respectively, remains unlogged. In California, 90 percent of the original temperate rain forest has been logged.

The loss of forest land for other uses is not a primary concern, as much of the logged lands are regenerating as second-growth forest. Rather, the concern is of the loss of old growth. As lands are harvested, they are managed so as to produce a sustainable supply of timber and related resources. Rotation periods for second and subsequent harvests rarely exceed one hundred years. Compared to their potential life cycle, trees of this age in the temperate rain forest will not have even begun to approach old age. In essence, the mature portion of the life cycle of the rain forest is lost, resulting in unknown impacts on the wildlife that relies on such forests for habitat.

Future Outlook

In a North American context, 16 percent of the original extent of coastal temperate rain forest area is protected. A close look reveals variation in the geographical distribution of protection of this rain forest, ranging from 41 percent in Alaska to 4 percent of the Oregonian range of the original rain forest. Also, the temperate rain forests cannot be isolated from the adjacent rainshadow and subalpine forests. The ecological integrity of the Marine West Coast Forests ecological region as a whole depends on conservation, protection and maintenance of essential ecological links and components among all these ecosystems.

AQUATIC RESOURCE MANAGEMENT ISSUES IN BASINS OVERLAPPING DIFFERENT COUNTRIES AND ECOLOGICAL REGIONS

A Shared Resource

Issues regarding water quality standards, biological criteria, and non-point source pollution control have become major concerns in recent years. Like other aspects of ecosystem quality, problems involving aquatic ecosystems do not recognize political boundaries. Typically, water quality-related problems are dealt with on a watershed or river basin level. Although basin boundaries are important to identify as areas that influence the quality and quantity of water at a point on a river, many resource management agencies, at both the national and regional levels, recognize that the areas having the most effect on the quality and quantity of water do not correspond to basin boundaries (Omernik and Griffith 1991; Hughes et al. 1994).

Whereas watersheds and basins merely define topographic drainage areas (where that is possible), ecological regions encompass the spatial similarities of combinations of characteristics that cause or reflect differences in the quality, health and integrity of ecosystems. As such, ecological regions have been shown to be effective for structuring water resource regulatory programs and for biological monitoring (Hughes et al. 1994, Hornig et al. 1995, Yoder and Rankin 1995). Additionally, adjacent states, provinces, or territories sharing similar ecological regions are not restricted by their own boundaries when assessing reference site data to develop biological criteria and other aquatic resource management goals (Omernik 1995).

Ecological regions also provide a critical mechanism for dealing with water quality problems and the assessment and management of aquatic ecosystems on an international scale. The basins of many important rivers in North America overlap large areas of adjacent countries. One example is the Red-Assiniboine River Basin, which covers large areas of North and South Dakota and Minnesota in the United States, as well as portions of Saskatchewan and Manitoba in Canada. Another example is the Rio Grande Basin, which drains parts of Colorado, New Mexico and Texas in the United States, and Chihuahua, Durango, Coahuila, Nuevo León and Tamaulipas in Mexico. The quality and quantity of water in both rivers and their tributaries are of great importance to the countries that occupy their basins. Land management activities in each country can have a major impact on the shared aquatic resources.

The Red-Assiniboine River Basin

The basin of the Red River, including its tributary, the Assiniboine River, overlaps three level I ecological regions. Although most of the basin lies within the nutrient-rich, agricultural Great Plains ecological region, a relatively high percentage of the water originates in the nutrient-poor Eastern Temperate Forests and Northern Forests ecological regions. The quality and quantity of the water originating from each of these regions is distinctly different, partly due to the mix of geographical factors that characterize each region and partly due to anthropogenic activities that also differ sharply between the regions. Variation (within ecosystems) inside each region is greatly reduced by using the more detailed level II regions and more so with those in level III. Efforts to determine attainable water quality management scenarios in the Red River Basin would benefit from the use of sets of ecological reference sites or areas (Hughes 1995, Omernik 1995). In this case, the reference areas would comprise watersheds that are representative of each of the ecological regions, but which have remained “relatively” unimpacted. For broader, national and international scales of assessments, the coarser distinctions of levels I and II are suitable, but for state or provincial uses, the more detailed level III regions are more appropriate.

Anthropogenic inputs to the ecosystems, such as fertilizer or pesticides, often vary from one political unit (county, state, province or country) to another and may lead to degradation of water quality. For example, within an area showing ecological homogeneity in the Red River Basin, a marked state-line difference is evident between the portion in Minnesota and that in North Dakota regarding the application of fertilizer, in turn causing water quality problems. Reported application rates of total nitrogen and total phosphorus are higher in Minnesota counties than in adjacent North Dakota counties (Tornes and Brigham 1994).

The Rio Grande

Perhaps an even more appropriate candidate for calibrating water-resource assessment and management methods by ecological region is the Rio Grande. Although the river basin covers four ecological regions, the bulk of the water originates in two of them, the Northwestern Forested Mountains and the Temperate Sierras, which comprise a small fraction of the basin’s total area. Most of the basin is located in the semi-arid to arid Great Plains and North American Deserts ecological regions. The bulk of water use in this part of the basin is in approximately 1.2 million ha of irrigated farmland near the river, two-thirds of which is located in the United States. Most of this land is near the mouth of the Rio Grande, where citrus

fruit, vegetables and cotton are the major crops. US interstate agreements and international treaties govern the allocation of the surface water.

Level I ecological regions afford a logical spatial framework for general water resource assessment and reporting within the Rio Grande Basin because of the striking difference between these regions in their respective contributions and uses of water. However, for selecting regional reference sites to help in developing biological criteria, water quality standards, and nonpoint source pollution management goals, levels II and III are more appropriate. Issues such as differences in the quality of aquatic biota that may be attributable to differences in pesticide use between the United States and Mexico can be clarified through analysis of data from reference sites in both countries within the same ecological region. In locating the reference sites, care should be taken to ensure that the differences relate to agricultural practices and not to inherent site conditions.

NORTH AMERICA'S ARCTIC REGIONS: BIODIVERSITY CONSERVATION

A Shared Asset

To many people, the Arctic and Tundra areas are a distant wilderness—barren and covered with ice and snow. Because the areas are remote, many also assume that these northern ecosystems have escaped significant interference from human and industrial activities. For the most part, these notions are myths. The Arctic is a direct and indirect asset to many people in North America and elsewhere. The oil, natural gas and mineral resources found there are well known. Many species of animals, from waterfowl to marine mammals, spend their summers in the Arctic and then migrate south for the winter, some going as far as Mexico and beyond. Tourists and sports enthusiasts from all over North America are attracted to the scenic majesty of the Arctic.

Out of Reach?

Considering that the entire population of the North American Arctic numbers fewer than 60,000, how could human activities possibly have an effect on these vast tracts of land and water? We must realize that because of climatic patterns and the fact that airborne pollution disseminates for great distances, air pollution is often 10 to 20 times worse in the Arctic than in southern parts of the continent. The Arctic has almost unknowingly become a receiving ground for many harmful wastes that originate in distant cities, countries and continents. Atmospheric and oceanic currents carry pesticides, acidic pol-

lutants and other substances from as far away as Mexico, Japan and Russia to the Arctic. Furthermore, local resource developments and waste disposal methods within the Arctic and Tundra areas are increasingly affecting the quality of regional ecosystems.

Vast and Diverse

The North American Arctic, comprised of two level I ecological regions (Arctic Cordillera and Tundra):

- covers more than 3 million km², or nearly 14 percent of the continent’s land mass and constitutes one of the largest major ecological regions;
- constitutes about 20 percent of the much larger circum-polar Arctic system, shared by Canada, the United States and six other countries;
- contains the continent’s second-largest chain of mountains as well as extensive plains and hills;
- embraces large parts of the Arctic Ocean as well as parts of the Pacific and Atlantic Oceans;
- includes 56 percent of the continent’s coastline;
- varies in vegetative cover, from barren grounds to richly covered plains; and
- includes over 50 percent of the remaining polar bear population.

Biodiversity and Conservation

Biodiversity is addressed at three levels worldwide: at the genetic level, the species level, and the ecosystem macro level. If ecosystems are unprotected, there is little chance to protect either species or the molecular gene pool, which are parts of ecosystems. To many people, the ecosystem level is the most strategic. This globally accepted approach is certainly needed to conserve the North American Arctic, which is very fragile and easily threatened, and individual species to whole ecosystems can be dramatically impacted by subtle changes.

Status of Protected Areas

North America has the oldest and most extensive networks of protected areas in the world. The success that has been achieved in protecting ecosystems, however, varies across the continent and, indeed, within the Arctic region. Many of the largest protected areas in North America are found there.

What proportion of the Arctic is protected by other nations? How well are these ecosystems protected and managed in North America? This is difficult to answer without examining the data more closely. One might say that 18 percent of the North American Arctic is protected—but the protected areas are disproportionately greater in Alaska than in Canada. Areas that are currently under protection may have been selected for reasons other than their ecological representativity (e.g., scenic values, specific species or opportunities to acquire properties).

PROTECTION OF THE ARCTIC IN NORTH AMERICA

Category	World Arctic	North American Arctic	Canadian Arctic	US Arctic
Area (km ²)	14,817,779	3,034,331	2,510,598	523,733
% of total area	2% of the world	14% of the continent, 20% of the global Arctic system	12% of the continent, 26% of Canada	2.5% of the continent, 6% of USA
Population	55,000,000	60,000	28,000	32,000
No. of protected areas	256+	88	33	55
No. of wilderness types	139	23	1	22
Park types	46	16	13	3
Wildlife species	88	33	19	14
Protected area (km ²)	2,079,616	546,179	202,982	52,373
% of Arctic protected	14%	18%	8%	10%
Coast (km)	unknown	67,483	60,908	6,575
% Arctic coastline	unknown	56% of the continent's	67% of Canada's	33% of the US'
Polar bear population	29,340	14,670	12,670	2,000
% total population of polar bears	100%	50%	43%	7%
Faunal species at risk	238	78	11	67
Floral species at risk	1,400	40+	40	unknown

**PERCENTAGE OF THE ARCTIC ECOSYSTEMS
WITHIN EACH COUNTRY THAT IS PROTECTED**

Canada	8.0 %
United States	10.0 %
Finland	32.6 %
Greenland (Denmark)	45.6 %
Iceland	8.9 %
Norway	25.4 %
Russia	3.4 %
Sweden	20.7 %

Are all the different types of ecosystems—whether they be marine, wetland, mountain, barrens, or freshwater—protected? Definitely, marine ecosystems are not protected to any significant degree. Many of the major wetlands are protected but under limited management authority. The larger and more freely roaming, or migrating species are inadequately protected, particularly as the land surrounding existing protected areas becomes subject to an increased array of human impacts.

Initiatives like the Conservation of Arctic Flora and Fauna (CAFF) are supporting efforts to protect Arctic ecosystems. The national strategy of the Canadian Council on Ecological Areas (CCEA) is also assisting Arctic groups. Canadian federal government programs designed to establish protected areas like those of Parks Canada and the Canadian Wildlife Service have been very successful.

THE TIJUANA-SAN DIEGO BORDER AREA: A UNIQUE HUMAN SETTLEMENT

The US-Mexico Border

The border between Mexico and the United States stretches nearly 3,200 km and separates two independent nations with distinct histories and cultures. From an environmental perspective, the border area, as defined on either side of the political boundary, is undivided. Several rivers flow along and across the border. Three major desert regions with their unique ecosystems also traverse the border. Groundwater aquifers that provide essential water resources are also located in geologic formations straddling the border area. Because of geographic characteristics, the nearly 10 million people (1990 data) inhabiting the area are unevenly distributed and concentrated in 14 sister cities facing each other across the border and sharing common ecosystems, airsheds and drainage basins.

The Tijuana-San Diego Area: Population and Environment

Within the Mediterranean California ecological region, the Tijuana-San Diego area, where 3.5 million people live (30 percent of the entire border area population), is of particular interest. This huge urban area, stretching over low hills and mesas, occupies a rectangle of about 80 km by 20 km along the Pacific Coast, and has a winter rainfall averaging 250 mm annually. Most of the area is located within the Tijuana River Basin. The population on both sides of the border has increased dramatically during the last few decades. It doubled between 1970 and 1990 on the US side and between 1980 and 1990 on the Mexican side. During the last 25 years, the economy of the area has become more industrialized, putting a corresponding pressure on the environment.

Water and Waste: Resources and Constraints

Major concerns for daily life are binational water availability, allocation and use, as well as wastewater treatment and hazardous waste disposal. These problems have differing perspectives on both sides, but can be considered common issues. Water for human use is, to a large extent, imported from external binational sources, such as the Colorado River system. Local water reservoirs are increasingly being challenged by rising consumption levels and periodic droughts.

For the past decade, wastewater treatment capacity has been overloaded, especially on the Mexican side. The Tijuana River estuary and beaches on both sides of the border exhibit different degrees of pollution caused by relatively high concentrations of untreated human waste from urban centers. Wastewater treatment is binationally addressed at federal and local levels. Construction of an international wastewater treatment and disposal system for the Tijuana-San Diego area, with a 95 million-liters-per-day treatment capacity, began in the mid-1990s.

