North American Terrestrial Ecoregions—Level III

April 2011

Commission for Environmental Cooperation

cec.org

This background paper (metadata for electronic information product) was prepared under CEC project 2007.1.8.8.1.1, Building Local Capacity for Integrated Ecosystem management and to Conserve Critical Species and Spaces•TERRESTRIAL ECOREGIONS, for the Secretariat of the Commission for Environmental Cooperation. The information contained herein is the responsibility of the author and does not necessarily reflect the views of the CEC, or the governments of Canada, Mexico or the United States of America.

Cite as: Wiken, Ed, Francisco Jiménez Nava, and Glenn Griffith. 2011. North American Terrestrial Ecoregions—Level III. Commission for Environmental Cooperation, Montreal, Canada.

Publication Details

Publication type: *Background paper*
Publication date: *May 2011*
Original language: *English*
Review and quality assurance procedures:
Final Party review: October-November 2009
QA07.30&32

Disponible en français – Disponible en español

For more information:

Commission for Environmental Cooperation
393, rue St-Jacques ouest
Bureau 200
Montreal (Quebec) Canada H2Y 1N9
t 514.350.4300 *f* 514.350.4372
info@cec.org / www.cec.org

The Canadian portion of these descriptions was prepared by:
Ed Wiken
Canadian Plains Research Center (www.cprc.com)
P.O. Box 59012
Ottawa, Ontario K1G 5T7
EdWiken@rogers.com
613-291-3109

The Mexican portion of these descriptions was prepared by:
Francisco Jiménez Nava under the direction of Dr. Francisco Takaki, Director General Adjunto de Normatividad de la D.G.G.
Instituto Nacional de Estadística, Geografía e Informática (INEGI)
52449 910 5300 X: 5365 / 5251

The US portion of these descriptions was prepared by:
Glenn Griffith
Corvallis, Oregon
541 754-4465
aggriffith@peak.org

Table of Contents

North American Terrestrial Ecoregions—Level III

Introduction

Considerations and Model for the Level III Ecoregion Descriptions

The concepts used to define and describe Level III ecoregions follow the original methodology outlined in the 1997 CEC publication, *Ecological Regions of North America: Toward a Common Perspective*, which provided a descriptive framework in its presentation and discussion of the Level I terrestrial ecoregions. Under this framework, ecoregions were defined in a holistic and comprehensive manner categorized according to a variety of biological, physical and human factors that are found to one extent or another in all natural and human-modified ecosystems across North America. These categories are: 1) Location; 2) Climate; 3) Vegetation; 4) Hydrology; 5) Terrain; 6) Wildlife; and 7) Land Use/Human Activities. The intent behind the Level III ecoregion descriptions was that they were to be concise and, organized by the seven categories, would follow a standard format that would outline the main features of each Level III unit.

In describing North American ecoregions, many sources of data from different agencies were used. Between Canada, Mexico, and the United States, some of these data were consistent and readily comparable, such as the topographical data. Data on vegetation types, land use changes, temperatures and precipitation measures, etc., differed in various ways. The time periods in which the data were collected, the methods to collect data, the terms to describe data, or the sampling frameworks for data collection also differed. However, many efforts have been made to cross-link the types and sources of ecoregion data. The most prominent differences in data descriptions found in this text are explained below.

Soils (Terrain): Information on soils appears in the terrain section of each ecoregion. Each North American ecoregion provides soil information, but each country uses a different taxonomic classification system. For instance, a type of soil in Canada may be called a Podzol but the same soil in the United States may be called a Spodosol. Mexico, the United States, and Canada have used different names but they can be cross-linked through the FAO system (Appendix 2).

Vegetation and Wildlife: Vegetation and wildlife descriptions for the United States and Canadian ecoregions use common names for species. However, Mexican ecoregions use scientific names, as there is a great range of variation in the use of common names, from region to region, for the same species.

Land Use/ Human Activities: As human population numbers and settlement patterns have molded many of the dominant traits of an ecoregion, thus many of the distinctive human activities, cropland types and native vegetation assemblages are provided to give examples of where land/water use activities have transformed the landscape. At a country level, Canada, Mexico and the United States have detailed demographic studies that focus on their national political boundaries. However, aggregating demographic information at an ecoregional scale that crosses national and international political boundaries was beyond the objectives of this edition. Thus, instead of providing populations per ecoregion, we simply provide the names of the largest cities, towns or communities.

Data/Information Bases for Descriptions

Data that can be used to describe Level III units within Canada, Mexico and the United States vary to some degree. Mapping coverages (areas, themes, time completed, detail), and classification systems (guidelines, standards, nomenclature), for example, at times allow for some easy comparisons of biological, physical and land use, human activity characteristics, whereas at other times they make comparisons more difficult.

Correlation of Descriptions

For Level III units that are shared across national borders, the descriptions were developed jointly.

Names and Codes of CEC Level III Designations

The names for Level III units have been taken mainly from the existing CEC map and legend. The numbering scheme of the Ecological Regions of North America evolved from the 1997 Level I and II map and publication to the current version at Level III. Revisions to the numbering "scheme" reflected not only conceptual changes in mapping at the continental scale, but also revisions to ecological mapping within each of the three countries. A few gaps in the numbering sequence of regions occurred, reflecting in part the dynamic nature of this type of mapping. For example, the regional code 5.3.2 is not currently used. As revisions were made to Level I Regions 5 (Northern Forests) and 8 (Atlantic Highlands), much of region 5.3.2 is now included in 8.1.9 Maritime Lowlands. In another example, the code 9.1 is not currently used at Level II. It was previously used for the Boreal Plains, which is now coded 5.4 as a part of the Northern Forests. A third gap in coding sequence is 9.3.2. The Montana Valley and Foothill Prairies ecological region in the United States has been modified on that country's Level III and IV ecoregion maps, no longer appearing at Level III. With these map revisions, the decision was made to not renumber all the remaining ecological regions. Our intention was rather to maintain continuity with previous versions of the CEC map and have less disruption in map region numbering in new editions.

References

The compilation of information for each country came from a variety of documents and scientific reports from each country as well as intra-agency consultion; thus the final list of references is organized by country.

Level III North American Terrestrial Ecoregions:
Short Descriptions for Canada, the United States, and Mexico

*Shared between Canada and the United States
**Shared between the United States and Mexico

1.0 Arctic Cordillera

1.1.1 Ellesmere and Devon Islands Ice Caps

Location: This ecoregions spans series of northern regions in Nunavut stretching from Devon Island through the poleward reaches of Ellesmere and Axel Heiberg islands.
Climate: It is characterized by very short, cold summers and long, cold winters. The mean annual temperature is approximately -18.5°C with a mean summer temperature of -2°C and a mean winter temperature ranging from -30 to -35°C. The average annual precipitation ranges between 200 and 300 mm. This ecoregion is classified as having a high arctic ecoclimate.
Vegetation: Most of the area is barren and consists of ice and snow. Clumps of moss, lichen, and cold-hardy vascular plants such as sedge and cottongrass are the dominant vegetation scattered over the barren soil/rock.
Hydrology: These regions are largely ice-covered terrain that acts as frozen reservoirs of water. Intermittent streams are present in the brief summer period.
Terrain: Series of large icecaps, more so than glacier fields, dominate the summit positions of most of the mountain ranges here. Elevations can reach up to 2,500 masl. These areas are underlain by continuous permafrost with low ice content. Ice fields and nunataks are common. Numerous steep-walled valleys and fjords with glaciers transect ranges and ridges. Soil areas are limited and consist of Regosolic Static and Regosolic Turbic Cryosols that have developed on colluvial, alluvial, and marine sediments.
Wildlife: There is low species diversity, as few arctic species use these areas as habitats. Characteristic wildlife includes arctic hare, arctic fox, lemming, muskox, caribou, and polar bears that can be common in coastal areas. Representative birds include king eider, rock ptarmigan, northern fulmar, ringed plover, hoary redpoll, and snow bunting. Marine mammals include walrus, seal, and whale.
Land Use/Human Activities: No settlements are located in these areas and few land uses are known. Some areas are valued for tourism and scientific purposes.

1.1.2 Baffin and Torngat Mountains

Location: This ecoregion extends from Bylot Island in Nunavut southwards along the eastern margins of Baffin Island and into northern Labrador.
Climate: A humid, extremely cold climate marked by very short, cold summers and long cold winters characterize the climatic conditions here. From north to south generally, the mean annual temperatures are approximately -6 to -11.5°C; the mean summer temperatures are 1 to 4 °C; the mean winter temperature are -16.5 to -23°C; and average annual precipitation amounts to 200–400 to 400–700 mm, with the higher values occurring in the high central elevations.
Vegetation: Discontinuous groundcover of mosses, lichens, and cold-hardy vascular plants, such as sedge and cottongrass, dominate northern areas and to the south grade increasingly into patches of low-lying and dwarf forms of arctic deciduous and evergreen shrubs. Terrain in the lower elevations and sheltered/south-facing valleys shows the greatest amounts of vegetative cover but this is largely sporadic in distribution, although it becomes more continuous in lower latitudes and in wetlands.
Hydrology: Most of the drainage is of low to moderate density and flows largely eastwards into the inlets, fjords and ocean waters of Baffin Bay. Streams and rivers show marked flows in the brief summer periods.
Terrain: Multiple-tonguing glaciers and some icecaps mask the elevated reaches of the Baffin and Torngat mountains. Peaks attain 1,525–2,135 m. Long fjord inlets with deep and steep-sided U-shaped valleys

commonly incise the eastern margins of this region where they abut the coastal zones of Baffin Bay. Deep, continuous permafrost with low ice content prevails. Bare bedrock and discontinuous mantles of colluvial, alluvial, and morainal materials are typical in lower elevations. Turbic Cryosols are associated with upland patterned ground and boulder fields and some Organic Cryosols occur on wetter valley lowlands.
Wildlife: While habitats are not overly productive in most cases, species present include arctic hare, arctic fox, lemming, caribou and polar bear in coastal areas. Birds can include king eider, rock ptarmigan, northern fulmar, plover, hoary redpoll, and snow bunting.
Land Use/Human Activities: The principal activities include tourism, hunting and fishing. Clyde and Broughton Island are some of the better-known coastal settlements; these towns have very small human populations.

2.0 Tundra

2.1 Northern Arctic

2.1.1 Sverdrup Islands Lowland

Location: This ecoregion is linked mainly to the Sverdrup Islands group (Prince Patrick, Mackenzie King, Borden, Ellef Ringnes, Amund Ringnes, and other smaller islands) in Nunavut and the Northwest Territories.
Climate: An area with short cool summers and long, cold winters, the mean annual temperature is approximately -18°C, with a summer mean of -1.5°C and a winter mean of -32°C. Annual precipitation typically ranges from 100 to 150 mm.
Vegetation: Vegetative cover is often discontinuous, especially on upland calcareous soils. Mosses, lichens, and in wetter areas cold-hardy vascular plants such as sedge and cottongrass are the dominant vegetation. Low-lying arctic willow and purple saxifrage occur infrequently.
Hydrology: Drainage networks are of low density and flow during the brief summer period.
Terrain: The land surface is rolling to hilly. Coastal lowland areas rise to hills and plateaus that reach as much as 425 masl. Surface materials consist of colluvial, alluvial, morainal, and marine deposits, and are intermixed with areas of exposed bedrock. This ecoregion is mainly underlain by deep, continuous permafrost with medium ice content. Regosolic Static and Orthic Turbic Cryosols are the dominant soils.
Wildlife: Wildlife includes muskox, arctic hare, arctic fox, caribou, seal, polar bear, ptarmigan, and king eider.
Land Use/Human Activities: No settlements exist except some scientific and exploration bases such as Mould Bay. The region has high hydrocarbon potential, including some producing wells.