In 1991, nearly 700 assembly plants employed about 70,000 individuals in Tijuana. Most of the plants are located adjacent to or inside residential areas. In 1989, according to the EPA, 76 of 145 industrial facilities processing toxic chemicals were concentrated in San Diego along the border. San Diego industries released an annual estimate of 7 million (metric) tons of toxic chemicals to the environment. Binational efforts concerning waste disposal controls and illegal transboundary shipments of waste are currently underway.

Ecological Regions and Multi-National Perspectives Toward Sustainability

Binational water and watershed management regional plans are important tools for assessing the sustainable use of natural resources. A map of ecological regions is a useful analytical tool for planners and can be extremely helpful in areas such as Tijuana-San Diego. The ecological regions can serve as a common framework, to which relevant socio-economic and demographic databases may be linked through binational geographic information systems. Due to the holistic nature of the concept underlying them, ecological regions are essential in evaluating environmental-economic conflicts arising from the demands of society over time.

This approach is being tested by a binational team sponsored by NOAA in the Tijuana River watershed. It is a joint effort involving site selection for waste disposal, assessments of water availability, detection of environmental degradation and environmental monitoring. This project promotes data access for communities and organizations on both sides of the border in order to facilitate joint decision-making and management of the Tijuana River watershed.

TROPICAL DRY FORESTS: A THREATENED ECOSYSTEM

In discussions of the role of the natural tropical environment in maintaining global environmental conditions, it is generally assumed that the tropics are covered by rain forest. However, in Mexico, tropical dry forest vegetation covers only about 16 percent of the country and is being severely affected by human activities. Since this ecological region is not of primary concern to international organizations, research into these ecosystems and their conservation has not been promoted and only a few groups have projects aimed at developing appropriate methods of resource utilization.

The Tropical Dry Forests ecological region is generally limited to fine-textured soils of the plains and shallow hillside soils. The limiting factors in this ecological region are water availability and high temperatures. As a result, the species living in these environments exhibit a particular phenology. Most of the tree species lose some or all of their leaves during the dry season (5 to 7 months of the year) as a means of reducing transpiration. As a result, the physiognomy of the area in the dry season contrasts strongly with that of the rainy season.

Conservation

Since 1982, the number of Protected Natural Areas in Mexico has increased from 16 to 125. The term encompasses national parks, natural monuments, biosphere reserves and other categories. In combination, these cover approximately 8 percent of

AMOUNT OF TROPICAL DRY FOREST CONTAINED IN PROTECTED AREAS

Type	Area (ha)	Percentage (%)
National parks	27,087	0.01
Biosphere reserves	120,482	0.06
Total	147,569	0.07

the country. However, as can be seen in the following table, only 0.07 percent of this area is Tropical Dry Forest, which is the least-protected of all ecological regions.

The Tropical Dry Forest, as well as the Tropical Humid Forest, contains a high number of endemic species and genera with high levels of biological diversification, as is found in the copales family among others.

Landscape Modifications

This area is inhabited by various indigenous groups such as Mayas, Mixtecs and Huichols. Their economy, based historically on traditional sustainable production methods, has been changing to more deleterious practices under the impact of Western culture. Few Tropical Dry Forest species are of interest to commercial forestry, but many are harvested extensively for firewood, bark and local building materials. Although this extraction is on a small scale, the population growth and its long-term impact on natural resources have resulted in the significant degradation of these ecosystems.

Some of the main irrigated areas in Mexico are part of this ecological region, located in the Western Pacific Coastal Plain. Despite the great productive potential of the legume trees dominating these plant communities, in the absence of demonstration projects showing their utility, the local inhabitants replace the natural vegetation with crop fields and pasture. Due to the hilly topography and the low investment required, goats are grazed extensively. Overgrazing summer pasture has resulted in damage from soil compaction and depletion of the wild vegetation. The result of these practices is a patchwork landscape of pasture, eroded areas and original forest. All this is largely the result of the expansion of the agricultural frontier.

Another pressure on these ecosystems in recent decades has been the major urban growth of important touristic developments in Acapulco, Manzanillo and elsewhere along the Pacific Coast, altering the habitat and affecting wildlife.

The Future

It is important to increase public awareness of the diversity of tropical environments as well as conduct research projects designed to increase knowledge pertaining to the conservation and use of these ecosystems.

Nearly 20 percent of Mexicans live in this region, making conservation difficult. Successful promotion of it can be achieved only by presenting management alternatives to the local inhabitants and involving them in conservation strategies. This requires implementing education and participatory research programs designed to prevent further ecological damage and restore degraded areas, when possible.

If the current trend towards deforestation of the dry tropics continues, the only remaining areas of that natural ecosystem will be located in mountainous terrain far from human settlement and in karst areas where agriculture is relatively unproductive.

ACRONYMS AND ABBREVIATIONS

BCMELP	British Columbia Ministry of Environment, Lands and Parks
CCEA	Canadian Council on Ecological Areas
CEC	Commission for Environmental Cooperation
DOE	Department of Energy (Canada)
EROS	Earth Resources Observation System
IdeE	<i>Instituto de Ecología, A.C.</i>
IdeE, UNAM	<i>Instituto de Ecología</i> of the <i>Universidad Nacional Autónoma de México</i> Institute for Ecology of the National Autonomous University of Mexico
INE	<i>Instituto Nacional de Ecología</i> National Institute for Ecology
INEGI	<i>Instituto Nacional de Estadística, Geografía e Informática</i> National Institute for Statistics, Geography and Informatics
NOAA	National Oceanic and Atmospheric Administration (United States)
Semarnap	<i>Secretaría de Medio Ambiente, Recursos Naturales y Pesca</i> Secretariat of Environment, Natural Resources and Fisheries
US-EPA	Environmental Protection Agency (United States)
USGS	United States Geological Survey

Units (metric):

ha	hectare (a land area of 2,471 acres or 10,000 square meters)
km	kilometer (a linear distance of 1000 meters, approximately 0.62 miles)
m	meter (a linear measure equaling approximately 39.4 inches)

SELECTIVE GLOSSARY

abiotic	substances, geologic features, etc., characterized by an absence of life	eolian	borne, produced, deposited, or eroded by the wind
afforestation	to establish forest cover on land not previously forested or that has been deforested for a significant period of time	epiphyte	a plant of the temperate zone or the tropics that grows upon another plant nonparasitically, or upon some other object, and that derives its moisture and nutrients from the air, rain, and even debris accumulating around it
anthropogenic	of or relating to the impact of humans upon nature	eskers	a long narrow often sinuous ridge or mound of sand, gravel, and boulders deposited between ice walls by a stream flowing on, within, or beneath a stagnant glacier
alluvium	clay, silt, sand, or similar detritic material deposited by running water during recent time, ordinarily occurring in the flood plains and deltas of rivers and flowing streams (or as in alluvial fans or cones at places where streams issuing from mountains lose velocity and deposit their contained sediment on a valley floor)	fluvial material	produced by river action
biotic	of or relating to life and living beings	holarctic	of or relating to the geographical distribution of animals in the whole northern or Arctic region
boreal	of or relating to the northern and mountainous parts of the northern hemisphere, especially the region where the mean temperature during the six hottest weeks does not exceed 18°C	karst	limestone region marked by sinks, abrupt ridges, irregular protuberant rocks, caverns, and underground streams
colluvium	rock detritus or soil placed at the foot of slopes, primarily by gravity	lacustrine	of, relating to, or formed in lakes
detritic material	loose material that results directly from rock disintegration or abrasion	orographic	of or relating to mountains, their location and accompanying phenomena; for instance, orographic precipitation patterns
ecosystem	a dynamic complex of organisms (biota), including humans, and their physical environment, interacting as a functional unit; they may vary greatly in size and composition and display functional relationships within and between systems (quoted in Government of Canada 1996)	phenology	study of the interactions between climate and periodic biological phenomena (e.g., nesting, migrations)
endemic	restricted to or native to a particular area or region, usually because of physical, reproductive or geographic barriers to its spread	playa	a dry lake bed of ephemeral, intermittent or perennial activity
		riparian	of or relating to or located on the banks of a watercourse (stream, river, sometimes a lake)
		xeric	low or deficient in moisture that is available for the support of plant life

REFERENCES

- Alvarez, S., M. Ticul, and E. González. 1987. Fauna. In *Atlas cultural de México*. SEP-INAH. Mexico City: Ed. Planeta.
- Alvarez, T., and F. de la Chica. 1974. Zoogeografía de los vertebrados de México. In *El escenario geográfico-recursos naturales*. A. Flores-Díaz, L. Gonzalez, Q.T. Alvarez and F. de la Chica, eds., 219–335. SEP-INAH.
- Anderson, J.R. 1970. Major land uses (map). In *The national atlas of the United States of America*. Reston, VA: US Geological Survey.
- Bailey, R.G. 1976. Ecoregions of the United States (map). Ogden, UT: US Department of Agriculture, US Forest Service, Intermountain Region.
- Bailey, R.G. 1989. Ecoregions of the continents (map). *Environmental Conservation*. 16(4): 307–10.
- Bailey, R.G. 1995. Description of the ecoregions of the United States. 2d ed.(map). Miscellaneous Publication No. 1391. Washington, D.C.: US Department of Agriculture, US Forest Service.
- Baldwin, J.L. 1974. *Climates of the United States*. Washington, D.C.: US Department of Commerce, National Oceanic and Atmospheric Administration.
- Banfield, A.W.F. 1977. *Les mammifères du Canada*. Quebec: Les Presses de l'Université Laval et l'Université de Toronto. (Original English edition: A.W.F. Banfield. 1974. *The mammals of Canada*. Published for the National Museum of Natural Sciences, National Museums of Canada, by University of Toronto Press, Toronto.)
- Barbour, M.G. and W.D. Billings, eds. 1988. *North American terrestrial vegetation*. Cambridge: Cambridge University Press.
- Barnes, C.P. and F.J. Marschner. 1933. Natural land-use areas of the United States (map). Washington, D.C.: US Department of Agriculture.
- Bocco, G. 1995. The Tijuana River Watershed GIS: A tool for shared management (Project overview). In R. Wright, K. Ries, and A. Winckell. *Identifying priorities for a GIS for the Tijuana River Watershed*. San Diego: SDSU.
- Campbell, J.A., and W.W. Lamar. 1989. *The venomous reptiles of Latin America*. Ithaca: Comstock Publishing Co.
- Canadian Council on Ecological Areas (CCEA). 1995. *Overview of Canada's marine ecosystem framework*. Ottawa: CCEA.
- CETENAL (now INEGI). 1976. *La información CETENAL en la Zonificación Agropecuaria y Forestal, con fines de un manejo mejor aprovechamiento de los recursos naturales*. México, D.F.
- Commission of the European Communities. 1993. *Multilingual illustrated dictionary of aquatic animals and plants*. Oxford: Blackwell's.
- Conant, R., and J.T. Collins. 1991. *Reptiles and amphibians; eastern and central North America*. 2d ed. Peterson Field Guides. Boston: Houghton Mifflin Co.
- Corbet, G.B. and J.E. Hill. 1991. *A world list of mammalian species*. New York: Oxford University Press.
- Cuanalo de la Cerda, H., E. Ojeda, A. Santos, and C. Ortiz Solorio. 1989. *Provincias, regiones y subregiones terrestres de México*. Montecillo, México: Colegio de Postgraduados. Centro de Edafología.
- Dunbier, R. 1968. *The Sonoran Desert. Its geography, economy and people*. Tucson: The University of Arizona Press.
- Ecological Stratification Working Group. 1996. *A national ecological framework for Canada*. Ottawa: Environment Canada, State of Environment Directorate, and Agriculture and Agri-Food Canada, Research Branch, Centre for Land and Biological Resources Research.
- Environment Canada. 1993. *Canadian climate normals. 1960–1991*. 6 vols. Ottawa: Atmospheric Environment Service.
- Environment Canada. 1978–1986. *Northern land use information map series, Districts of Keewatin, Mackenzie and Franklin, N.W.T.* Ottawa.
- Environment Canada. 1986. *Climate atlas climatique Canada: Map series 2 — Precipitation*. Ottawa: Atmospheric Environment Service.
- Escalante, P., A.M. Sada, and J.R. Gil. 1996. *Listado de nombres comunes de las aves de México*. México: Comisión Nacional para el Conocimiento y Uso de la Biodiversidad.
- Ezcurra E., P. Rump, and R.N. Phillip. 1993. *North American workshop on environmental information*, 19–22 October 1993, Mexico City.
- Fenneman, N.M. 1938. *Physiography of the eastern United States*. New York: McGraw-Hill.
- Fenneman, N.M. 1946. *Physical divisions of the United States* (map). Reston, VA: US Geological Survey.
- Fernald, M.L. 1950. *Gray's manual of botany*. New York: American Book Co.
- Ferrusquia-Villafranca, I. 1993. Geology of Mexico: a Synopsis. In *Biological diversity of Mexico: Origins and distribution*. T.P. Ramamoorthy, R. Bye, A. Lot and J. Fa, eds. Oxford: Oxford University Press.
- Flores, M.G., J. Jimenez, X. Madrigal S., F. Moncayo R., and F. Takaki. 1971. *Memoria y mapa de los tipos de vegetación de México*. México: SARH.
- Flores-Villela, O., and P. Gerez. 1994. *Biodiversidad y conservación en México: vertebrados, vegetación y uso del suelo*. México: CONABIO-UNAM.
- Flores-Villela, O. 1991. *Análisis de la distribución de la herpetofauna de México*. Tesis doctoral, Facultad de Ciencias. Mexico City: UNAM.
- Gallant, A.L., T.R. Whittier, D.P. Larsen, J.M. Omernik, and R.M. Hughes. 1989. *Regionalization as a tool for managing environmental resources*. EPA/600/3-89/060. Corvallis: US Environmental Protection Agency.
- García, E. 1991. *Modificaciones al sistema de clasificación climática de Köppen*. México.
- Gotch, A.F. 1995. Latin names explained: A guide to the scientific classification of reptiles, birds, and mammals. London: Blandford Press.
- Government of Canada. 1996. *Conserving Canada's natural legacy (the state of Canada's environment)*. CD-ROM version.
- Griffith, G.E., J.M. Omernik, C.M. Rohm, and S.M. Pierson. 1994. *Florida regionalization project*. EPA/600/Q-95-002. Corvallis: US Environmental Protection Agency, Environmental Research Laboratory.
- Griffith, G.E., J.M. Omernik, T.F. Wilton, and S.M. Pierson. 1994. Ecoregions and subregions of Iowa: A Framework for water quality assessment and management. *Journal of the Iowa Academy of Science* 101(1): 5–13.
- Hall, E.R. 1991. *The mammals of North America*, 2d edition. 2 vols. New York: John Wiley and Sons.
- Hammond, E.H. 1970. Classes of land-surface form (map). In *The national atlas of the United States of America*. Washington, D.C.: US Geological Survey, 62–63.
- Hills, G.A. 1961. *The ecological basis for land-use planning*. Research Report No. 46. Toronto: Ontario Department of Lands and Forests.
- Hirvonen, H. 1984. *The Atlantic region of Canada: An ecological perspective*. Dartmouth, NS: Environment Canada. Lands and Integrated Programs Directorate.
- Hirvonen, H. 1992. The development of regional-scale ecological indicators: A Canadian approach. In *Ecological Indicators*. 2 vols. Daniel McKenzie, D. Eric Hyatt and V. Janet McDonald, eds., 901–15. London: Elsevier Applied Science.
- Hirvonen, H., L. Harding, and J. Landucci. 1994. A national marine ecological framework for ecosystem monitoring and SOE reporting. In *Proceedings of the Second International Conference on Science and Management of Protected Areas*, 16–21 May 1994, Halifax, N.S.
- Hirvonen, H., and J. J. Lowe. 1995. Integration of Canada's forest inventory with the National Ecological Framework for State of Sustainability Reporting. Paper presented at IUFRO XX World Congress, 6-12 August 1995, Tampere, Finland.
- Hornig, C.E., C.W. Bayer, S.R. Twidwell, J.R. Davis, R.J. Kleinsasser, G.W. Linam, and K.B. Mayes. 1995. Development of regionally based biological criteria in Texas. In *Biological assessment and criteria: tools for water resource planning and decision-making*. W. Davis and T.P. Simon, eds., 145–52. Boca Raton, FL: Lewis Publishers.
- Howell, S.N.G., and S. Webb. 1995. *A Guide to the birds of Mexico and northern central America*. New York: Oxford University Press.