2.1.2 Ellesmere Mountains and Eureka Hills

Location: This region extends over the lowlands and uplands of Ellesmere and Axel Heiberg Islands in Nunavut.
Climate: The mean annual temperature is approximately -16°C, averaging -0.5°C in summer and -28.5°C in winter. Annual precipitation ranges from less than 100 to 200 mm.
Vegetation: Clumps of moss, lichen, and cold-hardy vascular plants such as sedge and cottongrass are the dominant vegetation. Arctic willow, purple saxifrage and dryas occur infrequently.
Hydrology: Drainage networks are of low density and flow during the brief summer period.
Terrain: The region is composed of hilly to mountainous terrain. Ice-covered mountains can reach 2,500 masl. The terrain contains numerous steep-walled valleys and fjords with glaciers. Continuous, low ice content permafrost occurs. Regosolic Static and Regosolic Turbic Cryosols are the dominant soils that have developed on colluvial, alluvial, and marine sediments.

Wildlife: Characteristic wildlife includes muskox, arctic hare, arctic fox, lemming, and caribou. Polar bears are common in coastal areas. Representative birds include king eider, rock ptarmigan, northern fulmar, plover, hoary redpoll, and snow bunting. Marine mammals include walrus, seal, and whale.
Land Use/Human Activities: There are no permanent settlements within the area. There is some seasonal recreational land use associated with the Ellesmere Island National Park.

2.1.3 Parry Islands Plateau

Location: This ecoregion incorporates areas associated with Parry Islands Group (southern Melville, Bathurst, Cornwallis Islands, and other smaller islands), the north half of Prince of Wales Island in Nunuvut, and the Northwest Territories.
Climate: It features long, cold winters and short, cool summers. The mean annual temperature is approximately -17.5°C, with a summer mean of -1.5°C and a winter mean of -31°C. The mean annual precipitation varies between 100 to 150 mm.
Vegetation: This region has a sparse and discontinuous vegetation cover of moss, along with mixed low-growing herbs and shrubs such as purple saxifrage, *Dryas spp.*, arctic willow, kobresia, sedge, and arctic poppy.
Hydrology: Summer streams are of low to medium density. Flows are restricted to brief summer periods.
Terrain: The terrain is rolling to hilly. It is composed of dolomite, limestone, shales, and sandstones that are broad, flat-topped, and straight-sided. Elevations average less than 400 masl. Soils have developed on morainal and colluvial deposits and are underlain by deep, continuous permafrost with medium ice content. Turbic Cryosols with Static Cryosols are the dominant soils.
Wildlife: Characteristic wildlife includes muskox, caribou, arctic hare, arctic fox, polar bear, seal, whale, seabirds, and waterfowl.
Land Use/Human Activities: Resolute is the largest settlement but with a small population; it is located on the southern shore of Cornwallis Island.

2.1.4 Lancaster and Borden Peninsula Plateaus

Location: This region is associated with southwestern Ellesmere Island, Devon Island, northern Somerset Island, the Brodeur and Borden Peninsulas of north central Baffin Island, and the southwestern coast of Bylot Island along Navy Board Inlet in Nunavut.
Climate: Typically the region features long, cold winters and short, cool summers. The mean annual temperature is approximately -13°C, with a summer mean of 2°C and a winter mean of -26.5°C. The mean annual precipitation varies between 100–200 mm.
Vegetation: Sparse vegetative cover, consisting of moss and mixed, low-growing herbs and shrubs such as purple saxifrage, *Dryas spp.*, arctic willow, kobresia, sedge, and arctic poppy, is found.
Hydrology: Drainage networks are of low to moderate density and flows are restricted to the short summer season.
Terrain: The hills and plateaus, ranging up to about 765 to 300 masl respectively, are formed largely of calcareous soils, derived dolomite, and limestone formations. Exposed bedrock is common near coastal areas. Regosolic Turbic and Regosolic Static Cryosols are the dominant soils, derived from colluvial, alluvial, morainal, and marine sediments. Permafrost is deep and continuous, with medium ice content.
Wildlife: Characteristic wildlife includes caribou, muskox, arctic fox, polar bear, arctic hare, lemming, gyrfalcon, jaeger, snowy owl, ptarmigan, seabirds, and waterfowl.
Land Use/Human Activities: Land uses include trapping, hunting, and fishing. The largest human settlement is Grise Fiord; considered the most northerly community in Canada. Other settlements include Nanisivik, Pond Inlet, and Arctic Bay.

2.1.5 Foxe Uplands

Location: The region covers many of the areas that surround the Foxe Basin water body, including eastern Baffin Island and Melville Peninsula in Nunavut.

Climate: Short cool summers and long cold winters are the norm. The mean annual temperatures range from approximately -11 to -13°C, with a summer mean of 0.5°C to 4.5°C, and a winter mean of -25 to -26.5 °C. The mean annual precipitation ranges from 100 mm in northern areas to 300 mm in southern areas.
Vegetation: Vegetation is discontinuous and dominated by purple saxifrage, *Dryas spp.*, arctic willow, alpine foxtail, and wood rush on Baffin Island. Dry sites are very sparsely vegetated, whereas wet areas have a continuous cover of sedge, cottongrass, saxifrage, and moss.
Closer to Melville Peninsula and Wager Bay vegetation consists of dwarf and low-lying birch, willow, northern Labrador tea, *Dryas*, and *Vaccinium*. Wet sites are dominated by willow and sedge.
Hydrology: Rivers and streams flow mainly in the short summer period and typically are low to moderate density networks that feed into the Foxe Basin. A low density of lakes and ponds is also present.
Terrain: The hilly uplands and lowlands are composed largely of Canadian Shield rocks that rise to about 400–600 masl. Bedrock outcroppings and thin soils are common. Most of the region is underlain by continuous permafrost with low ice content. Turbic Cryosols developed on hummocky, thin, discontinuous sandy moraine whereas Organic Cryosolic soils occur in wetter depressions.
Wildlife: Habitats are of low to medium productivity. Characteristic wildlife includes caribou, muskox, arctic hare, arctic fox, snowy owl, polar bear, seal, and seabirds.
Land Use/Human Activities: Land uses include trapping, hunting, and fishing. Small settlements like Repulse Bay provide support to tourism and exploration industries.

2.1.6 Baffin Uplands

Location: This ecoregion extends across the central uplands of Baffin Island, starting just south of Pond Inlet and running southwards to almost Lake Harbour in Nunuvut.
Climate: The mean annual temperature is approximately -11.5°C, although higher elevations are considerably colder than this. Lower elevations within the region have a mean summer temperature of 1°C and a mean winter temperature of -23°C. Mean annual precipitation ranges from 200 mm in the north to 400 mm in the south, and 300–400 mm at the southern tip.
Vegetation: A very sparse (up to about 15 percent) vegetative cover of moss and mixed, low-growing herbs and shrubs such as purple saxifrage, *Dryas*, arctic willow, kobresia, sedge, and arctic poppy is found in the ecoregion.
Hydrology: Freshwater in the region consists of low-density stream networks with short summer flow periods. Few lakes are present.
Terrain: The uplands of Baffin Island are a broad and gently rolling surface dissected by valleys. Elevations are typically in the range of 700 to 1,200 masl near the Barnes Ice Cap. Bare bedrock and thin soils are common, as are colluvial and morainal deposits, and continuous permafrost with low ice content is typical. Turbic Cryosols have developed where soils can establish.
Wildlife: Owing to low productivity of habitats, smaller populations of arctic hare, arctic wolf, arctic fox, and caribou are present.
Land Use/Human Activities: Very few land uses exist except for some tourism.

2.1.7 Gulf of Boothia and Foxe Basin Plains

Location: The ecoregion extends mainly across the areas contained within Prince Charles Island and the Great Plains of Koukdjuak in Nunavut.
Climate: The mean annual temperature is approximately -11°C, with a summer mean of 2°C and a winter mean of -23°C. The mean annual precipitation ranges from 100 mm in the northwest to 300 mm in the southeast.
Vegetation: These are some of the more lush arctic areas and can have fairly continuous covers of tundra vegetation such as purple saxifrage, *Dryas*, and arctic willow, along with alpine foxtail, and wood rush. Wet areas will feature a continuous cover of sedge, cottongrass, saxifrage, and moss.

Hydrology: Low-density summer-flowing streams and rivers prevail. Numerous round lakes and ponds are striking features.
Terrain: Composed of the coastal and lower elevation lowlands that reach from sea level to about 180 masl in elevation. Marine deposits dominate lower elevations and moraine is more prevalent at higher locations. Permafrost is continuous with medium ice content. Turbic and Static Cryosols soils are found in upland sites and some Organic Cryosols have developed in lower and wetter sites.
Wildlife: Animals found in the region include polar bear in coastal areas, as well as arctic hare, arctic fox, lemming, and caribou. Representative birds include king eider, rock ptarmigan, northern fulmar, plover, hoary redpoll, and snow bunting. Marine mammals include walrus, seal, and whale.
Land Use/Human Activities: Land uses are limited to trapping, hunting, fishing, and some tourism. The main settlements are Igloolik and Hall Beach.

2.1.8 Victoria Island Lowlands

Location: Includes the northern two-thirds of Victoria Island, the southwestern portion of Prince of Wales Island, King William Island, and a small portion of the western side of Boothia Peninsula.
Climate: The mean annual temperature is approximately -14°C, with a summer mean of 1.5°C and a winter mean of -29°C. The mean annual precipitation ranges 100–150 mm.
Vegetation: This ecoregion is characterized by a discontinuous upland vegetal cover dominated by purple saxifrage, *Dryas spp.,* arctic willow, alpine foxtail, wood rush, and other saxifrage. Wet areas have a continuous cover of sedge, cottongrass, saxifrage, and moss. Remaining upland areas are largely devoid of vegetation, a distinguishing characteristic of this area.
Hydrology: Drainage networks are of low to medium density. They flow in the brief summer periods in various directions towards the sea.
Terrain: Extensive areas of drumlinized ridges dominate this area that is underlain by carbonate rocks. Elevations lie predominantly below 100 masl, except in central Victoria Island where elevations rise up to over 200 masl. This area is underlain by continuous permafrost with medium to high ice content. Turbic Cryosols with Static Cryosols are dominant soil types in uplands and Organic Cyrosols occur in wet areas.
Wildlife: Characteristic wildlife includes caribou, muskox, polar bear, arctic hare, arctic fox, snowy owl, other raptors, seal, whale, seabirds, and waterfowl.
Land Use/Human Activities: Land uses in the ecoregion include trapping, hunting, fishing and tourism. The largest settlements are Gjoa Haven on King William Island, and Spence Bay on the Boothia Peninsula.

2.1.9 Banks Island and Amundsen Gulf Lowlands

Location: This region is located adjacent to Amundsen Gulf on the western and southern coastal plains of both Banks Island and Victoria Island.
Climate: The mean annual temperature is approximately -14°C, with a summer mean of 1°C and a winter mean of -29°C. The mean annual precipitation ranges between 100 and 200 mm.
Vegetation: Vegetation consists of moss, and mixed low-growing herbs and shrubs such as purple saxifrage, *Dryas spp*., arctic willow, kobresia, sedge, and arctic poppy.
Hydrology: Drainage networks are of low to medium density that flow in the brief summers in various directions towards the sea. Several small lakes and ponds exist.
Terrain: The largely coastal plains of the region are underlain by unconsolidated sands and gravel and are characterized by low and rolling hills. The deep, continuous permafrost has a high ice content with abundant ice wedges. Wetlands cover 25 to 50 percent of this area. Dominant upland soils are Turbic Cryosols with Static Cryosols and Organic Cryosols develop in wetter depressions.
Wildlife: Characteristic wildlife includes muskox, caribou, arctic hare, arctic fox, snowy owl, raptors, polar bear, seal, walrus, whale, seabirds, and waterfowl.
Land Use/Human Activities: Land uses in this ecoregion are predominantly trapping, hunting, and fishing. The settlements include Sachs Harbour, Cambridge Bay, and Holman Island.

2.2 Alaska Tundra

2.2.1 Arctic Coastal Plain

Location: This ecoregion occurs west of the Mackenzie River along the coast of the Beaufort Sea and near the international boundary between Alaska and the Yukon, Canada.
Climate: The dry, polar tundra or low arctic climate of the ecoregion is marked by short, cold, frequently foggy summers and long, very cold winters. The mean annual temperature is approximately -11°C, with a summer mean of 4.5°C and a winter mean of -24°C. The mean annual precipitation is low and ranges from 140 to 300 mm.
Vegetation: The region is treeless, but supports a nearly continuous cover of shrubby tundra vegetation, consisting of dwarf birch, willow, northern Labrador tea, *Dryas spp.*, rushes, and sedge tussocks. Tall dwarf birch, willow, and alder occur on warm sites; wet sites are dominated by arctic willow, sphagnum moss, and tussock-forming sedge.
Hydrology: Drainage networks are of low to medium density. They flow northerly in the brief summer periods towards the sea. Numerous thaw lakes and ponds can be found in wetland-dominated lowlands.
Terrain: A coastal plain largely covered with a thin veneer of marine and alluvial sediments. The terrain is flat to undulating as the coastal plain rises gradually from sea level to the adjacent foothills. Permafrost is continuous with high ice content, and abundant ice wedges. There is poor soil drainage and thick organic soil horizons. Turbic Cryosols are the dominant soils along with some Static Cryosols and Organic Cryosols.
Wildlife: This ecoregion covers parts of the calving and summer range for the Porcupine caribou herd. Other species found here include brown bear, muskox, snowshoe and arctic hare, red and arctic fox, wolf, and arctic ground squirrel. A variety of birds are present, including raptors, songbirds, ptarmigan, snowy owl, waterfowl, seabirds, and shorebirds. In the marine portion walrus, seal, beluga whale, polar bear, arctic char, broad whitefish, arctic cisco, and Dolly Varden are common species.
Land Use/Human Activities: Land uses include native subsistence trapping, hunting, and fishing, and recreation activities associated with Ivvavik National Park on the mainland and Herschel Island Territorial Park in the Beaufort Sea. There is also a traditional dependence on large marine mammals (e.g., whales, walrus, seals) for food and materials. There is high oil and gas potential off the coastal plain.

*2.2.2 Arctic Foothills

Location: This ecoregion occurs west of the Mackenzie River in the Yukon Territory (Canada), and continues along the coast of the Beaufort Sea through to Point Hope in northwestern Alaska.
Climate: The ecoregion has a mostly dry, polar tundra climate. It is somewhat warmer and wetter than the Arctic Coastal Plain (2.2.1) to the north. It has cool to cold summers and very cold winters. The mean annual temperature is approximately -11°C, with a summer mean of 4.5°C and a winter mean of -24°C. The mean annual precipitation ranges from less than 200 to 350 mm.
Vegetation: The region is predominantly treeless but supports a nearly continuous cover of shrubby tundra vegetation, consisting of dwarf birch, willow, alders, northern Labrador tea, *Dryas spp.*, and sedge tussocks. Some tall dwarf birch, willow, and alder occur on warm sites; wet sites are dominated by arctic willow, sphagnum moss, and tussock-forming sedge. *Dryas* tundra is found on ridges.
Hydrology: Drainage networks are of low to medium density. Many braided streams and rivers flowing northerly in the brief summer periods towards the sea. Numerous small lakes and ponds can be found in wetland-dominated lowlands.
Terrain: Landforms are mostly rolling hills and plateaus that grade from the coastal plain (ecoregion 2.2.1) on the north to the Brooks Range (2.3.1) on the south. Marine and alluvial sediments are dominant. Permafrost is continuous with high ice content, and abundant ice wedges. Soils are often saturated and have thick organic horizons.

Wildlife: This region covers parts of the calving and summer range for the Porcupine caribou herd. Other species found here include muskox, snowshoe and arctic hare, red and arctic fox, gray wolf, brown bear, and arctic ground squirrel. A variety of birds are present, including raptors, songbirds, ptarmigan, snowy owl, waterfowl, and shorebirds. Fish such as arctic char and arctic grayling are also present.
Land Use/Human Activities: Land uses include native subsistence trapping, hunting, and fishing, and recreation activities associated with national parks. There is high hydrocarbon potential off the coastal plain. Point Hope is the main community of this ecozone.

2.2.3 Subarctic Coastal Plains

Location: The oastal plains of the Kotzebue Sound area and the Yukon and Kuskokwim River delta area along the Bering Sea of western Alaska constitute this ecoregion.
Climate: It has a subarctic climate affected by both marine and continental climatic influences with cool summers and severe winters. The mean annual temperature is approximately -6°C. The mean annual precipitation ranges from 250-500 mm. The southern portion is warmer and wetter than the northern portion.
Vegetation: Coastal vegetation is dominated by brackish marshes and wet meadows. Inland, permafrost-dominated landscapes support low birch-ericaceous shrubs and sedge-tussock and sedge-moss bogs. Willow thickets occur along rivers and on better-drained slopes. In the south are found some white and black spruce stands.
Hydrology: Freshwater bodies consist of numerous thaw lakes and thaw sinks. Streams are sluggish with wide meanders.
Terrain: Flat, lake-dotted coastal plains and river deltas are characteristic of the region. Soils are wet and the permafrost table is shallow. Older coastal deposits of marine and alluvial sediments cover most of region. A few low volcanic hills occur.
Wildlife: Predominant wildlife are moose, black bear, caribou, gray wolf, sandhill cranes, waterfowl including brant, emperor geese, and tundra swans; shorebirds such as Sabines' gulls, black turnstones, and western sandpipers. In near shore coastal waters, beluga and bowhead whales, walruses, and seals are seen. In rivers, streams, and coastal waters, arctic char, and all five species of North American Pacific salmon occur.
Land Use/Human Activities: Small permanent and seasonal settlements are found throughout the region, mostly adjacent to rivers or along the coast. Activities include subsistence and recreational fishing and hunting. There is also some minor gold and silver mining.

2.2.4 Seward Peninsula

Location: Extending into the Bering Sea at the Bering Strait, this was an important ice-free migration corridor between North America and Asia.
Climate: The ecoregion has a moist polar climate. The ecoregion is surrounded on three sides by water, yet this has little ameliorating effect on the climate, and ice spans the waters for much of the year. Winters tend to be long and harsh and summers short, cool, and foggy along the coast. The eastern portion has more continental influence. The mean annual temperature is approximately -5° C. The mean annual precipitation ranges from 250 to 500 mm in the lowlands to about 1,000 mm in the highlands.
Vegetation: Mostly tundra vegetation and low scrub communities are found throughout the region, occupying extensive areas. Lower elevations are associated to moist sedge-tussock tundra, while high elevations are associated to alpine *Dryas*-lichen tundra. Low-growing, ericaceous and willow-birch shrubs occur on some better-drained areas.
Hydrology: Stream networks occur in the larger valleys, and in some narrow canyons. Numerous thaw lakes are found in lowland areas.
Terrain: Landforms include a mix of coastal lowlands, extensive uplands with broad convex hills with flat divides, scattered valleys, and small, isolated groups of rugged mountains. Elevations range from sea level to 1,400 masl. Sedimentary, metamorphic, and volcanic rocks are found, including some of the oldest Precambrian geologic formations in Alaska. Permafrost is continuous, but is thin in areas, and ice-

related features such as pingos, raised polygons, and stone stripes are present. Soils are often wet, shallow, and organic.
Wildlife: Dominant wildlife includes bears (including the southernmost range of polar bears on mainland Alaska), caribou, snowy owls, arctic foxes, Alaskan hares. Reindeer were introduced as a food source around 1900. Some Eurasian bird species occur here such as the gray-headed chickadee, yellow and white wagtails, and bluethroat. Other birds include spectacled eiders, ruddy and black turnstones, and the rare arctic loon. Chum salmon, arctic char, and sheefish occur; offshore are ribbon seals and walruses.
Land Use/Human Activities: Subsistence and recreational hunting and fishing occur in the region as does gold mining. Nome is the largest settlement.

2.2.5 Bristol Bay-Nushagak Lowlands

Location: This lowland ecoregion is located in southwestern Alaska off Bristol Bay.
Climate: The climate is maritime polar with substantial moderation by the southern Bering Sea and the North Pacific Ocean. The mean annual temperature is approximately 2°C and the mean annual precipitation ranges from about 400 to 800 mm.
Vegetation: Low and dwarf shrub communities with crowberry, labrador-tea, willow, birch, alder, lichens, and other species are widespread. Large areas of low scrub bog and other wetland communities occur. Mosses and lichens are abundant ground covers.
Hydrology: Lakes and ponds are scattered throughout the lowlands, but are not nearly as numerous as in the Subarctic Coastal Plains (2.2.3).
Terrain: The region has flat to rolling terrain, formed from moraine and outwash deposits. The glacial till and outwash were deposited by various Pleistocene glaciers from the surrounding mountainous ecoregions. Glacial, alluvial, and marine sediments are covered with varying amounts of loess. Permafrost occurs in scattered isolated masses. Soils of the lowlands are somewhat better drained than soils of the Subarctic Coastal Plains Ecoregion (2.2.3).
Wildlife: Large runs of sockeye salmon support populations of brown bears, eagles, and osprey. There is an abundance of waterfowl and shorebirds.
Land Use/Human Activities: Small permanent settlements occur along the coast or adjacent to the larger rivers. The main activities of the region are subsistence and recreational hunting and fishing, as well as commercial fishing and processing.

2.2.6 Aleutian Islands

Location: The region consists of an island chain in southwestern Alaska, marking the southern boundary of the Bering Sea. It is one of the most seismically and volcanically active areas in the world.
Climate: A cool maritime climate prevails, with cold ocean winds and near-constant clouds and fog that limit terrestrial warming. The mean annual temperature is approximately 3°C. The mean annual precipitation ranges from about 800 mm in the lowlands to over 2,000 mm at high elevations. The region is south of the winter sea ice pack and is generally free from permafrost.
Vegetation: Vegetation cover mainly consists of dwarf scrub communities at higher elevations and on sites exposed to wind, and of graminoid herbaceous communities in more protected sites. The flora is a blend of species from two continents, grading from North American to Asian affinities from east to west. Mountain flanks and coastlines are dominated by low shrubs of willow, birch, and alder interspersed with ericaceous-heath, *Dryas*-lichen, and grass communities. Alpine tundra and glaciers are on mountains. Introduction of exotic animal species has affected plant communities in some areas.
Hydrology: Most islands have radial drainage patterns. Streams are short and high gradient, some entering the sea as waterfalls. Some small lakes occur on the more rolling topography, and some lakes are in the volcanic craters and calderas.
Terrain: Landforms consist of a chain of islands (eroded from older volcanic formations) that are crowned by steep volcanoes. The islands are the volcanic summits of a submarine ridge extending from the Alaska

Peninsula to the Kamchatka Peninsula. They are the result of the Pacific crustal plate subducting, or descending, beneath the North American crustal plate. The region includes glaciated and rubble-strewn volcanic cones indented with fjords and bordered by sea cliffs or wave-beaten platforms. Elevations range from sea level to over 1,900 masl. The islands are covered by volcanic-ash soils or other soils developed over basalt. Some organic soils are found in depressions and broad valley bottoms.
Wildlife: The region is important for marine mammals such as northern fur seals, Steller sea lions, and sea otters; for waterfowl such as Aleutian cackling geese, emperor geese, and some Asian species; and for one of the largest nesting populations of seabirds in North America, including various species of auklet, red-legged kittiwakes, Aleutian terns and red-faced cormorants.
Land Use/Human Activities: Settlements are relatively sparse. Main economic activities in the region include subsistence and recreational fishing and hunting, especially using marine and tidal waters. Military lands are present. Many of the islands are part of the Alaska Maritime National Wildlife Refuge.