- Hughes, R.M. 1995. Defining biological status by comparing with reference conditions. In *Biological assessment and criteria: tools for water resource planning and decision-making*. W.S. Davis and T.P. Simon, eds., 31–47. Boca Raton, FL: Lewis Publishers.
- Hughes, R.M., S.A. Heiskary, W.J. Matthews, and C.O. Yoder. 1994. Use of ecoregions in biological monitoring. In *Biological monitoring of aquatic systems*. S.L. Loeb and A. Spacie, eds., 125–51. Boca Raton, FL: Lewis Publishers.
- Hughes, R.M., D.P. Larsen, and J.M. Omernik. 1986. Regional reference sites: A method for assessing stream potentials. *Environmental Management* 10(5): 629–35.
- Hunt, C.B. 1979. Surficial geology (map). Reston, VA: US Geological Survey.
- INEGI. 1970. *Serie de cartas temáticas (geología, suelo, clima, uso del suelo y vegetación, fisiografía) escalas 1:250 000; 1:1 000 000; 1:4 000 000*.
- INEGI. 1970. *Serie de cartas topográficas, escalas 1:250 000; 1:1 000 000 y 1:4 000 000*.
- INEGI. 1988. Carta climática. *Atlas nacional del medio físico*. México.
- INEGI. 1988. Carta edafológica. *Atlas nacional del medio físico*. México.
- INEGI. 1988. Carta geológica. *Atlas nacional del medio físico*. México.
- INEGI. 1989. Carta topográfica. *Atlas nacional del medio físico*. México.
- INEGI. 1991. *Datos básicos de la geografía de México*.
- INEGI. 1991. *XI Censo general de población y vivienda*. Ags. Méx.
- INEGI. 1995. *Serie espaciomas 1:250 000; 1:1 000 000; 1:4 000 000*.
- INEGI. 1995. *Estadísticas del medio ambiente*. México.
- Jaeger, E.C. 1957. *The North American deserts*. Palo Alto: Stanford University Press.
- Jaeger, E.C. 1965. *The Californian deserts*. 4th ed. Palo Alto: Stanford University Press.
- King, P.B., and H.M. Biekman. 1974. *Geologic map of the United States*. Reston, VA: US Geological Survey.
- Krajina, V. 1969/70. *Ecology of western North America*. 2 (no. 1 and 2). Vancouver: University of British Columbia, Department of Botany.
- Krane, W. 1986. Five-language dictionary of fish, crustaceans, and molluscs. Hamburg: Behr Verlag.
- Kuchler, A.W. 1964. *Potential natural vegetation of the conterminous United States*. Special Publication No. 36, New York: American Geographical Society.
- Kuchler, A.W. 1970. Potential natural vegetation (map). In *The National atlas of the United States of America*. Washington, D.C.: US Geological Survey, 89–91.
- Leopold, A.S. 1959. *Wildlife of Mexico: The game birds and mammals*. Berkeley: University of California Press.
- Leopold, A.S. 1977. *Fauna silvestre de México: Aves y mamíferos de caza*. México: Editorial PAX.
- Leopold, A.D., R.J. Gutiérrez, and M.T. Bronson. 1982. *North American game birds and mammals*. New York: Charles Scribner's Sons.
- Lopoukhine, N., N.A. Prout, and H.E. Hirvonen. 1979. *The ecological land classification of Labrador: A reconnaissance*. Halifax: Lands Directorate, Fisheries and Environment Canada.
- Loveland, T.R., J.W. Merchant, D.O. Ohlen, J.F. Brown, B.C. Reed, P. Olson, and J. Hutchinson. 1995. Seasonal land-cover regions of the United States. *Annals of the Association of American Geographers* 85(2): 339–55.
- Macura, P. 1979. *Elsevier's dictionary of botany*. Amsterdam: Elsevier Scientific Publishing Co.
- Matthews, L.H. 1971. *Les mammifères*. Paris/Montreal: Bordas.
- McGinnies, W.G., B.J. Goldman, and P. Paylores, eds. 1968. *Deserts of the world*. Tucson: The University of Arizona Press.
- Omernik, J.M. 1987. Ecoregions of the conterminous United States. *Annals of the Association of American Geographers* 77(1): 118–25.
- Omernik, J.M. 1995. Ecoregions: A spatial framework for environmental management. In *Biological assessment and criteria: tools for water resource planning and decision-making*. W. Davis and T. Simon, eds. Boca Raton, FL: Lewis Publishers, 49–62.
- Omernik, J.M., and A.L. Gallant. 1990. Defining regions for evaluating environmental resources. In *Global natural resource monitoring and assessments. Proceedings of the International Conference and Workshop*. Venice, Italy, 936–47.
- Omernik, J.M., and G.E. Griffith. 1991. Ecological regions versus hydrological units: frameworks for managing water quality. *Journal of Soil and Water Conservation* 46(5): 334–40.
- Oswald, E.T., and J.P. Senyk. 1977. *Ecoregions of Yukon Territory*. Publication No. BC-X-164. Victoria, BC: Environment Canada, Canadian Forestry Service.
- Ouellet, H., M. Gosselin, and J.P. Artigau. 1990. *French nomenclature of North American birds*. Ottawa: Minister of Supply and Services Canada.
- Preston, Richard J. 1961. *North American trees*. Ames: The Iowa State University Press.
- Rowe, J.S. 1972. *Forest regions of Canada*. Publ. No. 1300. Ottawa: Department of Environment, Canadian Forest Service.
- Robbins, C.S., B. Brunn, and H.S. Zim. 1983. *A guide to field identification of birds of North America*. New York: Golden Press.
- Rzedowski, J. 1978. *La vegetación de México*. México: Editorial Limusa.
- Rzedowski, J. 1993. Diversity and origins of the phanerogamic flora of Mexico. In T.P. Ramamoorthy, R. Bye, A. Lot and J. Fa, eds: *Biological diversity of Mexico: Origins and distribution*. Oxford: Oxford University Press.
- Saint-Laurent, Agnès, ed. 1986. *Faune et flore de l'Amérique du Nord*. Montréal: Reader's Digest Ltd.
- Seely, M. 1993. *Desiertos*. Barcelona (Spain): Plaza y Janes Editores, S.A.
- Shreve, G., and I.L. Wiggins. 1964. *Vegetation and flora of the Sonoran Desert*. Palo Alto: Stanford University Press.
- Stebbins, R.C. 1985. *Western reptiles and amphibians*. Peterson Field Guides, Boston: Houghton Mifflin Co.
- Strong, W.L., and K.R. Leggart. 1980. *Ecoregions of Alberta*. ENR Report Number 143. Edmonton: Alberta Department of Energy and Natural Resources.
- Tamayo, J.L. 1981. *Geografía moderna de México*. México: Editorial Trillas.
- Toledo, V.M., and M.J. Ordomez. 1993. The biodiversity scenario of Mexico: a review of terrestrial habitats. In T.P. Ramamoorthy, R. Bye, A. Lot and J. Fa, eds. *Biological diversity of Mexico: Origins and distribution*. Oxford University Press.
- Tornes, L.H., and M.E. Brigham. 1994. *Nutrients, suspended sediment and pesticides in waters of the Red River of the North basin, Minnesota, North Dakota and South Dakota, 1970-1990*. Water-Resources Investigations Report 93-4231. Mounds View, MN: US Geological Survey.
- Universidad Nacional Autónoma de México. 1990. *Atlas nacional de México*. México: UNAM, Instituto de Geografía.
- US Department of Agriculture, Forest Service. 1970. Major forest types (map). In *The national atlas of the United States of America*. Reston, VA: US Geological Survey, 154–55.
- US Department of Agriculture, Agriculture Experiment Station of the North Central Region. 1957. *Soils of the north central region of the United States* (map). Publication No. 76, Bulletin 544. Madison, WI: USDA.
- US Department of Agriculture, Agriculture Experiment Stations of the Southern States and Puerto Rico Land-Grant Universities, and USDA Soil Conservation Service. 1973. *Soils of the southern states and Puerto Rico* (map). In *Soils of the southern states and Puerto Rico*. Southern Cooperative Series Bulletin No. 174. Forth Worth, TX: USDA.
- US Department of Agriculture, Agriculture Experiment Stations of the Western States Land-Grant Universities and Colleges and US Department of Agriculture, Soil Conservation Service. 1964. *Soils of the western United States (exclusive of Hawaii and Alaska)* (map). Pullman, WA: USDA.