2.3 Brooks Range Tundra

*2.3.1 Brooks Range/Richardson Mountains

Location: This region extends from the Richardson Mountains in the northern Yukon and traverses east-west through much of northern Alaska to within 100 km of the Chukchi Sea. It is sometimes considered the northern extension of the Rocky Mountains.
Climate: The dry polar climate has short, cool summers and long, cold winters. Air temperatures decrease rapidly with rising elevation but climate is variable due to aspect, winds, and other factors. For instance, major mountain passes can be subject to strong outflow winds, causing severe wind chill conditions. The mean annual temperature for the area ranges from -6° to -12°C, with a summer mean of 6.5°C and a winter mean of -25°C. Mean annual precipitation ranges from 200 to 600 mm.
Vegetation: This ecoregion is characterized by alpine tundra at upper elevations and subalpine open woodland vegetation at lower elevations. Alpine vegetation consists of lichens, mountain avens, and intermediate to dwarf ericaceous shrubs, sedge, mosses, and cottongrass in wetter sites. Barren talus slopes are common. Subalpine vegetation consists of discontinuous open stands of stunted white spruce in a matrix of willow, dwarf birch, and Labrador tea.
Hydrology: Streams are often high gradient, incised, and in a trellis drainage pattern, with major streams draining north or south and their tributaries draining east and west. Lakes are relatively sparse, with some located in morainal areas, in floodplains, or in rock basins.
Terrain: Landforms consist of several groups of rugged, deeply dissected mountains carved from uplifted Paleozoic and Mesozoic sedimentary and some metamorphic rock. Unstable hillslopes are common. To the west and east, the topography becomes less rugged. The Richardson Mountains tend to have flat-topped summits flanked by stepped slopes. Elevation of mountain peaks ranges from 800 masl in the relatively low Baird Mountains in the west to 2,400 masl in the central and eastern Brooks Range. Pleistocene glaciation was extensive, and small glaciers persist at elevations above 1,800 masl. Continuous thick permafrost underlies the Alaskan portion, while low ice content permafrost is predominant in the southern Canadian side. Turbic Cryosols with some Static Cryosols are dominant soil types.
Wildlife: Characteristic wildlife includes caribou, grizzly bear, Dall's sheep, moose, snowshoe hare, fox, gray wolf, marmot, and arctic ground squirrel. The area is within the annual migration range of the Porcupine caribou herd. Other common species are golden eagle, peregrine falcon, short-eared owl, green-winged teal, horned larks, and arctic grayling in streams.
Land Use/Human Activities: On the Canadian portion there are no permanent settlements within the ecoregion, and land uses are restricted to subsistence wildlife trapping, hunting and tourism associated with national parks. On the US portion Native American groups have been using the area for subsistence hunting, fishing and gathering. Today mining is also an important activity.

2.4 Southern Arctic

2.4.1 Amundsen Plains

Location: The region extends from the eastern side of the Mackenzie Delta in the Northwest Territories southeastwards along the mainland coastal plain to Bathurst Inlet in Nunavut.
Climate: The mean annual temperature is approximately -10.7°C, with a summer mean of 5.5°C and a winter mean of -26.5°C. The mean annual precipitation ranges from 200 to 300 mm.
Vegetation: Much of the upland surface is composed of unvegetated rock outcrops that are common on the Canadian Shield. Vegetative cover is characterized by shrub tundra, consisting of dwarf birch, willow, northern Labrador tea, *Dryas spp*., and *Vaccinium*. Willow, sphagnum moss, and sedge tussocks dominate depressional sites. Scattered stands of spruce occur along the southern boundary of the region. The southern boundary of the region encompasses the area of tundra and subarctic forest transition, where open, very stunted stands of black spruce and tamarack can occur.
Hydrology: Numerous lakes fill the lowlands. Rivers and streams mainly flow northwards in summer periods into the Amundsen Gulf.
Terrain: The region consists mainly of massive shield rocks that form broad, sloping uplands, plateaus, and lowlands. Some rugged ridges reach about 610 masl but the rolling surfaces are generally below 300 masl elevation. The uplands are dominated by discontinuous covers of sandy morainal and fluvioglacial materials, and in association with rock outcrops. Organic and marine deposits can dominate the coastal lowlands. Permafrost is deep and continuous with low ice content. Organic and Turbic Cryosols have developed as soils. Some Regosolic Static Cryosols occur in the active deltas and some Brunisolic soils start to develop on warmer and more southern sites.
Wildlife: One encounters caribou, muskox, moose, grizzly and black bear, polar bear, hare, fox, wolf, lynx, raptors, shorebirds, seabirds, waterfowl, beluga whale, seals, and walrus.
Land Use/Human Activities: Land uses include subsistence trapping and hunting. The area has high mineral development potential and considerable exploration activity has taken place. Paulatuk, Tuktoyaktuk and Coppermine are the main settlements.

2.4.2 Aberdeen Plains

Location: The region extends from the MacAlpine Lake region in Nunavut and southeasterly to the Hudson Bay region near the community of Rankin Inlet.
Climate: The mean annual temperature is approximately -8°C in the south to -11°C in the north, with a summer mean of 5.5°C and a winter mean of -25.5°C. The mean annual precipitation ranges 200-275 mm; with higher precipitation (400 mm) in the southeastern section near Eskimo Point.
Vegetation: Mainly shrub tundra vegetation is found. Dwarf birch, willow, and alder occur on warm, dry sites; poorly drained sites are dominated by willow, sedge, and moss.
Hydrology: Drainage networks are of moderate to high densities. Summer flows are largely in either a northeasterly and easterly direction. Numerous lakes and ponds prevail across the landscape.
Terrain: This area extends across the Canadian Shield and massive granitic rocks, forming a broad, level terrain grade into gently sloping plains and hills that reach 300 masl. The surface has outcrops and discontinuous, thin, sandy moraine. Permafrost is continuous with low ice content. Upland soils are composed of Turbic and Static Cryosols, and lower and wetter areas have Organic Cryosolic soils. Wetlands cover 25 to 50 percent of the land area.
Wildlife: The region is an important summer range for caribou and provides breeding habitat for snow and Canada goose, and other waterfowl. Other wildlife includes moose, red and arctic fox, snowshoe hare, arctic ground squirrel, masked shrew, lemming, wolf, lynx, weasel, snowy owl, shorebirds, and other raptors.
Land Use/Human Activities: Land uses include fishing, trapping, and hunting as well as mineral exploration and developments. Most of the human population and land use is along the coast and include Chesterfield Inlet, Eskimo Point, and Rankin Inlet. Baker Lake is the main inland settlement.

2.4.3 Central Ungava Peninsula and Ottawa and Belcher Islands

Location: This ecoregion extends from the northeastern coast of Hudson Bay to the western shores of Ungava Bay in northern Quebec.
Climate: Mean annual temperature in the region is approximately -7°C, with a summer mean of 3.5°C and a winter mean of -17.5°C. The mean annual precipitation ranges from 400 to 500 mm.
Vegetation: Nearly continuous cover of low arctic shrub tundra vegetation is characteristic, consisting of dwarf birch, willow, northern Labrador tea, *Dryas spp.*, and *Vaccinium spp.* The southern portion of the region has a mix of tundra vegetation and open, dwarf coniferous forest.
Hydrology: Rivers and streams generally flow eastwards or westwards from the central upland divide. Small lakes and ponds are numerous, covering about 20 percent of the surface.
Terrain: Much of the area lies above 200 to 300 masl and has an undulating surface with elevations that can reach 680 masl. Granitic and gneisses formations are widely exposed and intermixed with thin covers of moraine. Bare rock outcroppings are common. Permafrost is continuous, with low ice content. Upland soils are composed of Turbic and Static Cryosols and lower and wetter areas have Organic Cryosolic soils.
Wildlife: Characteristic wildlife includes caribou, wolverine, snowshoe hare, fox, polar bear, raptors, shorebirds, and waterfowl.
Land Use/Human Activities: Hunting, fishing and trapping are common activities. Settlements include Inukjuak, Povungnituk, and other smaller settlements.

2.4.4 Queen Maud Gulf and Chantrey Inlet Lowlands

Location: This region extends eastward from Bathurst Inlet along the arctic coastal zone to Rasmussen Basin, and southwards to about the Back River in Nunuvut.
Climate: The mean annual temperature is approximately -11.5°C, with a summer mean of 5.0°C and a winter mean of -27.5°C. The mean annual precipitation ranges from 125 to 200 mm.
Vegetation: The region is characterized by a cover of shrub tundra vegetation, consisting of dwarf birch, willow, northern Labrador tea, *Dryas spp*., and *Vaccinium spp*. Tall dwarf birch, willow, and alder occur on warm sites; sphagnum moss and sedge tussocks dominate wet sites.
Hydrology: A moderate density network of rivers and streams flow mainly northwards to Queen Maud Gulf. The area contains many small lakes and ponds.
Terrain: Rolling uplands are found that can reach about 300 masl and feature massive bedrock exposures and thin moraines. Lowlands and valleys are more typically covered with marine silts and clays. Permafrost is continuous and deep with low ice content. Upland soils are composed of Turbic and Static Cryosols and lower and wetter areas have Organic Cryosolic soils.
Wildlife: The area is prime habitat for migratory birds (ducks, geese) habitat. Caribou, muskox, polar bear, moose, grizzly bear, wolverine, hare, fox, raptors, walrus, seal, and whale are common.
Land Use/Human Activities: Bathurst Inlet, with a population of about 100, is the main settlement. Hunting, trapping and fishing are common activities. Bathurst Inlet is also supporting diamond-mining activities.

3.0 Taiga / Taiga

3.1 Alaska Boreal Interior

*3.1.1 Interior Forested Lowlands and Uplands

Location: This region extends from the western margins of Alaska through to the Old Crow Basin in northwestern Yukon. This is a diverse ecological region representing a patchwork of ecological characteristics that mainly covers a large portion of central Alaska.
Climate: The ecoregion has a subarctic, continental-influenced climate, marked by cool to mild summers and long cold winters. Climate in the region is influenced by distance from the ocean, elevation, and other

factors. Summer temperatures can be relatively warm. The mean annual temperature for the area is approximately -9.5°C, with a summer mean of 7.5°C and a winter mean of -26°C. Mean annual precipitation ranges from 200 to 800 mm and mostly occurs during summer convective storms.
Vegetation: Needle leaf, broadleaf, and mixed forests occur, with a complex of vegetation communities resulting from the interplay of permafrost, surface water, fire, local elevational relief, and hillslope aspect. Lightning fires are very frequent. In Alaska, white and black spruce are the most common forest species, tamarack is also present in the bottom areas, as well as broadleaf forest of balsam poplar and quaking aspen on floodplains. On the Canadian side, black spruce and tamarack, with secondary quantities of white spruce and ground cover of dwarf birch, willow, ericaceous shrubs, cottongrass, lichen, and moss, are predominant. Tussock tundra vegetation covers most gentle slopes.
Hydrology: Streams within the region are mostly short and lakes are scarce. Some thaw lakes and oxbow lakes occur, though. Larger streams originate in adjacent mountainous regions. In Canada, wetlands have a significant coverage.
Terrain: The landscape is characterized by generally flat to gently rolling terrain and dissected plateaus. Geology consists mostly of Mesozoic and Paleozoic sedimentary rocks, along with some areas of volcanic formations. The region was not glaciated during the Pleistocene. There is little exposure of bedrock due to alluvium and slope deposits. In Alaska, elevations range from sea level to over 700 masl; permafrost is discontinuous but thicker and more continuous to the west. In Canada, elevations range from 1,000 masl in the east to 400 masl in the west; permafrost is continuous with medium ice content. Turbic Cryosols are dominant soil types. Regosolic Turbic, Regosolic Static and Organic Cryosols occur as well.
Wildlife: The region's fauna includes caribou, grizzly and black bear, moose, beaver, arctic fox, wolf, Alaska hare, raven, rock and willow ptarmigan, golden eagle, salmon, whitefish, blackfish, and pike.
Land Use/Human Activities: Subsistence and recreational hunting, trapping and fishing. Recreation and tourism are becoming increasingly important in Canada. In Alaska, metal, coal, and uranium mining are important activities, as well as sand and gravel extraction. Main communities include Old Crow Flats in Canada.

3.1.2 Interior Bottomlands

Location: This ecoregion consists of low elevation areas of interior Alaska.
Climate: It has a subarctic, continental-influenced climate, marked by cool summers and cold winters and is drier in the eastern portions of the disjunct region. The mean annual temperature ranges from approximately -6°C to -4°C. The mean annual precipitation ranges from 280 to 500 mm.
Vegetation: Forests are dominated by spruce and hardwood species; tall scrub thickets and wetlands are also common. The vegetation along the major rivers is mostly white spruce and balsam poplar. White spruce, white birch, and trembling aspen are often found on south-facing slopes. Active floodplains and riverbars support tall stands of alders and willows. Wet sedge meadows and aquatic vegetation occur in sloughs and oxbow ponds. The permafrost-dominated lowlands support black spruce woodlands, and birch-ericaceous shrubs and sedge-tussock bogs. Tall willow, birch, and alder communities are scattered throughout.
Hydrology: Meandering streams and abundant side sloughs. The bottomlands are dotted with thaw ponds and oxbow lakes. There are a few morainal lakes near the Alaska Range (6.1.2). Many flat organic surfaces are pockmarked with dense concentrations of lakes and ponds. Groundwater-charged seeps and springs are common in gravel deposits.
Terrain: Flat to nearly flat bottomlands occur along the larger rivers of interior Alaska, with some inclusions of local hills. Elevations range from 120 masl in the west to 600 masl in the east. Fluvial and aeolian deposits are deep and outwash and morainal deposits occur in some areas. Soils are poorly drained and shallow, often over permafrost that tends to be discontinuous. Poor drainage caused by

permafrost contributes to the prevalence of wet, organic-rich soils. The ecoregion was not glaciated during the Pleistocene.
Wildlife: Moose, black bear, beaver, muskrat, porcupine, trumpeter swans, and numerous other waterfowl are to be found. The large rivers support important runs of chinook, chum, and coho salmon.
Land Use/Human Activities: Many of the settlements of interior Alaska are in the bottomlands because of food sources and transportation routes provided by rivers. Principal activities include subsistence and recreational hunting and fishing as well as some gold and silver mining, logging and small areas of agriculture along the Tanana River.

3.1.3 Yukon Flats

Location: The Yukon Flats ecoregion is a lowland area in east central Alaska where the Porcupine River joins the Yukon River.
Climate: It has a dry continental subarctic climate with considerable seasonal temperature variation. Summers are warmer and winters are colder than in other areas of comparable latitude. The mean annual temperature ranges from approximately -8° to -4° C. The mean annual precipitation is low, generally about 180 to 250 mm, and is less than the annual precipitation of the Interior Bottomlands (3.1.2).
Vegetation: A variety of different communities, including forests dominated by spruce and hardwood species, tall scrub communities, and wet graminoid herbaceous communities. Vegetation varies with soil drainage, grading from wet grass marshes and low shrub swamps to open black spruce forests to closed spruce-aspen-birch forests on better-drained uplands. Summer forest fires are common.
Hydrology: Large braided and meandering rivers, streams, numerous thaw and oxbow lakes, and meander scars are found throughout the region. The poorly drained flats and terraces have vast wetlands pockmarked with dense concentrations of thaw lakes and ponds. On the flats, water levels of lakes are often maintained by spring flooding rather than precipitation.
Terrain: The region features a relatively flat, marshy basin floor surrounded by more undulating topography of depositional fans, terraces, pediments, and mountain toeslopes with fewer water bodies. Deep deposits of colluvial, alluvial, and eolian origin are underlain by permafrost. Active fluvial processes result in deltaic fans, terraces, and floodplains. The Yukon River forms a maze of islands, sandbars, sloughs, and oxbow lakes as it meanders across the lower flats.
Wildlife: One of the most productive habitats for wildlife in North America, the region includes moose, bear, lynx, snowshoe hare, river otter, beaver, muskrat, marten, mink, great gray owls, boreal chickadee, spruce grouse, three-toed woodpecker, ravens, large concentrations of nesting waterfowl and other migratory birds, northern pike, sheefish, arctic grayling, and king, silver, and chum salmon.
Land Use/Human Activities: The main activities include subsistence and recreational hunting and fishing, along with some gold mining. Only small villages populate the area.

3.2 Taiga Cordillera

*3.2.1 Ogilvie Mountains

Location: The Taiga Cordillera extends across the Ogilvie and Wernecke mountains and basins, and takes in the Eagle Plain, Bell Basin, and part of the Porcupine Plateau.
Climate: The region has a severe, mid-latitude, subarctic climate. The mean annual temperature for the area is approximately -6°C, with a summer mean of 9.5°C and a winter mean of -23°C. Mean annual precipitation ranges from 300 to 600 mm.
Vegetation: Open stands of white and black spruce grow in a matrix of ericaceous shrubs, dwarf willow, birch, and a ground cover of moss and lichen in more protected subalpine sections of this area. Paper birch can form extensive communities on lower-elevation and mid-slope terrain. Many of the mountain slopes are largely devoid of vegetation, particularly the steeply sloping calcareous rock outcrops.
Hydrology: Drainage networks are of low to medium densities. Some ponds and thermokarst basins occur in valley bottoms.

Terrain: The region occupies the northern portions of the unglaciated Ogilvie and Wernecke mountains and associated intermontane basins, and the Porcupine Plateau. Permafrost is continuous and wetlands cover 25 to 50 percent of the area. Bedrock is dominated by limestone and shale and some occurrences of karst topography. Most elevations are between 1,400 to 2,200 masl. The surface cover comprises coarse rubbly to fine colluvium. Turbic and Static Cryosols have developed on colluvium deposits and are dominant in the region. On warmer permafrost-free sites, Eutric and Melanic Brunisols soils have developed.
Wildlife: Characteristic wildlife includes caribou, grizzly and black bear, Dall's sheep, moose, beaver, fox, wolf, hare, lynx, raven, rock and willow ptarmigan, bald and golden eagle, and salmon.
Land Use/Human Activities: Land uses include recreation, tourism, hunting, fishing, and trapping. Potential reserves of mineral and hydrocarbon resources exist. There are minor areas of mineral mining. Permanent settlements are few, but include Eagle Plains in the United States.

3.2.2 Mackenzie and Selwyn Mountains

Location: This region extends across the border between Yukon and the Northwest Territories from the area north of Dawson southeastto Wrigley.
Climate: Climatic conditions vary with elevation. The mean annual temperature for major valley systems is approximately -4.5°C, with a summer mean of 9.5°C and a winter mean of -19.5°C. Mean annual precipitation is highly variable, ranging from 400 mm at lower elevations up to 750 mm at high elevations.
Vegetation: The region is characterized by alpine tundra at upper elevations and subalpine open woodland vegetation at lower elevations. Alpine vegetation consists of lichens, mountain avens, intermediate to dwarf ericaceous shrubs, and dwarf willow; sedge and cottongrass are present in wetter sites. Barren talus slopes are common. Subalpine vegetation consists of discontinuous open stands of stunted white spruce and occasional alpine fir in a matrix of willow, dwarf birch, and Labrador tea.
Hydrology: Drainage networks are of low to medium densities.
Terrain: The region includes the Ogilvie and Wernecke mountains as well as the Selwyn Mountains. Region shows evidence of localized alpine and valley glaciation. Elevations can reach 2,950 masl. Permafrost is continuous and mostly of low ice content. Alluvium, fluvioglacial deposits, and morainal veneers and blankets are dominant in the region. Rocky outcrops are common at higher elevation.
Wildlife: Characteristic wildlife includes caribou, grizzly and black bear, Dall's sheep, moose, beaver, fox, wolf, hare, raven, rock and willow ptarmigan, golden eagle, gyrfalcon, and waterfowl.
Land Use/Human Activities: This area supports various forms of hunting and trapping, and has considerable mineral potential, but for the most part it is an isolated wilderness with little permanent human settlement.

3.2.3 Peel River and Nahanni Plateaus

Location: This ecoregion extends along parts of the northerly Yukon and Northwest Territories border and then along the foothills of the Mackenzie Mountains.
Climate: The area is marked by long, very cold winters and short cool summers. The mean annual temperature is approximately -6°C, the mean annual summer temperature is 10°C and the mean winter temperature is -22.5°C. Mean annual precipitation ranges from 200 to 500 mm.
Vegetation: Predominant vegetation consists of open, very stunted stands of black spruce and tamarack with secondary quantities of white spruce, and a ground cover of dwarf birch, willow, ericaceous shrubs, cottongrass, lichen, and moss. Poorly drained sites usually support tussocks of sedge, cottongrass, and sphagnum moss. Low shrub tundra, consisting of dwarf birch and willow, is also common.
Hydrology: Low to moderate density streams and rivers prevail, flowing mainly in the brief summer period and draining mainly eastwards into the Mackenzie River.

Terrain: The hilly to plateau-like region is covered by thin to discontinuous glacial drift and organic deposits. Elevations can typically be 1,100 to 1,200 masl. Wetlands are present on over 25 percent of the ecoregion. Permafrost is continuous, and characterized by sparse ice wedges and massive ground ice bodies, with high to medium ice content. Dystric and Eutric Brunisols are more common in lower elevations whereas Static and Turbic Cryosols with Regosols develop more so on upper-elevations.
Wildlife: Characteristic wildlife includes caribou, moose, grizzly and black bear, wolf, coyote, red fox, lynx, weasel, snowshoe hare, beaver, muskrat, and ground squirrel. Common birds include raven, osprey, spruce grouse, snowy owl, snow and Canada geese.
Land Use/Human Activities: Land use activities include trapping, hunting, and fishing, with some recreation and tourism. There are no permanent communities in this ecoregion.

3.3 Taiga Plains

3.3.1 Great Bear Plains

Location: This region begins at the northwestern shores of Great Slave Lake in the Northwest Territories and then extends in a northwesterly direction through to the Mackenzie Delta.
Climate: Its climate is marked by short, cool summers and long, very cold winters. The mean annual temperature is approximately -9°C in the northern areas and -6°C in the south. The amount of variation in the mean summer temperatures is similar, going from 8°C to 11.5 °C, and the mean winter temperature is -25.5°C. Mean annual precipitation ranges between 200 and 300 mm.
Vegetation: The latitudinal limits of tree growth are reached along the region's northern boundary. The predominant vegetation consists of open, very stunted stands of black spruce and tamarack with secondary quantities of white spruce and a ground cover of dwarf birch, willow, ericaceous shrubs, cottongrass, lichen, and moss. Poorly drained sites usually support tussocks of sedge, cottongrass, and sphagnum moss. Low shrub tundra, consisting of dwarf birch and willow, is also common.
Hydrology: Several small lakes and ponds occur. Moderate density streams and rivers flow in the summer periods, mainly in a northwesterly direction.
Terrain: Underlain by shale and limestone strata, the surface of this area is generally below 350 masl. Undulating moraine and outwash deposits generally covers the area. Permafrost is extensive and discontinuous with low to medium ground ice content. Organic and Turbic Cryosols occur on colder sites and, Eutric and Dystric Brunisols dominant soils in warmer areas.
Wildlife: The region's wildlife species includes caribou, moose, grizzly and black bear, wolf, coyote, arctic and red fox, snowshoe hare, muskrat, and beaver. Common birds are spruce grouse, raven, osprey, and waterfowl.
Land Use/Human Activities: Land use activities include trapping, hunting, fishing, recreation, and tourism. The principal communities are Colville Lake, Fort Good Hope, Deline, and Lac la Martre.