- US Department of Agriculture, Soil Conservation Service. 1970. Distribution of principal kinds of soils: orders, suborders, and great groups (map). In *The national atlas of the United States of America*. Washington, D.C.: US Geological Survey, 86–87.
- US Department of Agriculture, Soil Conservation Service. 1981. Land resource regions and major land resource areas of the United States. *Agriculture handbook* 296. Washington, D.C.: US Government Printing Office.
- US Department of Commerce, Bureau of the Census. 1990. Census of agriculture, 1987. Volume 2, Subject Series. In Part 1, *Agricultural atlas of the United States*. Washington, D.C.: US Government Printing Office.
- US Environmental Protection Agency. 1991. *[Report of the] Ecological Processes and Effects Committee*. EPA-SAB-EPEC-91-003. Washington, D.C.: US Environmental Protection Agency.
- US Environmental Protection Agency, Science Advisory Board. 1991. *Evaluation of the ecoregion concept. Report of the Ecoregions Subcommittee of the South*. Southern Forest Experiment Station, New Orleans, LA, and Southeastern Forest Experiment Station, Asheville, NC.
- Van Wijk, H.L.G. 1971. *A dictionary of plant names*. Amsterdam: Asher and Co.
- Weatherall, W., and E. Wiken, comps. 1985. *Canada, and state of the environment reporting*. Ottawa: Environment Canada.
- Wiken, E., comp. 1986. *Terrestrial ecozones of Canada*. Ecological Land Classification Series No. 19. Hull, QC: Environment Canada.
- Wiken, E. 1994. Preliminary discussions with the author on working document and notes: Protected areas of North America: An ecosystem profile. April 1994 in Fort Collins, CO.
- Wiken, E. 1996. Ecosystems: frameworks for thought. In *World Conservation*, 27(1) Gland, Switzerland CH-1196.
- Wiken, E. 1996. *Terrestrial and marine ecozones of Canada*. Ottawa: Environment Canada.
- Wiken, E., and D. Gauthier. 1994. Discussions with the author on working document and notes of North American Trilateral Committee, Ecosystem Framework and Analysis Working Group #1. 29 November to 1 December 1994, Lincoln City, USA.
- Wiken, E., and D. Gauthier. 1995. Discussions with the author on working document II of North American Ecosystem Trilateral Workshop: Ecological Regionalization, Ecological Indicators, Ecological Approach and Protected Areas. 28–30 March 1995, Coatepec, Mexico.
- Yoder, C.O., and E.T. Rankin. 1995. Biological criteria program development and implementation in Ohio. In *Biological assessment and criteria: tools for water resource planning and decision-making*. W. Davis and T.P. Simon, eds. Boca Raton, FL: Lewis Publishers, 109–44.

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Common and scientific names of selected characteristic species

Notes: Species whose ranges are far from an area where a given language is spoken may not have vernacular names in that language. On the other hand, frequently encountered species may have more than one common name in a region. In all cases, the Latin name should be considered to have priority for further reference.

† = a name derived for a species by combining a well-established vernacular genus name with a transliteration of the Latin species name.

‡ = a species for which no vernacular name could be found in the literature consulted.

This list is a work in progress. Readers with suggestions for corrections or additions are cordially requested to send them to the CEC Secretariat.

COMMON AND SCIENTIFIC NAMES OF SELECTED CHARACTERISTIC SPECIES

ENGLISH	LATIN	FRENCH	SPANISH
FISH	PISCES	POISSONS	PECES
Chub, Bonytail	<i>Gila elegans</i>	Cyprin épineux (†)	Cacho espinoso
Chub, Chihuahua	<i>Gila nigrescens</i>	Cyprin du Chihuahua	Cacho de Chihuahua
Chub, Humpback	<i>Gila cypha</i>	Cyprin à bosse	Cacho jorobado
Chub, Sonora	<i>Gila ditaenia</i>	Cyprin du Sonora	Cacho de Sonora
Cod sp.	<i>Gadidae</i> sp.	Morues (Gadidés)	Bacalaos
Cui-ui, Pyramid Lake	<i>Chasmistes cujus</i>	Cui-ui du lac Pyramid	Cui-ui
Goby, Tidewater	<i>Eucyclogobius newberryi</i>	Goujon de mer	Gobio de agua corriente
Herring	<i>Clupeidae</i>	Harengs	Arenque
Muskellunge sp.; Pike sp.	<i>Esocidae</i> sp.	Brochets	Lucios
Salmon, Pacific	<i>Oncorhynchus</i> sp.	Saumon du Pacifique	Salmón del Pacífico
Shark, Blue	<i>Prionace glaucus</i>	Requin bleu	Tiburón azul
Sharks, Requiem (Great White, Bull, Tiger)	<i>Carcharhinidae</i>	« Mangeurs d'hommes » (requin blanc, requin-tigre, requin-taureau)	Tiburones feroces (blanco, toro, tigre)
Shiner, Beautiful	<i>Cyprinella formosa</i>	Beau mené	Carpa plateada
Shiner, Pecos Bluntnose	<i>Notropis simus pecosensis</i>	Mené camus du lac Pecos	Carpa nariz roma de Pecos
Squawfish, Colorado	<i>Ptychocheilus lucius</i>	Sauvagesse du Colorado	Salmón blanco de Colorado
Sturgeons	<i>Acipenseridae</i>	Esturgeons	Esturiones
Sucker, Razorback	<i>Chasmistes brevirostris</i>	Carpe noire	Catostómido espalda de navaja
Tarpons	<i>Elopidae</i>	Tarpons	Tarpón; Pez lagarto

COMMON AND SCIENTIFIC NAMES OF SELECTED CHARACTERISTIC SPECIES (continuation)

Trout, Lahontan Cutthroat	<i>Oncorhynchus clarki henshawi</i>	Truite fardée de Lahontan	Trucha de Lahontan
Trout, Rainbow; Steelhead (Trout)	<i>Oncorhynchus mykiss (Salmo gairdneri)</i>	Truite arc-en-ciel	Trucha arcoiris (o de arcoiris)
AMPHIBIANS	AMPHIBIA	AMPHIBIENS	ANFIBIOS
Axolotl, Mexican	<i>Ambystoma mexicanum</i>	Salamandre du Mexique	Axolotl o Ajolote
Frogs	<i>Ranidae</i> sp.	Grenouilles	Ranas
Salamander, Alligator (Hellbender)	<i>Cryptobranchus alleganiensis</i>	Salamandre-alligator (Ménopome)	Salamandra gigante
Salamander, Santa Cruz Long-toed	<i>Ambystoma macrodactylum croceum</i>	Salamandre à longs doigts de Santa Cruz	Salamandra de dedos largos
Salamander, Tiger	<i>Ambystoma tigrinum</i>	Salamandre-tigre	Salamandra tigre
Toad, Hammond's Spadefoot	<i>Scaphiopus hammondi</i>	Pieds-en-bêche de Hammond (†)	Sapo cavador
Toads	<i>Bufo</i> sp.	Crapauds véritables	Sapos
REPTILES	REPTILIA	REPTILES	REPTILES
Alligator Lizard, Arboreal	<i>Abronia taeniata</i>	Lézard-alligator arboricole (†)	Escorpioncillo verde
Alligator Lizard, Mexican (†)	<i>Barisia imbricata</i>	Lézard-alligator du Mexique (†)	Escorpión falso
Alligator Lizard, Red-lipped	<i>Abronia litrochyla</i>	Lézard-alligator à lèvres rouges (†)	Dragoncito de labios rojos
Alligator, American	<i>Alligator mississippiensis</i>	Alligator américain	Lagarto
Anole, Green; Chameleon	<i>Anolis carolinensis</i>	Anolis de la Caroline	Anolis de Carolina; Camaleón verde
Caiman, Spectacled	<i>Caiman crocodilus</i>	Caïman à lunettes	Caimán de anteojos
Chuckwalla	<i>Sauromalus obesus</i>	Chuckwalla	Cachorón
Constrictor, Boa	<i>Constrictor constrictor</i>	Boa constricteur	Boa; Mazacuata
Crocodile, American	<i>Crocodylus acutus</i> or <i>americanus</i>	Crocodile américain	Cocodrilo amarillo
Crocodile, Morelet's	<i>Crocodylus moreletii</i>	Crocodile de Morelet (†)	Cocodrilo de pantano o moreleti
Fer de lance	<i>Bothrops asper</i>	Fer de lance (†)	Nauyaca real; Barba amarilla; Cuatronarices
Gecko, Banded	<i>Coleonyx variegatus</i>	Gecko varié	Salamanquesa de bandas
Gecko, San Lucas Left-toed	<i>Phyllodactylus unctus</i>	Gecko de San Lucas (†)	Salamanquesa del Cabo
Horned Lizard, Texas	<i>Phrynosoma cornutum</i>	Tapaya du Texas; Lézard cornu	Tapayatzin; Lagartija cornuda
Iguana, Black	<i>Ctenosaura pectinata</i>	Iguane mexicain	Iguana negra; Tilcampo

COMMON AND SCIENTIFIC NAMES OF SELECTED CHARACTERISTIC SPECIES (continuation)

Iguana, Green	<i>Iguana iguana</i>	Iguane vert	Iguana verde
Leopard Lizard, Blunt-nosed	<i>Gambelia silus</i>	Lézard-léopardin à museau arrondi	Lagartija leopardo de nariz chata
Lizard, Mexican Beaded	<i>Heloderma horridum</i>	Lézard perlé mexicain	Lagarto enchiquerado
Lizard, Sagebrush	<i>Sceloporus graciosus</i>	Lézard des armoises (†)	Lagartija llanera
Moccasin, Tropical; Ornate Cantil	<i>Agkistrodon bilineatus</i>	Mocassin	Cantil; Metapil
Moccasin, Water	<i>Agkistrodon piscivorus</i>	Mocassin aquatique; Vipère d'eau	Cantil de agua
Monster, Gila	<i>Heloderma suspectum</i>	Monstre de Gila	Monstruo de Gila; Escorpión
Rattlesnake, Baja California	<i>Crotalus enyo</i>	Crotale de la Baja California	Cascabel de Baja California
Rattlesnake, Black-tailed	<i>Crotalus molossus</i>	Crotale à queue noire (†)	Víbora de cascabel cola negra
Rattlesnake, Horned; Sidewinder	<i>Crotalus cerastes</i>	Crotale cornu	Cascabel cornuda
Rattlesnake, Mexican Pygmy	<i>Sistrurus ravus</i>	Crotale pygmée du Mexique (†)	Víbora fina
Rattlesnake, Mohave	<i>Crotalus scutulatus</i>	Crotale du désert de Mohave (†)	Víbora cola seca
Rattlesnake, Neotropical	<i>Crotalus durissus</i>	Crotale des forêts tropicales	Cascabel tropical
Rattlesnake, Red Diamondback	<i>Crotalus ruber</i>	Crotale diamantin rouge (†)	Víbora de cascabel roja
Rattlesnake, Ridge-nosed	<i>Crotalus willardi</i>	Crotale de l'Arizona	Cascabel de freno Arizona
Rattlesnake, Rock (banded)	<i>Crotalus lepidus</i>	Crotale des rochers	Cascabel de las rocas
Rattlesnake, Western Diamondback	<i>Crotalus atrox</i>	Crotale diamantin de l'Ouest	Cascabel de diamantes
Skink, Banded	<i>Eumeces fasciatus</i>	Scinque à bandes	Lincer fajado
Snake, Bull	<i>Pituophis melanoleucus</i>	Serpent taureau; Couleuvre à gouttelettes	Cencoate; Alicante
Snake, Gopher	<i>Pituophis melanoleucus</i>	Couleuvre à nez mince	Víbora tuza
Tortoise, Berlandier's	<i>Gopherus berlandieri</i>	Tortue de Berlandier; Gophère du désert	Tortuga del desierto
Tortoise, Bolson	<i>Gopherus flavomarginatus</i>	Tortue de bolson; Gophère de Mapimí	Tortuga de Mapimí
Tortoise, Desert	<i>Gopherus agassizi</i>	Tortue du désert	Tortuga del desierto sonorensis
Tortoise, Gopher	<i>Gopherus polyphemus</i>	Tortue fousseuse; Gophère polyphème	Tortuga topo
Turtle, Yucatán	<i>Terrapene mexicana</i>	Tortue-boîte du Yucatán (†)	Tortuga yucateca

COMMON AND SCIENTIFIC NAMES OF SELECTED CHARACTERISTIC SPECIES (continuation)