3.3.2 Hay and Slave River Lowlands

Location: This ecoregion extends from northeastern British Columbia and southwest (Northwest Territories) eastwards to the Slave River region in the Northwest Territories and northeastern Alberta.
Climate: The region's climate is marked by short, warm summers and long, cold winters. The mean annual temperature is approximately -2.5°C, the mean summer temperature is 13°C and the mean winter temperature is -19°C. The mean annual precipitation ranges from 350 to 500 mm.
Vegetation: Vegetation is characterized by closed mixed stands of trembling aspen, balsam poplar, white spruce, balsam fir, and black spruce on drier sites.
Hydrology: Low to moderate drainage networks prevail and flow easterly within the Mackenzie, Hay, and Slave River systems. Numerous small lakes and ponds are associated with wetlands.
Terrain: The region is composed of low relief, flat-lying lowlands with poorly drained wetlands covering about 30 percent of the area.. Surface deposits are predominantly peat-covered clayey lacustrine, and moraine on nearly level to gently rolling topography. Sporadic discontinuous permafrost with low ice

content is confined to organic deposits. Organic Cryosolic soils are found in colder sites. Mineral soils are mainly Gray Luvisols with some Brunisols with Gleysols in wetter areas.
Wildlife: Moose, bison, black bear, wolf, lynx, muskrat, beaver, snowshoe hare, red squirrel, raven, ruffed grouse, sandhill crane, and waterfowl are the typical wildlife encountered. Woodland caribou are found in some areas. The most species-rich habitats are the mixed woods and shrublands associated with the fens, bogs, ponds, streams, and lakes.
Land Use/Human Activities: Some pulpwood and local sawlog forestry, oil and gas extraction and exploration, water-oriented recreation, and wildlife trapping and hunting are the dominant uses of land in this region. There are at least eight major communities, including Hay River, For Providence, Fort Liard, Pine Point, Fort Resolution, and Fort Smith.

3.4 Taiga Shield

3.4.1 Kazan River and Selwyn Lake Uplands

Location: This region stretches across the area where the borders of Manitoba, Saskatchewan, Northwest Territories and Nunavut meet, going from Dubawnt Lake and south to Reindeer Lake.
Climate: The region's climate is marked by cool summers and very cold winters. The mean annual temperatures are approximately -8°C to -5°C. The mean summer temperatures are 8°C to 11°C and the mean winter temperatures are -24.5°C to -21.5°C. The mean annual precipitation ranges from over 200 to over 400 mm.
Vegetation: This is an area where tundra and boreal forest make a transition. The predominant vegetation consists of open, very stunted stands of black spruce and tamarack with secondary quantities of white spruce, a shrub layer of dwarf birch, willow, and ericaceous shrubs; with ground cover of cottongrass, lichen, and moss. Drier sites can be dominated by open stands of white spruce, ericaceous shrubs, and a ground cover of mosses and lichens. Poorly drained sites usually support tussock vegetation of sedge, cottongrass, and sphagnum moss. Low shrub tundra vegetation, consisting of dwarf birch and willow, is also common. Wetlands are common in depressional lows.
Hydrology: Small lakes and ponds are numerous. Drainage networks have moderate to high density and flow northeasterly and easterly into Hudson's Bay.
Terrain: The area is associated with the Canadian Shield and is a mix of rolling uplands and lowlands. Most of the elevations are above 300 masl. Bedrock outcrops and covers moraine are characteristic. Permafrost is almost continuous and has low to medium ice content. Dystric Brunisols commonly occurring on drier sites and Turbic Cryosolic soils are common in colder sites. Organic Cryosols are typical in wetlands.
Wildlife: Barren-ground caribou, black bear, arctic fox, wolf, wolverine, weasel, marten, otter, mink, snowshoe hare, and brown lemming are mammalian species typically encountered. Bird species in the region include rock and willow ptarmigan, sandhill crane, waterfowl, and shore birds.
Land Use/Human Activities: Land use activities are limited to fishing, trapping and hunting, and some recreation and tourism. Major communities include Wollaston Lake, Lac Brochet, and Brochet.

3.4.2 La Grande Hills and New Quebec Central Plateau

Location: This region extends from the western shores of James and Hudson Bay eastwards into the interior of Quebec to regions around Schefferville and Fort Chimo.
Climate: The cool summers and very cold winters typically average 8.5°C in summer and -18ºC in winter, giving a mean annual temperature of approximately -4.5°C. The mean annual precipitation ranges from 600 mm in the north to 900 mm in the south.
Vegetation: Open coniferous forests in the southern margins are transitional to more tundra and alpine tundra communities to the north. Open stands of lichen-black/white spruce woodland with an understory

of feathermoss, dwarf birch, northern Labrador tea, and lichens. Vegetative cover is reduced on exposed sites; poorly drained sites support Labrador tea, cottograss, sedge, and sphagnum moss.
Hydrology: Numerous small lakes and ponds occur throughout the area. Drainage networks are of moderate to high density and mainly flow westerly into Hudson Bay.
Terrain: This is part of the rolling uplands and lowlands of the Canadian Shield. Elevations can reach 915 m but much of the surface lies between 400 to 600 m. Permafrost is sporadic, discontinuous, and with low ice content. Rock outcroppings and covers of moraine are common. Turbic and Organic Cryosols form on colder sites and Dystric Brunisolic and some Humo-Ferric Podzols develop on warmer sites.
Wildlife: Caribou, wolverine, snowshoe hare, arctic and red fox, wolf, coyote, black bear, grouse, raven, osprey, and waterfowl are present.
Land Use/Human Activities: Land uses are limited to wildlife trapping and hunting, recreation, and tourism. Hydroelectric development is another important land use in La Grande Hills with the largest hydroelectric power development in Canada, the James Bay project. Main communities are Chisasibi and Kuujjuarapik. The population is approximately 5,700.

3.4.3 Smallwood Uplands

Location: The region stretches from the southern end of the Torngat Mountains in Labrador and southwards to the Quebec/Newfoundland border.
Climate: As in the regions to the west, the climate is marked by cool summers and very cold winters. The mean annual temperatures are approximately -4°C in the north to 11°C in the southern regions. In a similar pattern, the mean summer temperatures are 6.5°C to 10°C, and the mean winter temperature is -15°C to -13°C. The mean annual precipitation ranges from 600 to 1,150 mm.
Vegetation: This is a transitional area where tundra and alpine tundra vegetative communities in the northern sections grade into coniferous boreal forests to the south. Continuous vegetation occurs only in depressions where snow accumulates and provides moisture throughout the growing season. Bare rock and tundra, and alpine heath of lichens, mosses, and sedges, each comprise about 50 percent of the upper surfaces. Dwarf, open black spruce, dwarf mixed evergreen deciduous shrubs, and moss are dominant on bogs and poorly drained sites.
Hydrology: Many small lakes and ponds occur throughout the area. Drainage networks are of moderate density and mainly flow easterly into the Labrador Sea.
Terrain: This ecoregion is part of the rolling uplands and lowlands of the Canadian Shield. Hummocky and drumlinized moraine and some outcrops cover the surfaces. Elevations are in the range of 500-600 masl. Permafrost is extensive and discontinuous, with low to moderate ice content. Mesisols and Fibrisols are the dominant organic soils with some Organic Cryosols; Ferro-Humic Podzols and Dystric Brunisols occur in mineral areas.
Wildlife: The ecoregion includes habitats for caribou, moose, black bear, red fox, lynx, other small mammals, waterfowl, colonies of seabirds, and other birds.
Land Use/Human Activities: Land use activities include hunting, trapping, recreative and commercial fishing, and outdoor recreation. Hydro electrical and mineral developments also occur. Principal communities are Churchill Falls, Postville, Nain, Makkovik, Cartwright, Hopedale, Davis Inlet, and Voisey's Bay.

3.4.4 Ungava Bay Basin and George Plateau

Location: This ecoregion extends southwards from Ungava Bay in northeastern Quebec to regions north of the Smallwood Reservoir.
Climate: Cool summers and very cold winters are typical. The mean annual temperature is approximately -4.5°C. The mean summer temperature is 8.5°C and the mean winter temperature is -16°C. The mean annual precipitation ranges 300–400 mm around Ungava Bay to 750 mm in the south.
Vegetation: The region's vegetation is dominated by open to very open (less than 50 percent cover) stands of black spruce, dwarf birch, northern Labrador tea, and lichens. Vegetative cover is reduced on dry sites;

poorly drained sites support open black spruce, Labrador tea, sedge, and sphagnum moss. Vegetative cover becomes sparser and more open as it approaches Ungava Bay.
Hydrology: Numerous small lakes and ponds occur throughout the area. Drainage networks are of moderate density and mainly flow northerly into Ungava Bay.
Terrain: Composed of uplands and lowlands based on Canadian Shield rocks. Elevations range from about 730 masl in the south and central parts to about 360 masl in the north. Hummocky and drumlinized moraines and outcroppings cover the land surfaces. Sporadic discontinuous permafrost with medium ice content is present over most of the ecoregion. Lithic Regosols, Dystric Brunisols, Humo-Ferric Podzols, and colder Turbic and Organic Cryosols occur in this region.
Wildlife: The region provides habitat for caribou, small mammals, waterfowl, and other birds.
Land Use/Human Activities: Important activities include hunting, trapping, and outdoor recreation. Major communities include Tasiujaq, Kuujjuaq (Fort Chimo), Schefferville, and Kangiqsualujjuaq.

3.4.5 Coppermine River and Tazin Lake Uplands

Location: This ecoregion begins on the eastern side of Great Bear Lake in the Northwest Territories and then extends in a southeasterly direction to the northern edges of Lake Athabasca in Saskatchewan.
Climate: Its climate is marked by short, cool summers and very cold winters. The mean annual temperatures are approximately -5°C to -7.5°C. The mean summer temperatures are 9°C to 11°C, and the mean winter temperature are -24.5°C to -21.5°C. The mean annual precipitation ranges from 200 to 375 mm.
Vegetation: This area is part of the tundra and boreal forest transition, where the latitudinal limits of tree growth are reached. The predominant vegetation consists of open, very stunted stands of black spruce and tamarack with secondary quantities of white spruce and a ground cover of dwarf birch, willow, ericaceous shrubs, cottongrass, lichen, and moss. Poorly drained sites usually support tussocks of sedge, cottongrass, and sphagnum moss. Low shrub tundra, consisting of dwarf birch and willow, is also common.
Hydrology: Numerous lakes and ponds occur in this area. Drainage networks are of moderate to high density, and flow in many northerly and southerly directions.
Terrain: Canadian Shield uplands and lowlands comprise the landforms. Hills reach 490 m in elevation. Bare rock outcrops and discontinuous covers of moraine, fluvioglacial, and organic deposits are common. Permafrost ranges from continuous to discontinuous in the south. Dystric Brunisols with some colder Turbic, Static, and Organic Cryosols are the dominant soils.
Wildlife: Characteristic wildlife includes caribou, moose, grizzly and black bear, snowshoe hare, fox, wolf, beaver, muskrat, osprey, raven, spruce grouse, and waterfowl.
Land Use/Human Activities: Land uses include hunting, trapping, fishing, local forestry, and tourism. Diamond exploration is a more recent activity. Principal communities include Yellowknife, Uranium City, Reliance, Rae, Edzo, Fort Chipewyan, Snare Lakes and Rae Lakes.

4.0 Hudson Plains / Planicies de Hudson

4.1 Hudson Plains

4.1.1 Coastal Hudson Bay Lowlands

Location: This region extends from the southwestern coast of Hudson Bay near Churchill, Manitoba, through to the northwestern side of James Bay in Ontario.
Climate: It is marked by short, cool summers and very cold winters. The mean annual temperature is approximately -4° to -7 C° in northern sites. The mean summer temperature is 10.5°C and the mean winter temperature is -19°C. The mean precipitation ranges from 400 mm in the northwest to 600 mm in the east.