Water Snake, Pacific	<i>Nerodia validus</i>	Serpent d'eau du Pacifique	Culebra de agua del Pacífico
Whipsnake	<i>Masticophis flagellum</i>	Couleuvre de Baur	Chirriónera del Cabo
Whiptail, Baja California	<i>Cnemidophorus labialis</i>	Pnémidophire de la Baja California	Huico de Baja California
BIRDS	AVES	OISEAUX	AVES
Bluebird, Eastern	<i>Sialia sialis</i>	Merle-bleu de l'Est	Azulejo garganta canela
Bobwhite, Black-throated	<i>Colinus nigrogularis</i>	Colin à gorge noire	Codorniz yucateca
Bobwhite, Northern	<i>Colinus virginianus</i>	Colin de Virginie	Codorniz mascarita
Brant (Goose)	<i>Branta bernicla</i>	Bernache cravant	Ganso de collar
Bunting, Snow	<i>Plectrophenax nivalis</i>	Bruant des neiges	Colorín
Cardinal, Northern	<i>Cardinalis cardinalis</i>	Cardinal rouge	Cardenal norteño
Chachalaca, Plain	<i>Ortalis vetula</i>	Ortalide chacamel	Chachalaca del Golfo
Chachalaca, Rufous-bellied	<i>Ortalis ruficauda</i>	Ortalide à ventre rouge	Chachalaca vientre castaño
Chachalaca, W. Mexican	<i>Ortalis poliocephala</i>	Ortalide du Pacifique	Chachalaca del Pacífico
Chickadees	<i>Parus</i> sp.	Mésanges	Carboneros
Condor, California	<i>Gymnogyps californianus</i>	Condor de Californie	Cóndor californiano
Cormorants	<i>Phalacrocorax</i> sp.	Cormorans	Cormoranes
Crow, Northwestern	<i>Corvus caurinus</i>	Corneille d'Alaska	Cuervo noroccidental
Curassow, Great	<i>Crax rubra</i>	Hocco, Grand	Ocofaisán
Dove, Mourning	<i>Zenaida macroura</i>	Tourterelle triste	Huilota; Paloma torcaza
Dove, White-winged	<i>Zenaida asiatica</i>	Tourterelle à ailes blanches	Paloma de alas blancas
Duck, American Black	<i>Anas rubripes</i>	Canard noir	Pato negro
Duck, Mexican	<i>Anas diazi</i>	Canard du Mexique	Pato triguero
Duck, Muscovy	<i>Cairina moschata</i>	Canard musqué	Pato real
Ducks; Teals; etc.	<i>Anas</i> sp.	Anatidés; Canards; Sarcelles	Patos; Cercetas
Eagle, Bald	<i>Haliaeetus leucocephala</i>	Pygargue à tête blanche	Águila calva
Eagle, Golden	<i>Aquila chrysaetos</i>	Aigle royal	Águila real
Eagle, Harpy	<i>Harpia arpyja</i>	Harpie féroce	Águila arpía
Egret, Snowy	<i>Egretta thula</i>	Aigrette neigeuse	Garceta pie-dorado
Eider, King	<i>Somateria spectabilis</i>	Eider à tête grise	Eider; Pato de flojel
Falcon, Mexican	<i>Falco mexicanus</i>	Faucon du Mexique	Halcón mexicano
Falcon, Peregrine	<i>Falco peregrinus</i>	Faucon pèlerin	Halcón peregrino
Flamingo, Greater	<i>Phoenicopterus ruber</i>	Flamant rose	Flamenco
Fulmar, Northern	<i>Fulmarus glacialis</i>	Fulmar boréal	Fulmar norteño
Gnatcatcher, California	<i>Poliptila californica</i>	Gobemoucheron de Californie	Perlita californiana

COMMON AND SCIENTIFIC NAMES OF SELECTED CHARACTERISTIC SPECIES (continuation)

Goose, Canada	<i>Branta canadensis</i>	Bernache du Canada	Ganso canadiense
Goose, Snow	<i>Chen caerulescens</i>	Oie des neiges	Ganso azul
Goshawk, Northern	<i>Accipiter gentilis</i>	Autour des palombes	Azor
Grosbeaks	<i>Pheucticus</i> sp.	Cardinaux	Picogruesos
Grouse, Blue	<i>Dendragapus obscuris</i>	Tétras sombre	Urogallo azul
Grouse, Sage	<i>Centrocercus urophasianus</i>	Gélinotte des armoises	Gallina de la pradera
Grouse, Sharp-tailed	<i>Tympanuchus phasianellus</i>	Gélinotte à queue fine	Gallina cola afilada
Grouse, Spruce	<i>Dendragapus canadensis</i>	Tétras du Canada	Urogallo de Canadá
Guan, Horned	<i>Oreophasis dervianus</i>	Oréophase cornu	Pavón
Gulls	<i>Larus</i> sp.	Goélands	Gaviotas
Gyrfalcon	<i>Falco rusticolus</i>	Faucon gerfaut	Halcón gerifalco
Harrier, Northern; Marsh Hawk	<i>Circus cyaneus</i>	Busard Saint-Martin	Gavilán rastrero
Hawk, Red-tailed	<i>Buteo jamaicensis</i>	Buse à queue rousse	Aguililla cola roja
Hawk, White-breasted	<i>Accipiter chionogaster</i>	Épervier à poitrine blanche	Gavilán pechiblanco
Heron, Great Blue	<i>Ardeas herodias</i>	Héron, Grand	Garzón azul
Heron, Little Blue	<i>Egretta caerulea</i>	Aigrette bleue	Garcita azul
Hummingbird, Costa's	<i>Calypte costae</i>	Colibri de Costa	Colibrí cabeza violeta
Jaeger, Parasitic	<i>Stercorarius parasiticus</i>	Labbe parasite	Salteador parásito
Jay, Blue	<i>Cyanocitta cristata</i>	Geai bleu	Urraca azul o azulajo
Jay, Gray	<i>Perisoreus canadensis</i>	Geai du Canada	Charra gris
Jay, San Blas	<i>Cyanocorax sanblasianus</i>	Geai de San Blas	Urraca de San Blas
Jay, Steller's	<i>Cyanocitta stelleri</i>	Geai de Steller	Chivo o Pájaro de hielo
Junco, Yellow-eyed	<i>Junco phaenotus</i>	Junco aux yeux jaunes	Ojitos de lumbre
Kite, Everglades Snail	<i>Rostrhamus sociabilis</i>	Milan des marais des Everglades	Gavilán caracolero
Kitiwakes, Black-legged	<i>Rissa tridactyla</i>	Mouette tridactyle	Gaviota patinegra
Loon, Arctic	<i>Gavia arctica</i>	Huart arctique	Colimbo del Ártico
Loon, Red-throated	<i>Gavia stellata</i>	Huart à gorge rousse	Colimbo menor
Loon, Yellow-billed	<i>Gavia adamsii</i>	Huart à bec blanc	Colimbo de Adams
Macaw, Military	<i>Ara militaris</i>	Ara militaire	Guacamaya verde
Macaw, Scarlet	<i>Ara macao</i>	Ara rouge	Guacamaya roja
Magpie, Black-billed	<i>Pica pica</i>	Pie bavarde	Urraca de pico negro
Meadowlark, Eastern	<i>Sturnella magna</i>	Sturnelle des prés	Pradero tortilla-con-chile
Meadowlark, Western	<i>Sturnella neglecta</i>	Sturnelle de l'Ouest	Pradero occidental
Mockingbird, Northern	<i>Mimus polyglottos</i>	Moqueur polyglotte	Cenzontle

COMMON AND SCIENTIFIC NAMES OF SELECTED CHARACTERISTIC SPECIES (continuation)

Murre, Thick-billed	<i>Uria lomvia</i>	Marmette de Brünnich	Arao de pico grueso
Murrelet, Marbled	<i>Bracyramphus marmoratus</i>	Alque marbrée	Mérgulos
Night Heron, Black-crowned	<i>Nycticorax nycticorax</i>	Bihoreau à couronne noire	Garza nocturna
Oldsquaw (Duck)	<i>Clangula hyemalis</i>	Canard kakawi	Pato cola larga
Osprey	<i>Pandion haliaetus</i>	Balbuzard	Gavilán pescador
Owl, Boreal	<i>Aegolius funereus</i>	Nyctale boréale	Búho boreal
Owl, Burrowing	<i>Athene (Speotyto) cunicularia</i>	Chouette des terriers	Mochuelo de madriguera, Tecolote llanero
Owl, Great Horned	<i>Bubo virginianus</i>	Grand-duc boréal	Tecolote cornudo
Owl, Snowy	<i>Nyctea scandiaca</i>	Harfang des neiges	Búho de las nieves
Owl, Spotted	<i>Strix occidentalis</i>	Chouette tachetée	Búho manchado
Parakeet, Green	<i>Aratinga holochlora</i>	Conure verte	Periquito verde
Parrot, Maroon-fronted	<i>Rynchopsitta terrisi</i>	Conure à front brun	Cotorra serrana oriental
Parrot, Red-crowned	<i>Amazona viridigenalis</i>	Amazone à joues vertes	Loro tamaulipeco
Parrot, Thick-billed	<i>Rynchopsitta pachyrhyncha</i>	Conure à gros bec	Cotorra serrana occidental
Pelican, Brown	<i>Pelecanus occidentalis</i>	Pélican brun	Pelícano café
Petrels	<i>Pterodroma</i> sp.	Diablotins	Petreles
Phalaropes	<i>Phalaropus</i> sp.	Phalaropes	Falaropos
Pheasant, Ring-necked	<i>Phasianus colchicus</i>	Faisan de chasse	Faisán de collar
Pigeon, Band-tailed	<i>Columba fasciata</i>	Pigeon à queue barrée	Paloma de collar
Plover, Common Ringed	<i>Charadrius hiaticula</i>	Gravelot, Grand	Chorlos
Ptarmigan, Rock	<i>Lagopus mutus</i>	Lagopède des rochers	Perdiz nival
Ptarmigan, White-tailed	<i>Lagopus leucurus</i>	Lagopède à queue blanche	Perdiz de cola blanca
Ptarmigan, Willow	<i>Lagopus lagopus</i>	Lagopède des saules	Perdiz del sauce
Puffin, Atlantic	<i>Fratercula arctica</i>	Macareux moine	Frailecillo
Pygmy-Owl, Cape	<i>Glaucidium hoskinsi</i>	Chouette naine du Cap	Tecolotito enano del Cabo
Pygmy-Owl, Northern	<i>Glaucidium gnoma</i>	Chouette naine	Tecolote enano
Quail, California	<i>Callipepla californica</i>	Colin de Californie	Codorniz californiana
Quail, Gambel's	<i>Callipepla gambelii</i>	Colin à ventre noir	Codorniz chiquiri
Quail, Mountain	<i>Oreortyx pictus</i>	Colin des montagnes	Codorniz de montaña
Quail, Scaled	<i>Callipepla squamata</i>	Colin écaillé	Codorniz escamosa
Quetzal, Resplendent	<i>Pharomachrus mocinno</i>	Quetzal resplendissant	Quetzal
Rail, California Clapper	<i>Rallus longirostris obsoletu</i>	Râle gris	Picudo
Raven, Common	<i>Corvus corax</i>	Corbeau, Grand	Cuervo común
Redpoll, Common	<i>Carduelis flammea</i>	Sizerin flammé	Jilguero común
Redpoll, Hoary	<i>Carduelis hornemanni</i>	Sizerin blanchâtre	Jilguero de Hornemann (†)

COMMON AND SCIENTIFIC NAMES OF SELECTED CHARACTERISTIC SPECIES (continuation)

Roadrunner, Greater	<i>Geococcyx californianus</i>	Géocoucou, Grand	Correcaminos norteño
Roadrunner, Lesser	<i>Geococcyx velox</i>	Géocoucou véloce	Correcaminos tropical
Sandpipers; Curlews; Godwits; Snipes; Stints; Phalaropes	<i>Scolopacidae</i> (Fam.)	Chevaliers; Courlis; Barges; Bécasseaux; Phalaropes	Agachonas; Tildios; Playeros
Scoters	<i>Melanitta</i> sp.	Macreuses	Negretas
Screech-Owl, Balsas	<i>Otus seductus</i>	Petit-duc du Balsas	Tecolotito del Balsas
Screech-Owl, Pacific	<i>Otus cooperi</i>	Petit-duc de Cooper	Tecolotito del Pacífico
Shrike, Northern	<i>Lanius excubitor</i>	Pie-grièche grise	Verdugo norteño
Sparrow, Black-throated	<i>Amphispiza bilineata</i>	Bruant à gorge noire	Zacatonero garganta negra
Sparrow, Fox	<i>Pasarella iliaca</i>	Bruant fauve	Gorrión pescador
Sparrow, Sage	<i>Amphispiza belli</i>	Bruant de Bell	Zacatonero
Swan, Whistling; Tundra Swan	<i>Cygnus columbianus</i>	Cygne siffleur	Cisne de tundra
Swans	<i>Cygnus</i> sp.	Cygnés	Cisnes
Teal, Blue-winged	<i>Anas discors</i>	Sarcelle à ailes bleues	Cerceta de alas azules
Tern, Least	<i>Sterna antillarum</i>	Sterne, Petite	Charrán mínimo
Terns	<i>Sterna</i> sp.	Sternes	Charranes
Thrasher, Curve-billed	<i>Toxostoma curvirostre</i>	Moqueur à bec courbe	Cuitlacoche pico curvo
Thrasher, Sage	<i>Oreoscoptes montanus</i>	Moqueur des armoises	Cuitlacoche de chías
Toucan, Keel-billed	<i>Ramphastos sulfuratus</i>	Toucan à carène	Tucán
Trogon, Eared	<i>Euptilotus neoxenus</i>	Trogon cornu	Coa orejona
Turkey, Ocellated	<i>Agriocharis ocellata</i>	Dindon ocellé	Guajolote ocelado
Turkey, Wild	<i>Meleagris gallopavo</i>	Dindon sauvage	Guajolote silvestre; Cocono
Vireo, Bell's	<i>Vireo bellii</i>	Viréo de Bell	Vireo de Bell
Vulture, Turkey	<i>Cathartes aura</i>	Urubu à tête rouge	Aura o Zopilote de cabeza roja
Warbler, Red-faced	<i>Cardellina rubrifrons</i>	Paruline à face rouge	Chipe carirrojo
Wood-partridge, Long-tailed	<i>Dendrortyx macroura</i>	Colin à longue queue	Gallina de monte
Woodnymph, Mexican	<i>Thalurania ridgwayi</i>	Dryade du Mexique	Ninfa mexicana
Woodpecker, Gila	<i>Melanerpes uropygialis</i>	Pic des saguaros	Carpintero de los saguaros
Woodpecker, Lewis'	<i>Melanerpes lewis</i>	Pic de Lewis	Carpintero de Lewis
MAMMALS	MAMMALIA	MAMMIFÈRES	MAMÍFEROS
Antelope, Pronghorn (+ varieties: Peninsular, Sonoran)	<i>Antilocapra americana</i> (+ var.: <i>peninsularis</i> , <i>sonorensis</i>)	Antilope d'Amérique (+ var. : péninsulaire, du Sonora)	Berrendo (y variantes: peninsular, de Sonora)