Vegetation: Part of the tundra and high boreal forest transition. Shrub covers of dwarf birch, willows or ericaceous plants as well as covers of cottongrass or lichen and moss predominate. Vegetation is characterized by very open stands of stunted black spruce and tamarack with secondary quantities of white spruce. Shrub layers include dwarf birch, willow, ericaceous shrubs, and ground cover of cottongrass, liquen and moss. Poorly drained sites usually support tussock vegetation of sedge, cottongrass, and sphagnum moss.
Hydrology: Streams and rivers of low to moderate density flow mainly northwards into Hudson Bay. Many small lakes and ponds occur.
Terrain: The ecoregion is part of the Hudson Bay Lowlands, which are mainly underlain by marine sediments. Strandlines (beach ridge features) are common along the coasts. Marshes, shallow waters and extensive tidal flats dominate the coastal areas. Wetlands cover the marine sediments inland and occupy up to 70 percent of the surface. Permafrost with low to high ice is widespread. Organic Cryosols have developed in colder locations; in warmer organic areas Mesisols have formed; and Regosols and Gleysols occur to a lesser extent along the coast.
Wildlife: Characteristic wildlife includes barren-ground caribou, polar bear, arctic fox, brown lemming, snow and Canada goose, swan, sea ducks, shorebirds, seal, and white whale.
Land Use/Human Activities: Human activities are limited to trapping, hunting, marine mammal hunting, fishing, recreation, and tourism. Major communities include Peawanuck, Fort Severn, and Churchill.

4.1.2 Hudson Bay and James Bay Lowlands

Location: This ecoregion extends from Herchmer in northeastern Manitoba through to the Fort Rupert/Waskaganish area on the east side of James Bay, Quebec.
Climate: Short cool summers and very cold winters are characteristic of this ecoregion. The mean annual temperatures range from about -3.5°C to -2°C. The mean summer temperature is 11°C and the mean winter temperatures are -16°C to -18.5°C. The mean annual precipitation ranges from less than 500 to 800 mm.
Vegetation: Most of the area is poorly drained and contains cottongrass, sedge, sphagnum hummocks and mosses; as well as more open stands of stunted black spruce and tamarack. Shrub layers consist of dwarf birch, willow and northern Labrador tea. Drier and warmer sites often support open stands of white spruce with an ericaceous shrub layer, and a ground cover of lichen.
Hydrology: Streams and rivers of low to moderate density flow mainly northwards into Hudson Bay. Many small lakes and ponds occur.
Terrain: The area is part of the Hudson Bay Lowlands with maximum elevations at about 120 m in the south. The marine sediments which mantle the surface are extensive and support poorly drained wetlands, which cover up to 75 percent of the area. Moderate to high ice content permafrost is widespread. Organic Cryosols formed in colder sites; Mesisols formed on warmer organic soils; and Eutric Brunisols are associated with warmer mineral upland areas.
Wildlife: Barren-ground caribou, moose, lynx, wolf, snowshoe hare, willow ptarmigan, snow and Canada goose, ruffed grouse, and shorebirds will be found in the region.
Land Use/Human Activities: Human activities, while limited, include mining, hunting, trapping, sport fishing, and localized tourism. Shamattawa, Attawapiskat, Eastmain, Waskaganish, and Moosonee are the principal communities.

5.0 Northern Forests

5.1 Softwood Shield

5.1.1 Athabasca Plain and Churchill River Uplands

Location: This region extends from the south side of Lake Athabasca in Saskatchewan southeasterly to just west of Thompson, Manitoba.

Climate: The climate is marked by cool summers and very cold winters. The mean annual temperature is approximately -2.5°C. The mean summer temperature is 12.5°C and the mean winter temperature is -18.5°C. The mean annual precipitation ranges from 400 to 500 mm.
Vegetation: Vegetation here forms part of the high boreal coniferous forest that extends from northwestern Ontario to Great Slave Lake in the Northwest Territories. Predominating are closed stands of black spruce and jack pine with a shrub layer of ericaceous shrubs and a ground cover of mosses and lichens. Black spruce is the climax species. Closed to open stands of stunted black spruce with ericaceous shrubs and a ground cover of sphagnum moss dominate poorly drained peat-filled depressions.
Hydrology: Numerous small lakes and ponds are present and drainage networks are of moderate to high densities. The Churchill, Nelson and Seal river systems flow mainly in a northeasterly direction.
Terrain: Permafrost is distributed throughout the area. The uplands and lowlands occur on the Canadian Shield with elevations that rarely exceed 25 m; exposed bedrock and covers of moraine are common. Wetlands are typical in depressional low areas. Dystric and Eutric Brunisols are associated with the drier and warmer uplands along with Gray Luvisolic. Mesisols and Organic Cryosols are associated with peatlands.
Wildlife: Wildlife encountered includes barren-ground caribou, moose, black bear, lynx, wolf, beaver, muskrat, snowshoe hare and red-backed vole. Bird species include raven, common loon, spruce grouse, bald eagle, gray jay, hawk owl, sanhill cranes, pelicans, ducks, grouse, and geese.
Land Use/Human Activities: Pulpwood and saw lumber industries operate to a limited extent in the southern parts of the region. Trapping, hunting, fishing, mining, and tourism are the dominant land uses. Major communities include Flin Flon, La Ronge, Stony Rapids and Cree Lake.

5.1.2 Lake Nipigon and Lac Seul Uplands

Location: This area extends eastward from Lake Winnipeg in Manitoba to just past Lake Nipigon in southwestern Ontario.
Climate: The climate is marked by warm summers and very cold winters. The mean annual temperature is approximately 1°C. The mean summer temperature is 14°C and the mean winter temperature is -14.5°C. The mean annual precipitation ranges from 450 mm in the northwest to 800 mm in the southeast.
Vegetation: Coniferous forests with some limited areas of mixed forests are the main communities. Characteristic vegetation includes white spruce, balsam fir, and black spruce with some trembling aspen and balsam poplar, although jack pine and black spruce are more common on moderately well-to-imperfectly drained sites. Poorly drained areas are covered by fens and bogs and are dominated by black spruce.
Hydrology: Numerous small lakes and ponds are present. Drainage networks are of moderate to high densities and river systems flow mainly in a northeasterly direction. Wetlands cover over 25 percent of the area.
Terrain: The uplands and lowlands of the Canadian Shield commonly have outcrops and covers of moraine. Elevations are generally below 360 masl. Dystric Brunisolic and warmer HumoFerric Podzolic soils dominate the region, with significant inclusions of Gleysolic, Fibrisolic, Mesisolic, and Gray Luvisolic soils.
Wildlife: Wildlife includes wolf, lynx, ermine, fisher, mink, moose, black bear, woodland caribou, red squirrel and snowshoe hare. Bird species include the spruce grouse, herring gull, and double-crested cormorant, as well as bald eagle, great horned owl, red-tailed hawk, sharp-tailed grouse, and waterfowl.
Land Use/Human Activities: Forestry, recreation, and hunting are the major land uses in this region. Main communities include Red Lake, Sioux Lookout, Nipigon and Geraldton.

5.1.3 Central Laurentians and Mecatina Plateau

Location: This region extends from Lac Saint-Jean valley and plains in Quebec to the Straits of Belle Isle between Quebec and Newfoundland.

Climate: Marked by predominantly cool summers and cold winters, the mean annual temperature is approximately 0.5°C. The mean summer temperature is 12°C and the mean winter temperature is -11.5°C. The mean annual precipitation ranges 800 to 1,000 mm north-to-south.
Vegetation: The region forms part of the boreal coniferous forest where closed stands of black spruce and balsam fir are dominant along lower slopes, whereas upper slopes are dominated by more open stands of black spruce with some white spruce and paper birch, usually associated with lichens and feathermosses. In the drier, northern parts of the region, white, red, and jack pine, along with spruce and balsam fir are more common. Eastern white cedar and black spruce are associated with wetlands. Much of the region has been deforested. Bedrock exposures are usually covered with lichens; while exposed hilltops are characterized by matted patches of dwarf, krummholz forms of black spruce that give way to white spruce near the coastal area. Sphagnum mosses, sedges, cottongrass, and other wetland species occupy poorly drained areas.
Hydrology: Many lakes and ponds are found here. Drainage networks are of moderate density and tend to flow in a southerly direction into the Gulf of St. Lawrence.
Terrain: Landforms are mainly Canadian Shield uplands and lowlands where outcroppings and moraine covers are common. Elevations are typically in the 500–600 masl range. Permafrost is found in patches of low ice content. Humo-Ferric and Ferro-Humic Podzols, Dystric Brunisols, Mesisols, and Organic Cryosols soil types have developed.
Wildlife: Wildlife includes caribou, moose, white-tailed deer, black bear, wolf, fox, lynx, and snowshoe hare. Bird species include Canada goose, ruffed grouse, American black duck, shorebirds, and seabirds.
Land Use/Human Activities: Land uses are limited but include forestry, hunting, fishing, and recreation. Significant agricultural areas occur in the warmer climate of the Lac Saint-Jean valley and plains. Major communities include Chicoutimi, Sept-Îles, Labrador City, Baie-Comeau, Jonquières, Havre-Saint-Pierre, Saint-Augustin, and Natashquan.

5.1.4 Newfoundland Island

Location: This region extends across the island of Newfoundland.
Climate: The climate is marked by cool summers and short, cold winters in the most continental part of the island. The mean annual temperature is approximately 5°C. The mean summer temperature is 12°C and the mean winter temperature is -2.5°C. The mean annual precipitation ranges 1,000 to 1,600 mm.
Vegetation: Forests are dominated by closed, intermediate-to-low stands of balsam fir and black spruce on steep, moist, upland slopes. Paper birch, aspen, balsam fir, and black spruce are typical of disturbed sites. Drier sites are characterized by woodlands of black spruce, kalmia heath, and lichens. Dwarf, open stands of black spruce and tamarack with ericaceous shrubs are found on raised domed bogs.
Hydrology: Various small lakes and ponds are present; waters flow in various directions toward the sea.
Terrain: Rugged and rocky uplands and lowlands predominate, with outcrops and moraine covers. Elevations range from sea level to about an average of 250 masl. Soils include Humo-Ferric and Ferro-Humic Podzols, Dystric Brunisols, Mesisols, and Organic Cryosols.
Wildlife: Wildlife includes moose, lynx, black bear, red fox, and caribou.
Land Use/Human Activities: Forestry, wood processing, farming, commercial fishing, and some mining are the principal land uses in the ecoregion. Major communities include Gander, Grand Falls, Windsor, Stephenville, Port aux Basques, Bonavista, St. John's, Marystown, Grand Bank, Carbonear and Botwood.

5.1.5 Hayes River Uplands and Big Trout Lake

Location: This region extends from the area around Thompson, Manitoba, southeast to just north of Lake Nipigon in Ontario.
Climate: Cool summers and very cold winters are typical. The mean annual temperature is approximately -3°C. The mean summer temperature is 12°C and that of the winter is -18.5°C. The mean annual precipitation ranges from 400 mm in the northwest to 775 mm in the southeast.
Vegetation: Black spruce is the climax tree species, but stands consist predominantly of medium to tall, closed stands of black spruce and jack pine with some paper birch. The understory is dominated by

ericaceous shrubs, willow, and alder. Ground cover consists of mosses and lichens, low ericaceous shrubs, and some herbs. Depending on drainage, surficial material, and local climate, trembling aspen, white birch, white spruce and, to a lesser extent, balsam fir, occupy significant areas, especially in the southern section. Closed-to-open stands of stunted black spruce with ericaceous shrubs and a ground cover of sphagnum moss dominate poorly drained, peat-filled depressions.
Hydrology: Numerous lakes and ponds occur. Drainage networks are of moderate to high density, and generally flow northwards to Hudson Bay.
Terrain: Canadian Shield uplands and lowlands are characterized by outcroppings and moraine covers. Permafrost is found throughout the region. Eutric Brunisols and inclusions of Dystric Brunisols occur. Organic Cryosols are found in colder sites and some Gray Luvisols in more southern areas.
Wildlife: Area wildlife includes wolf, lynx, otter, marten, beaver, moose, black bear, woodland caribou, snowshoe hare, red squirrel, short-tailed weasel, red-backed vole, and least chipmunk. Bird species found in the region include spruce grouse, sharp-tailed grouse, willow ptarmigan, common nighthawk, raven, gray jay, bald eagle, hawk owl, and numerous passerine and waterfowl species.
Land Use/Human Activities: Wildlife trapping and hunting, water-oriented recreation and tourism are the dominant uses of the land. Some mining, pulpwood, and local sawlog industries also occur. The major communities include Thompson, Norway House, Sandy Lake, Gillam, and Gods Lake Narrow.