COMMON AND SCIENTIFIC NAMES OF SELECTED CHARACTERISTIC SPECIES (continuation)

Armadillo	<i>Dasyurus novemcinctus</i>	Tatou à neuf bandes	Armadillo
Badger, American	<i>Taxidea taxus</i>	Blaireau d'Amérique	Tlalcoyote
Bat, Big Brown	<i>Eptesicus fuscus</i>	Sérotine brune	Murciélago café grande
Bat, Common Vampire	<i>Desmodus rotundus</i>	Vampire commun	Murciélago vampiro
Bat, Little Brown	<i>Myotis lucifugus</i>	Vespertilion brun	Murciélago café chico
Bat, Red	<i>Lasiurus borealis</i> (Müller)	Chauve-souris rousse	Murciélago colorado
Bat, Western Big-eared	<i>Plecotus townsendii</i>	Oreillard de Townsend	Murciélago de orejas grandes
Bear, American Black	<i>Ursus americanus</i>	Ours noir	Oso negro
Bear, Grizzly	<i>Ursus arctos</i>	Grizzli; Ours brun	Oso gris
Bear, Polar	<i>Ursus maritimus</i>	Ours blanc	Oso polar
Beaver, American	<i>Castor canadensis</i>	Castor	Castor
Bison, American	<i>Bison bison</i>	Bison d'Amérique	Bisonte americano
Bison, Wood	<i>Bison bison athabasca</i>	Bison des bois	Bisonte de los bosques
Bobcat	<i>Lynx rufus</i>	Lynx roux	Lince; Gato montés
Brocket, Red (deer)	<i>Mazama americana</i>	Mazama	Venado temazate
Caribou (Barren Ground, Woodland, Peary, Grant)	<i>Rangifer tarandus</i>	Caribou (de la toundra, des bois, de Peary, de Grant)	Caribú
Cat, Ring-tailed	<i>Bassariscus astutus</i>	Bassaris	Cacomixtle
Chipmunks	<i>Tamias</i> sp.	Suisses et tamias	Chichimocos
Coati; Coatimundi	<i>Nasua nasua</i>	Coati	Tejón
Cottontail, Desert	<i>Sylvilagus audubonii</i>	Lapin de garenne	Conejo del desierto
Cottontail, Eastern	<i>Sylvilagus floridanus</i>	Lapin à queue blanche	Conejo de monte
Cougar; Mountain Lion; Florida Panther	<i>Felis concolor</i>	Cougar; Puma; Panthère de la Floride	Puma
Coyote	<i>Canis latrans</i>	Coyote	Coyote
Deer, Black-tailed	<i>Odocoileus hemionus columbianus</i>	Cerf à queue noire	Venado cola prieta
Deer, Key	<i>Odocoileus virginianus clavia</i>	Cerf de Key (†)	Venado de los cayos (†)
Deer, Mule	<i>Odocoileus hemionus</i>	Cerf mulet	Venado bura
Deer, White-tailed	<i>Odocoileus virginianus</i>	Cerf de Virginie	Venado cola blanca
Dolphin, Common	<i>Delphinus delphis</i>	Dauphin commun	Delfín
Dolphin, Pacific White-sided	<i>Lagenorhynchus obliquidens</i>	Dauphin à flancs blancs du Pacifique	Delfín de costados blancos
Elk, American; Wapiti	<i>Cervus elaphus</i>	Wapiti; Élan d'Amérique	Ciervo
Fisher	<i>Martes pennanti</i>	Pékan	Marta pescadora
Fox, Arctic	<i>Alopex lagopus</i>	Renard arctique	Zorra del ártico

COMMON AND SCIENTIFIC NAMES OF SELECTED CHARACTERISTIC SPECIES (continuation)

Fox, Gray	<i>Urocyon cinereoargenteus</i>	Renard gris	Zorra gris
Fox, Kit	<i>Vulpes macrotis</i>	Renard nain	Zorra norteña
Fox, Red	<i>Vulpes vulpes</i>	Renard roux	Zorra roja
Fox, San Joaquin Kit	<i>Vulpes macrotis mutica</i>	Renard nain de San Joaquin	Zorra del desierto
Fox, Swift	<i>Vulpes velox</i>	Renard véloce	Zorra norteña
Goat, Mountain	<i>Oreamnos mericanus</i>	Chèvre de montagne	Cabra montés
Grison, Greater	<i>Galictis vittata</i>	Grison	Grisón
Ground Squirrel, Arctic	<i>Spermophilus parryii</i>	Spermophile arctique	Ardilla terrestre del Ártico
Ground Squirrel, California	<i>Spermophilus beecheyi</i>	Spermophile de Californie	Ardilla de California
Ground Squirrel, Columbian	<i>Spermophilus columbianus</i>	Spermophile du Columbia	Ardilla terrestre de Columbia
Ground Squirrel, Richardson's	<i>Spermophilus richardsonii</i>	Spermophile de Richardson	Ardilla terrestre de Richardson
Ground Squirrel, Ring-tailed	<i>Spermophilus annulatus</i>	Spermophile à queue annelée (†)	Ardilla de cola anillada
Ground Squirrel, Spotted	<i>Spermophilus spilosoma</i>	Spermophile tacheté	Juancito
Ground Squirrel, Tropical	<i>Spermophilus adocetus</i>	Spermophile des tropiques	Cuinique
Hare, Arctic	<i>Lepus arcticus</i>	Lièvre arctique	Liebre ártica
Hare, Snowshoe	<i>Lepus americanus</i>	Lièvre d'Amérique	Liebre americana
Jackrabbit, Antelope	<i>Lepus alleni</i>	Lièvre antilope	Liebre antiflope
Jackrabbit, Black-tailed	<i>Lepus californicus</i>	Lièvre de Californie (†)	Liebre de cola negra
Jackrabbit, White-sided	<i>Lepus callotis</i>	Lièvre à flancs blancs	Liebre torda
Jackrabbit, White-tailed	<i>Lepus townsendii</i>	Lièvre de Townsend	Liebre de cola blanca
Jaguar	<i>Felis onca</i>	Jaguar	Jaguar; Tigre
Kangaroo-Rat, Ord's	<i>Dipodomys ordii</i>	Rat-kangourou d'Ord	Rata canguro
Lemming, Collared	<i>Dicrostonyx toquatus</i>	Lemming variable	Lemmingo
Lion, Sea	<i>Zalophus californianus</i>	Otarie de Californie	León marino
Lynx	<i>Lynx lynx</i>	Loup-cervier; Lynx du Canada	Lince canadiense
Manatee, Caribbean	<i>Trichechus manatus</i>	Lamantin	Manatí
Marmot sp.	<i>Marmota</i> sp.	Marmottes	Marmotas
Marten, American	<i>Martes americana</i>	Martre d'Amérique	Marta americana
Mink, American	<i>Mustela vison</i>	Vison d'Amérique	Visón
Mole, Eastern	<i>Scalopus aquaticus</i>	Taupe à queue glabre	Topo del Este
Mole, Shrew	<i>Neurotrichus</i> sp.	Taupe naine	Topo
Monkey, Howler	<i>Alouatta palliata</i>	Singe hurleur	Saraguato; Mono aullador
Monkey, Spider	<i>Ateles geoffroyi</i>	Singe-araignée; Atèle	Mono araña

COMMON AND SCIENTIFIC NAMES OF SELECTED CHARACTERISTIC SPECIES (continuation)

Moose	<i>Alces alces</i>	Orignal	Alce
Mouse, Deer	<i>Peromyscus maniculatus</i>	Souris sylvestre	Ratón campesino
Mouse, Salt-marsh Harvest	<i>Reithrodontomys raviventris</i>	Souris des marais salins (†)	Ratón cosechador de las marismas
Mouse, Western Harvest	<i>Reithrodontomys megalotis</i>	Souris des moissons	Ratón de las mieses
Mouse, White-footed	<i>Peromyscus leucopus</i>	Souris à pattes blanches	Ratón de patas blancas
Muskrat	<i>Oridatra zibethicus</i>	Rat musqué	Ratón almizclero
Narwhal	<i>Monodon monoceros</i>	Narval	Narval
Opossum, Virginia	<i>Didelphis virginiana</i>	Opossum d'Amérique	Tlacuache
Otter, Neotropical	<i>Lutra longicaudis</i>	Loutre néotropicale (†)	Perro de agua; Nutria neotropical
Otter, River	<i>Lutra canadensis</i>	Loutre de rivière	Nutria
Otter, Sea	<i>Enhydra lutris</i>	Loutre de mer	Nutria marina
Ox, Musk	<i>Ovibos moschatus</i>	Bœuf musqué	Buey almizclero
Paca; Agouti	<i>Agouti paca</i>	Agouti	Tepezcuintle
Peccary, Collared	<i>Tayassu tajacu</i>	Pécari à collier	Pecarí de collar
Peccary, White-lipped	<i>Tayassu pecari</i>	Pécari à lèvres blanches	Jabalí de labios blancos
Porcupine, American	<i>Erethizon dorsatum</i>	Porc-épic d'Amérique	Puerco espín
Porcupine, Mexican; Coendou	<i>Coendou mexicanus</i>	Porc-épic du Mexique	Puerco espín mexicano
Prairie Dog, Black-tailed	<i>Cynomys ludovicianus</i>	Chien de prairie	Perrito de las praderas de cola negra
Prairie Dog, Mexican	<i>Cynomys mexicanus</i>	Chien de prairie du Mexique (†)	Perro de las praderas
Rabbit, Marsh	<i>Sylvilagus palustris</i>	Lapin des marais (†)	Conejo de los pantanos
Rabbit, Volcano	<i>Romerolagus diazi</i>	Lapin des volcans	Teporingo; Zacatuche
Raccoon	<i>Procyon lotor</i>	Raton laveur	Mapache
Rat, Magdalena	<i>Xenomys nelsoni</i>	(‡)	Rata arborícola de Chamela
Rock Squirrel, Baja California	<i>Spermophilus atricapillus</i>	Écureuil des rochers de la Baja California	Ardillón de Baja California
Seal, Bearded	<i>Erignathus</i> (var.: <i>Phoca</i>) <i>barbatus</i>	Phoque barbu	Foca barbuda
Seal, Guadalupe Fur	<i>Arctocephalus townsendii</i>	Otarie à fourrure de Townsend	Lobo fino de Guadalupe
Seal, Harbor	<i>Phoca vitulina</i>	Phoque commun	Foca común
Seal, Ringed	<i>Phoca hispida</i>	Phoque annelé	Foca anillada
Sheep, Bighorn	<i>Ovis canadensis</i>	Mouflon d'Amérique	Borrego cimarrón
Sheep, Dall	<i>Ovis dalli</i>	Mouflon de Dall	Carnero blanco
Shrew, Cape	<i>Sorex ornatus lagunae</i>	Musaraigne du Cap (†)	Musaraña de la Sierra de la Laguna

COMMON AND SCIENTIFIC NAMES OF SELECTED CHARACTERISTIC SPECIES (continuation)

Shrew, Masked; American Common Shrew	<i>Sorex cinereus</i>	Musaraigne cendrée	Musaraña
Skunk, Hog-nosed	<i>Conepatus mesoleucus</i>	Moufette à groin (†)	Zorrillo de espalda blanca
Skunk, Hooded	<i>Mephitis macroura</i>	Moufette à capuchon	Zorrillo
Skunk, Pygmy Spotted	<i>Spilogale pygmaea</i>	Moufette tachetée naine	Zorrillo pigmeo
Skunk, Striped	<i>Mephitis mephitis</i>	Moufette rayée	Zorrillo listado
Squirrel, American Red	<i>Tamiasciurus hudsonicus</i>	Écureuil roux	Ardilla roja
Squirrel, Fox	<i>Sciurus niger</i>	Écureuil fauve	Ardilla zorro
Squirrel, Gray or Black	<i>Sciurus carolinensis</i>	Écureuil gris ou noir	Ardilla gris del este
Squirrel, Mexican Fox	<i>Sciurus nayaritensis</i>	Écureuil gris du Mexique	Techalote
Squirrel, Western Gray	<i>Sciurus griseus</i>	Écureuil gris (†)	Ardilla gris del oeste
Tapir	<i>Tapirus bairdii</i>	Tapir	Tapir; Anteburro
Vole, Insular	<i>Microtus abbreviatus</i>	Campagnol trapu (†)	Ratón insular
Vole, Long-tailed	<i>Microtus longicaudus</i>	Campagnol longicaude	Ratón de cola larga
Vole, Meadow	<i>Microtus pennsylvanicus</i>	Campagnol des champs	Metorito
Vole, Mexican	<i>Microtus mexicanus</i>	Campagnol du Mexique (†)	Ratón mexicano
Walrus	<i>Odobenus rosmarus</i>	Morse	Morsa
Weasel, Least	<i>Mustela nivalis</i>	Belette pygmée	Comadreja de cola corta
Weasel, Long-tailed	<i>Mustela frenata</i>	Belette à longue queue	Comadreja de cola larga
Weasel, New York	<i>Mustela frenata noveboracensis</i>	Belette commune de New York	Comadreja neoyorquina
Whale, Blue	<i>Balaenoptera musculus</i>	Baleine bleue	Ballena azul
Whale, Bowhead	<i>Balaena mysticetus</i>	Baleine boréale; Baleine franche du Groenland	Ballena de Groenlandia
Whale, California Gray	<i>Eschrichtius robustus</i>	Baleine grise de Californie	Ballena gris
Whale, Fin	<i>Balaenoptera physalus</i>	Rorqual commun	Rorcual común
Whale, Killer; Orca	<i>Orcinus orca</i>	Épaulard	Orca
Whale, White (Beluga)	<i>Delphinapterus leucas</i>	Béluga	Beluga
Wolf, Timber	<i>Canis lupus</i>	Loup	Lobo
Woodchuck	<i>Marmota nonax</i>	Marmotte commune	Marmota
PLANTS	PLANTAE	PLANTES	PLANTAS
Acacia, Catclaw	<i>Acacia greggii</i>	Acacia ongle-de-chat	Uña de gato
Adam tree; Candle-wood	<i>Fouquieria peninsularis</i>	«Árbol de Adán» (‡)	Árbol de Adán
Agave, Pulque	<i>Agave atrovirensdeserti</i>	Agave vert noirâtre	Maguëy pulquero
Agave; Century Plant	<i>Agave americana</i>	Agave	Maguëy
Agave; Soap Plant; Maguëy	<i>Agave</i> sp.	Agaves	Maguëyes

COMMON AND SCIENTIFIC NAMES OF SELECTED CHARACTERISTIC SPECIES (continuation)

Alder, Red	<i>Alnus rubra</i>	Aulne rouge	Aile rojo
Alders	<i>Alnus</i> sp.	Aulnes	Ailes
“Amole”(‡); Soapberry	<i>Sapindus saponaria</i>	Arbre à savon	Amole
Allspice tree	<i>Pimenta dioica</i>	Piment type Jamaïque	Pimienta
Angelica tree; Loblolly Sweet-wood	<i>Dendropanax arboreus</i>	Angélique épineuse	Mano de león
“Árbol de las manitas” (‡)	<i>Chirantodendron pentadactylon</i>	«Árbol de las manitas» (‡)	Árbol de las manitas
“Arrayán” (‡)	<i>Psidium sartorianum</i>	«Arrayán» (‡)	Arrayán
Ash sp.	<i>Fraxinus</i> sp.	Frênes	Fresnos
Aspen, Trembling	<i>Populus tremuloides</i>	Peuplier faux-tremble	Álamo temblón
Baldcypress	<i>Taxodium distichum</i>	Cyprés chauve	Sabino
Barley, Wild	<i>Hordeum jubatum</i>	Orge agréable	Cebada silvestre (‡)
Barreta	<i>Helietta parvifolia</i>	«Barreta» (‡)	Barreta
Basswood, American	<i>Tilia americana</i>	Tilleul d’Amérique	Tilo
Bearberry	<i>Arctostaphylos uva-ursi</i>	Raisin d’ours	Manzanita osera (†)
Beardgrass, Forked (Bluestem)	<i>Andropogon furcatus</i>	Barbon fourchu	<i>Andropogon furcatus</i> (‡)
Beardgrass, Gerard’s (Bluestem)	<i>Andropogon gerardii</i>	Barbon de Gérard	<i>Andropogon gerardii</i> (‡)
Beech, American	<i>Fagus grandifolia</i>	Hêtre à grandes feuilles	Haya
Beech, Mexican	<i>Fagus mexicana</i>	Hêtre mexicain	Haya mexicana
Birch sp.	<i>Betula</i> sp.	Bouleaux	Abedules
Birch, White	<i>Betula papyrifera</i>	Bouleau à papier	Abedul blanco (†)
Birch, Yellow	<i>Betula alleghaniensis</i>	Bouleau jaune	Abedul amarillo (†)
Bitterbrush sp.	<i>Purshia</i> sp.	Purshies	Amargosos (†)
Bitterbrush, Desert	<i>Purshia glandulosa</i>	Purshie du désert (†)	Amargoso del desierto
Blite, Sea	<i>Suaeda maritima</i>	Suéda maritime	Saladillo
Bluegrass, Annual; Low Spear Grass	<i>Poa annua</i>	Pâturin annuel	Pastillo de invierno
Bluegrass, Canada; Wire Grass	<i>Poa compressa</i>	Pâturin comprimé	Zacate azul de Canada (†)
Bluegrass, Kentucky; Spear Grass	<i>Poa pratensis</i>	Pâturin des prés; Foin à vaches	Zacate azul de Kentucky (†)
Bluegrass; Spear Grass	<i>Poa</i> sp.	Pâturins	Zacate azul (†)
Bluestem	<i>Andropogon littoralis</i>	Andropogon côtier	Popotillo; Plumerillo
Boxwood	<i>Tabebuia donnell-smithii</i>	Tabebuia	Primavera
Breadnut	<i>Brosimum alicastrum</i>	«Ramón»; «Capomo» (‡)	Ramón; Capomo
Brush, Antelope	<i>Purshia tridentata</i>	Purshie tridentée	Amargoso tridentado

COMMON AND SCIENTIFIC NAMES OF SELECTED CHARACTERISTIC SPECIES (continuation)

Brush, Rabbit	<i>Chrysothamnus nauseosa</i>	Bigelovie puante	Hierba del conejo (‡)
Bumelia, Gum; Ironwood	<i>Bumelia</i> sp.	«Bumelias» (‡); Bois de fer	Bumelias (‡); Bebelamas
Bunchberry	<i>Cornus canadensis</i>	Cornouiller du Canada	Cornejo canadiense (‡)
Bursera	<i>Bursera morelensis</i>	Arbre à encens	Cuajote
Bursera; Copal	<i>Bursera excelsa</i>	«Copal» (‡)	Copal
Bush, Creosote	<i>Larrea tridentata</i>	Larrea tridenté	Gobernadora; Guamis
Cactus, Barrel	<i>Ferocactus wislizenii</i>	Férocactus de Wislizen	Biznaga
Cactus, Bigelow's	<i>Opuntia bigelovii</i>	Opuntia de Bigelow	Choya brincadora
Cactus, Saguaro	<i>Carnegiea gigantea</i>	Saguaro	Saguaro
Camachile	<i>Pithecellobium dulce</i>	«Guamúchil» (‡)	Guamúchil
Canalete, Princewood	<i>Cordia alliodora</i>	Canalete	Amapa; Laurel
Canela; Aguacatillo	<i>Nectandra</i> sp.	«Aguacatillo» (‡)	Aguacatillo
Cardon	<i>Pachycereus pringlei</i>	«Cardón» (‡)	Cardón
Ceanothus; Buckbrush	<i>Ceanothus</i> sp.	Céanothus	Chaquira
Cedar, Eastern Red	<i>Juniperus virginiana</i>	Genévrier rouge de Virginie	Junípero; Cedro rojo de Virginia
Cedar, Mexican Red	<i>Cedrela mexicana</i>	Genévrier rouge mexicain	Cedro rojo
Cedar, Western Red	<i>Thuja plicata</i>	Thuya géant	Cedro rojo occidental
Cedar, White	<i>Cupressus lindleyii</i>	Thuya occidental	Cedro blanco
Cedar, Yellow; Nootka False Cypress	<i>Chamaecyparis nootkatensis</i>	Cyprès de Nootka (‡)	Ciprés amarillo
Ceiba	<i>Ceiba</i> sp.	«Pochote» (‡)	Pochote; Ceiba
“Cerón” (‡)	<i>Phyllostylon brasiliensis capaneuca</i>	«Cerón» (‡)	Cerón
Chamiso	<i>Adenostoma fasciculatum</i>	Adénostome fasciculé	Chamiso; Cenizo
Cheatgrass; Downy Brome	<i>Bromus tectorum</i>	Brome des toits	Bromo vellosa
Cherry, Wild Black	<i>Prunus serotina</i>	Cerisier noir	Capulín
Chestnut, American	<i>Castanea dentata</i>	Châtaigner d'Amérique	Castaña americano
Cholla	<i>Opuntia cholla</i>	Cholla	Cholla
Cirio; Boojum Tree; California Candle-wood	<i>Fouquieria columnaris</i>	«Cirio» (‡)	Cirio
Condalia	<i>Condalia</i> sp.	Condalies	Chaparro prieto; Tecomblate
Copai-yé wood	<i>Vochisia hondurensis</i>	Bois creuzot	Corpo; Maca blanca
“Copalcahuite” (‡)	<i>Bursera jorullensis</i>	«Copalcahuite» (‡)	Copalcahuite
“Copales” (‡)	<i>Bursera</i> sp.	«Copales» (‡)	Copales; Papelillos
“Copaljiote” (‡)	<i>Pseudosmodium perniciosum</i>	«Copaljiote» (‡)	Copaljiote

COMMON AND SCIENTIFIC NAMES OF SELECTED CHARACTERISTIC SPECIES (continuation)

Corbagallina	<i>Neopringlea intergrifolia</i>	«Corbagallina»	Corbagallina
Cordia	<i>Cordia dodecandra</i>	«Circicote» (‡)	Circicote; Siricote
Cordia	<i>Cordia eleagnoides</i>	«Cuéramo» (‡)	Cuéramo
Courbaril; Brazilian Gum–Copal Tree	<i>Hymenaea courbaril</i>	Bois de courbaril; Copalier d'Amérique	Guapinol
Cypress, Monterey	<i>Cupressus macrocarpa</i> Cyprés de Lambert	Cyprés à gros fruits;	Ciprés
Dogwood, Flowering	<i>Cornus florida</i>	Cornouiller de Floride	Cornejo florido (†)
Ebano; Texas Ebony	<i>Pithecellobium flexicaule</i>	Ébénier du Texas (†)	Ébano
Elm sp.	<i>Ulmus</i> sp.	Ormes	Olmos
Engelhardtia; Spurious Walnut Tree	<i>Engelhardtia mexicana</i>	<i>Engelhardtia mexicana</i> (‡)	Nicocxuahuitl
Figs	<i>Ficus</i> sp.	Figuiers	Amates; Matapalos
Fir sp.	<i>Abies</i> sp.	Sapins	Oyameles; Abetos
Fir, Amabilis (Pacific Silver)	<i>Abies amabilis</i>	Sapin gracieux	Abeto
Fir, Balsam	<i>Abies balsamea</i>	Sapin baumier	Abeto balsámico
Fir, Douglas	<i>Pseudotsuga menziesii</i>	Douglas	Abeto de Douglas (†)
Fir, Grand	<i>Abies grandis</i>	Sapin grandissime	Abeto grande (†)
Fir, Mexican	<i>Abies religiosa</i>	Sapin mexicain	Oyamel
Fir, Noble	<i>Abies procera</i>	Sapin noble	Abeto noble (†)
Fir, Silver	<i>Abies alba</i>	Sapin argenté	Abeto plateado (†)
Fir, Subalpine	<i>Abies lasiocarpa</i>	Sapin subalpin	Abeto subalpino
Fir, White	<i>Abies concolor</i>	Sapin blanc	Abeto blanco; Pinabete
Gavia	<i>Acacia amentacea</i>	Acacia amentifère (†)	Gavia
Granjeno	<i>Celtis pallida</i>	«Granjeno» (‡)	Granjeno
Grass, Alkali	<i>Distichlis stricta</i>	Distichlis dressé	Zacate salado
Grass, Blue Grama	<i>Bouteloua gracilis</i>	Boutelou gracieux	Navajita; Banderita
Grass, Buffalo	<i>Buchloe dactyloides</i>	Herbe à bison	Zacate borreguero
Grass, Cord; Sacahuista	<i>Spartina spartinae</i>	Spartine	Zacahuiscle
Grass, Cotton	<i>Eriophorum</i> sp.	Linaigrettes	Lino silvestre (†)
Grass, Muhly	<i>Muehlenbergia</i>	Muhlenbergie	Zacate liendrilla
Grass, Porcupine	<i>Stipa spartea</i>	Stipe à balai; Herbe porc-épic	Zacate aguja (‡)
Grass, Saw	<i>Cladium jamaicensis</i>	Marisque (†)	Saibal
Grass, Tall Wheat	<i>Agropyron elongatum</i>	Agropyre élevé	Agropiro largo
Grass, Tobosa; Galleta	<i>Hilaria mutica</i>	«Toboso» (‡)	Toboso
Grass, Wheat	<i>Agropyron</i> sp.	Agropyres	Agropiro; Zacate triguero
Grasses, Short; Grama Grasses	<i>Bouteloua</i> sp.	Bouteloux	Navajitas; Banderitas

COMMON AND SCIENTIFIC NAMES OF SELECTED CHARACTERISTIC SPECIES (continuation)

Grasses, Threeawn	<i>Aristida</i> sp.	Aristides	Zacate tres barbas
Greasewood	<i>Sarcobatus vermiculatus</i>	<i>Sarcobatus vermiculatus</i>	Vidrillo
“Guacoyul” (‡)	<i>Orbignya guacuyule</i>	«Guacoyul» (‡)	Guacoyul; Coquito de aceite
Gummo-limbo	<i>Bursera simaruba</i>	Arbre baume; Cachibou	Chacá; Palo mulato
Hackberry	<i>Celtis occidentalis</i>	Micocoulier occidental	Almez
Hawthorn, Mexican	<i>Crataegus</i> sp.	Aubépine du Mexique (†)	Tejocotes
Heath	<i>Erica</i> sp.; <i>Calluna</i> sp.	Éricacées	Ericáceas; Brezos
Hemlock sp.	<i>Tsuga</i> sp.	Pruches	Pinabetes
Hemlock, Mountain	<i>Tsuga mertensiana</i>	Pruche subalpine	Pinabete subalpino
Hemlock, Western	<i>Tsuga heterophylla</i>	Pruche occidentale	Pinabete occidental
Henequen	<i>Agave fourcroyoides</i>	Henequen; Agave	Henequén
Hickory sp.	<i>Carya</i> sp.	Caryers	Nogales americanos
Huisache, White; Cassie	<i>Acacia farnesiana</i>	Huisache blanc (†)	Huisache; Binorama
Huisaches	<i>Acacia</i> sp.	Huisaches	Huisaches
“Huisache chino” (‡)	<i>Acacia schaffnerii</i>	«Huisache chino» (‡)	Huisache chino
Juniper sp.	<i>Juniperus</i> sp.	Genévriers	Táscates; Cipreses
Juniper, Alligator	<i>Juniperus pachyphloea</i>	Genévrier gercé	Enebro
Juniper, California	<i>Juniperus californica</i>	Genévrier de Californie	Enebro de California
Juniper, Ground	<i>Juniperus communis</i>	Genévrier commun	Junípero; Táscate
Juniper, One-seed	<i>Juniperus monosperma</i>	Genévrier à une graine	Táscate; Enebro
Juniper, Rocky Mountain	<i>Juniperus scopulorum</i>	Genévrier saxicole	Junípero de las rocal losas
“Llamarada” (‡)	<i>Bernoullia falmmea</i>	«Llamarada» (‡)	Llamarada
Leadtree	<i>Leucaena glauca</i>	Leucaena glauque	Guaje
Lechuguilla	<i>Agave lechuguilla</i>	Lechuguilla	Lechuguilla
Lemonwood	<i>Calycophyllum candidissimum</i>	Calycophyle	Camarón
Lichen, Tufted	<i>Ramalina reticulata</i>	Lichen spongieux	Orchilla
Lotebrush	<i>Castela tortuosa (texana)</i>	«Chaparro amargoso» (‡)	Chaparro amargoso
Madrone, Mexican	<i>Arbutus xalapensis</i>	Arbousier mexicain	Madroño
Madrone, Pacific	<i>Arbutus menziesii</i>	Arbousier de Menzies	Madroño del Pacífico (†)
Magnolia, Southern	<i>Magnolia grandiflora</i>	Magnolia à grandes feuilles	Magnolia
Mahogany	<i>Swietenia macrophylla</i>	Arbre d’Acajou	Caoba
Mangrove, American	<i>Rhizophora mangle</i>	Manglier; Palétuvier noir	Mangle
Manzanita	<i>Arctostaphylos</i> sp.	Busserole manzanita	Manzanita
Maple, Silver	<i>Acer saccharinum</i>	Érable argenté	Arce plateado

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Maple, Sugar	<i>Acer saccharum</i>	Érable à sucre	Arce de azúcar
Mesquite	<i>Prosopis laevigata</i>	Mesquite; Prosopis	Mezquite
Mesquite, Honey	<i>Prosopis glandulosa</i>	Prosopis glanduleux	Mezquite dulce
Morning glory	<i>Ipomoea purpurea</i>	Gloire du matin	Cazahuate; Palo bobo
Oak sp.	<i>Quercus</i> sp.	Chênes	Encinos; Robles
Oak, Garry; Oregon White Oak	<i>Quercus garryana</i>	Chêne de Garry	Roble blanco de California
Oak, Live	<i>Quercus virginiana</i>	Chêne de Caroline	Encino de Virginia (†)
Oak, Mexican Blue	<i>Quercus oblongifolia</i>	Chêne bleu mexicain	Encino aguloso (†)
Oak, Northern Red	<i>Quercus rubra (borealis)</i>	Chêne rouge; Chêne boréal	Encino colorado
Oak, White	<i>Quercus alba</i>	Chêne blanc	Encino blanco
Ocotillo; Candlewood	<i>Fouquieria splendens</i>	Ocotillo	Ocotillo
Olive, Texas; Anacahuite	<i>Cordia boissieri</i>	Sébastien anacahuite	Anacahuita
Palm	<i>Scheelea liebermannii</i>	Palmier	Palma; Coroz
Palmetto	<i>Sabal</i> sp.	«Sabales» (‡)	Palma; Guano
Palmetto, Saw	<i>Serenoa repens</i>	Chou palmiste nain	Palmita aserrada
“Palo de arco” (‡)	<i>Apoplanesia paniculata</i>	«Palo de arco» (‡)	Palo de arco; Cacanaguaste
Paloverde; Greenwood	<i>Cercidium torreyanum, macrum, or microphyllum</i>	Paloverdi bleu	Palo verde
Papaw	<i>Pileus mexicanus (Jacaratia mexicana)</i>	«Bonete» (‡)	Bonete
Papaya; Pa[w]paw	<i>Carica papaya</i>	Arbre à melon; Papayer	Papaya
“Paque” (‡)	<i>Dialium guianense</i>	«Paque» (‡)	Paque; Guapaque
Parota	<i>Entherolobium cyclocarpum</i>	«Parota» (‡)	Parota; Guanacastle
Pear, Prickly; Cholla	<i>Opuntia polyacantha</i>	Opuntia à plusieurs aiguilles	Cholla rastrera, Nopal
Persimmon, Common	<i>Diospiros virginiana</i>	Plaqueminier	Pérsimo
Pine, Eastern White	<i>Pinus strobus</i>	Pin blanc	Pino blanco
Pine, Jack	<i>Pinus banksiana</i>	Pin gris	Pino de Banks (†)
Pine, Loblolly	<i>Pinus taeda</i>	Pin à encens	Pino teda; Pino incienso
Pine, Lodgepole	<i>Pinus contorta</i>	Pin tordu	Pino torcido (†)
Pine, Monterey	<i>Pinus radiata</i>	Pin de Monterey	Pino de Monterrey (†)
Pine, Ocote	<i>Pinus montezumae</i>	Pin de Montezuma	Ocote; Pino
Pine, Ponderosa	<i>Pinus ponderosa</i>	Pin ponderosa	Pino ponderosa (†)
Pine, Red	<i>Pinus resinosa</i>	Pin rouge	Pino colorado
Pine, Shortleaf	<i>Pinus echinata</i>	Pin épineux	Pino dulce
Pine, Slash	<i>Pinus elliotii</i>	Pin d’Elliot	Pino de Elliot (†)
Pine, Sugar	<i>Pinus lambertiana</i>	Pin à sucre	Pino azúcar

COMMON AND SCIENTIFIC NAMES OF SELECTED CHARACTERISTIC SPECIES (continuation)

Pine, Torrey	<i>Pinus torreyana</i>	Pin de Torrey	Pino de Torrey (†)
Piñon, Mexican	<i>Pinus cembroides</i>	Pin pignon	Pino piñonero
Plum, Hog; Ciruelo	<i>Spondias mombin</i>	Mombin jaune	Jobo
Poplar, Balsam	<i>Populus balsamifera</i>	Peuplier baumier	Álamo balsámico
Poplar, Yellow; Tuliptree	<i>Liriodendron tulipifera</i>	Tulipier d'Amérique	Tilo americano
Primavera; White Mahogany	<i>Roseodendron donnell-smithii</i>	Primavera; Acajou blanc	Primavera
Redwood	<i>Sequoia sempervirens</i>	Séquoia géant	Secoyas
Rubber tree, Central American	<i>Castilla elastica</i>	Caoutchouc du Mexique; Hulé	Hule
“Sabicú” (‡)	<i>Lysiloma</i> sp.	«Sabicú» (‡)	Tepeguaje; Tzalam
Sage, Burro; Bur Sage	<i>Franseria dumosa</i>	Gaetnère	Hierba del burro
Sage, Coastal	<i>Salvia</i> sp.	Sauge côtière	Salvia blanca; Cenizo
Sagebrush sp.	<i>Artemisia</i> sp.	Armoises	Artemisias
Sagebrush, Big	<i>Artemisia tridentata</i>	Armoise tridentée	Artemisia
Samphire, Red	<i>Salicornia rubra</i>	Passe-pierre	Saladilla
Sapodilla; Chicozapote	<i>Manilkara zapota</i>	«Chicozapote» (‡)	Chicozapote
Sapota; Sapote; Zapote	<i>Pouteria zapota</i>	«Zapote» (‡)	Zapote mamey
Sedge	<i>Carex</i> sp.	Carex	Carex (†)
Shadscale	<i>Atriplex canescens</i>	Arroche blanchâtre	Chamiso
Silverleaf	<i>Leucophyllum</i> sp.	Leucophylles	Cenizos
“Sombrerete” (‡)	<i>Terminalia amazonia</i>	«Sombrerete» (‡)	Sombrerete
Spruce, Black	<i>Picea mariana</i>	Épinette noire	Picea negra (†)
Spruce, Engelmann	<i>Picea engelmannii</i>	Épinette d'Engelmann	Picea de Engelmann (†)
Spruce, Red	<i>Picea rubens</i>	Épinette rouge	Picea roja (†)
Spruce, Sitka	<i>Picea sitchensis</i>	Épinette de Sitka	Picea de Sitka (†)
Spruce, White	<i>Picea glauca</i>	Épinette blanche	Picea blanca (†)
Sterculia, Mexican	<i>Sterculia mexicana</i>	Sterculie du Mexique (†)	Castaño
Sweet gum, American	<i>Liquidambar styraciflua</i>	Liquidambar à Styrax; Copalme d'Amérique	Liquidámbar; Ocozote; Quirámbaro
Tamarack	<i>Latrix laricina</i>	Mélèze laricin	Alerce
Tarbrush	<i>Flourensia cernua</i>	<i>Flourensia cernua</i> (‡)	Hojasén
Tea, Labrador	<i>Ledum groenlandicum</i>	Thé du Labrador	Té de Labrador
Terminalia	<i>Terminalia</i> spp.	Terminalia	Volador; Sombrerete
Tree, Elephant	<i>Bursera microphylla</i>	Gomart à petites feuilles	Torote blanco
Tree, Joshua	<i>Yucca brevifolia</i> , <i>elata</i> or <i>valida</i>	Yucca arborescent	Izote; Palma; Yuca

COMMON AND SCIENTIFIC NAMES OF SELECTED CHARACTERISTIC SPECIES (continuation)

Trumpet tree	<i>Tabebuia rosea</i>	Tabebuia rose (†)	Palo de rosa; Roble de sabana
Tucuma	<i>Astrocaryum mexicanum</i>	Astrocaryum	Chocho
Tupelo, Water	<i>Nyssa aquatica</i>	Nyssa aquatique	Tupelo
Tupelos sp.	<i>Tupelo</i> sp.	Nyssas	Tupelos
Walnut, Black	<i>Juglans nigra</i>	Noyer noir d'Amérique	Nogal negro
Walnuts	<i>Juglans</i> sp.	Noyers	Nogales
Willows	<i>Salix</i> sp.	Saules	Sauces