5.1.6 Abitibi Plains and Rivière Rupert Plateau

Location: The region extends from Longlac in Ontario and eastwards to the Mistassini Lake in Quebec.
Climate: The region's climate is marked by warm summers and cold, snowy winters. The mean annual temperature is approximately 0.5°C. The mean summer temperature is 13°C and the mean winter temperature is -13°C. The mean annual precipitation ranges from 650 to 900 mm.
Vegetation: Its mixed forest is characterized by stands of white spruce, balsam fir, paper birch, and trembling aspen. Drier sites may have pure stands of jack pine or mixtures of jack pine, paper birch, and trembling aspen. Wet sites are characterized by black spruce and balsam fir. Understory vegetation is typically moss, as well as lichen in cold and wet sites.
Hydrology: Numerous lakes and ponds occur. Drainage networks are of moderate to high density, generally flowing northwards to Hudson Bay.
Terrain: Dominated by the Canadian Shield uplands and lowlands where outcropping and morainal covers dominate the land surface. Altitudes of the discontinuous rolling surfaces are between 300–350 masl, but higher altitudes can reach up to 1,065 masl. Mesisols and Fibrisols are the main organic soils and Humo-Ferric Podzols are the main mineral soils. Some Gray Luvisols and Gleysols have also developed.
Wildlife: Wildlife includes moose, black bear, lynx, snowshoe hare, caribou, wolf, and coyote. Bird species include sharp-tailed grouse, American black duck, wood duck, hooded merganser, pileated woodpecker, and Canada goose.
Land Use/Human Activities: Forestry, hunting, trapping, mining, power generation, and outdoor recreation are the most common land uses in this area. Major communities include Hearst, Kapuskasing, Cochrane, Timmins, Chibougamau, Rouyn-Noranda, Val-d'Or, Amos, and Matagami.

5.2 Mixed Wood Shield

*5.2.1 Northern Lakes and Forests

Location: This ecoregion sits astride the US-Canada border. It includes southeast Manitoba, southwest Ontario, northeastern Minnesota, northern Wisconsin, and northern Michigan.
Climate: The ecoregion is more identified with the warmer, more humid mixed forests of southeastern Canada than with the colder, drier boreal regions to the north. The climate can be considered as severe, mid-latitude, humid continental, marked by warm summers and severe winters, with no pronounced dry season. The mean annual temperature ranges from approximately 2°C to 6°C. The mean summer

temperature is 16°C, and the mean winter temperature is -10°C. The frost-free period lasts from 100 to 170 days. The mean annual precipitation is 768 mm, ranging from 500 to 960 mm.
Vegetation: Forest types are mostly coniferous and northern hardwood forests, with sugar maple, red maple, paper birch, yellow birch, aspen, white spruce, balsam fir, hemlock, eastern white pine, jack pine, and red pine. Cooler and wetter sites have black spruce, tamarack, and northern white cedar.
Hydrology: Moderate to low gradient perennial streams are typical. Wetlands are widespread. The numerous glacial lakes are clearer and less productive than those in ecoregions further south.
Terrain: The terrain is varied, with glaciated, irregular plains and undulating morainal plains and hills, broad lacustrine basins, and extensive sandy outwash plains. Most of the rocks are Precambrian igneous and metamorphic rocks, along with some Paleozoic sedimentary rocks. Nutrient-poor glacial soils are the norm. They are thicker than those in ecoregions to the north and generally lack the arability of soils in adjacent ecoregions to the south. Spodosols, Alfisols, and Histosols are typical, with frigid soil temperature regimes and aquic and udic soil moisture regimes.
Wildlife: The region is rich in wildlife, with moose, black bear, gray wolf, white-tailed deer, lynx, snowshoe hare, ruffed grouse, pileated woodpecker, bald eagle, turkey vulture, common loon, walleye, northern pike, brook trout, and muskellunge.
Land Use/Human Activities: Main economic activities for this border region include forestry, recreation, tourism, hunting and fishing, and iron ore mining. Parts of the ecoregion contain some public national, state, and provincial parks or forestlands. There is also some farming with hay, grain crops, and dairy cattle. Major cities and towns include Thunder Bay, Atikokan, Kenora, Duluth, Superior, Ashland, Rhinelander, and Marquette.

*5.2.2 Northern Minnesota Wetlands

Location: This is a small region on the international border near Lake of the Woods and Rainy Lake in Ontario, Manitoba, and Minnesota.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate, marked by warm summers and cold winters. The mean annual temperature is approximately 2°C; the mean summer temperature is 16°C; and the mean winter temperature is -12°C. The frost-free period ranges from 115 to 150 days. The mean annual precipitation is 599 mm, ranging only from 550 to 700 mm.
Vegetation: The region possesses a mixed conifer/bog forest, and boreal forest vegetation. Common species are white spruce, black spruce, and balsam fir. There are also areas of maples and white pine. Successional areas contain aspen, paper birch, and jack pine.
Hydrology: Much of the region is wetland, with some lakes. Some low-gradient streams and eroded river channels are found, especially to the east.
Terrain: Flat plains and irregular plains characterize the region. A vast and nearly level marsh, formerly occupied by broad glacial lakes, today most of the flat terrain in this ecoregion is still covered by standing water. Peat soils occur on the former lakebed, along with Histosols, Alfisols and Entisols soil types. They have a frigid soil temperature regime and aquic soil moisture regime.
Wildlife: Characteristic species include black bear, gray wolf, white-tailed deer, snowshoe hare, mink, river otter, bald eagle, osprey, common loon, walleye, and northern pike.
Land Use/Human Activities: The area has a relatively small human population. Principal land uses include forestry, recreation, hunting, fishing, and some minor areas of mixed farming and grazing. In US portion, there are tribal land, state forest, and wildlife management land. Larger communities include Fort Frances and International Falls.

5.2.3 Algonquin/Southern Laurentians

Location: This region extends from the eastern shores of Lake Superior in Ontario eastwards to just west of Chicoutimi, Quebec.
Climate: Its climate is marked by warm summers and cold, snowy winters. The mean annual temperature is approximately 2°C. The mean summer temperature is 14.5°C and the mean winter temperature is

-10°C. The southern margins of the ecoregion exhibit a warmer, cool temperate climate. The mean annual precipitation ranges from 800 mm in the northwest to 1,000 mm near Quebec City.
Vegetation: Its mixed forest is characterized by stands of white spruce, balsam fir, paper birch, aspen, and, in some cases, pure stands of trembling aspen. Black spruce and balsam fir occur on wet, poorly drained sites, whereas strips of tamarack are found on colder, wet sites. Warmer areas along Lake Superior contain sugar and red maple, yellow birch, whereas white, red, and jack pine occur on drier terrain.
Hydrology: Numerous lakes and ponds occur here. Drainage networks are of moderate to high density, and generally flow southwards to the St. Lawrence River.
Terrain: The region is situated on the Canadian Shield, where outcroppings and morainal deposit cover the land surface. Relief is commonly about 300–600 masl, with scattered summits reaching 900 to 1,200 masl. Humo-Ferric Podzols are the dominant soils, and there are also inclusions are Ferro-Humic Podzols, Dystric Brunisols. Mesisols are the main organic soil types; some Gray Luvisols occur.
Wildlife: Includes moose, black bear, lynx, snowshoe hare, wolf, coyote, white-tailed deer, and chipmunk. Bird species include the American black duck, wood duck, hooded merganser, pileated woodpecker and cardinal.
Land Use/Human Activities: The major land use activities include forestry, mining, hydroelectric power generation, recreation and tourism. Hunting, trapping, and low-intensity farming (with agricultural use comprising less than two percent of the ecoregion) are other land use activities. Major communities include Gatineau, Maniwaki, Saint-Jérôme, Témiscaming, Wawa, Chapleau, Kirkland Lake, Sault Ste. Marie, Shawinigan, Elliot Bay, and Sudbury.

5.3 Atlantic Highlands

*5.3.1 Northern Appalachians and Atlantic Maritime Highlands

Location: The ecoregion covers most of the northern and mountainous parts of New England, the Appalachians of Quebec, the uplands of Nova Scotia, as well as the Adirondacks and Catskill Mountains in New York State.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate, marked by warm summers and snowy, cold winters. The mean annual temperature ranges from approximately 1°C to 8°C. The mean summer temperature is about 14.5°C and that of the winter is about -3°C. The frost-free period ranges from 100 to 180 days. The mean annual precipitation is around 1,200 mm, ranging from 850 to over 2,000 mm on high peaks.
Vegetation: Mostly mixed hardwood and spruce-fir forests. Forest vegetation is somewhat transitional between the boreal regions to the north and the broadleaf deciduous forests to the south. Typical forests include mixed hardwoods like sugar maple, beech, and yellow birch; mixed forests with hardwoods, hemlock, and white pine; and spruce-fir forests with balsam fir, red spruce, and birches. In swampy areas, black spruce, white spruce, red maple, black ash, and tamarack dominate.
Hydrology: Numerous perennial, high-gradient streams are found in the region, together with some larger rivers and many large to small glacial lakes. Many of the lakes and streams in the region are sensitive to acidic deposition originating from upwind industrial sources, particularly to the west.
Terrain: Hills and mountains with narrow valleys are common. Nearly all the region has been glaciated. A variety of metamorphic and igneous rocks occur, along with some areas of sedimentary materials. Soils are shallow and generally nutrient-poor. Typical soil types are Podzols and Inceptisols. Maximum elevations can reach up to 950 masl in Vermont.
Wildlife: Characteristic wildlife are moose, black bear, white-tailed deer, red fox, bobcat, lynx, snowshoe hare, porcupine, fisher, marten, racoon, beaver, rabbit, northern flying squirrel, osprey, red-tailed hawk, wild turkey, ruffed grouse, black-backed woodpecker, gray jay, common loon, and red-back salamander. Diverse types of shorebirds and seabirds are also abundant.

Land Use/Human Activities: This is a relatively sparsely populated region compared to adjacent regions. Recreation, tourism, and forestry are primary land uses. Farm-to-forest conversion began in the 19th century and continues today, producing dairy products, forage crops, apples, blueberries, potatoes, and maple syrup. In addition to the timber industry, recreational homes and associated lodging and services sustain the forested regions economically, but they also create development pressure that threatens to change the pastoral character of the region. River and marine fisheries are also another important economic activity. Major communities include Sherbrooke, Thetford Mines, Rimouski, Matane, Murdochville, Gaspé, Canso, Lunenburg, Liverpool, Bridgewater, Sydney, Montpelier, Rutland, Keene, and Pittsfield.

5.3.3 North Central Appalachians

Location: Northern Pennsylvania and southern New York are the site of this region.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate, marked by warm summers and snowy, cold winters. The mean annual temperature ranges from approximately 3°C to 8°C. The frost-free period ranges from 120 to 160 days. The mean annual precipitation is 1,082 mm, ranging between 840 mm and 1,270 mm.
Vegetation: More forest-covered than most adjacent ecoregions, this region has considerable variety in its tree species, with northern hardwood forests of sugar maple, beech, and yellow birch, and Appalachian oak forests with white oak, red oak, and hickory species. Some areas with hemlock, pitch pine, and white pine occur. Some bogs and marshes are also present.
Hydrology: Many moderate-to-high gradient perennial streams are found in the region. Some areas have numerous lakes.
Terrain: The area is part of a vast, elevated plateau composed of horizontally bedded sandstone, shale, siltstone, conglomerate, and coal. It consists of plateau surfaces, high hills, and low mountains that, unlike the ecoregions to the north and west, was largely unaffected by continental glaciation. Only small portions of the ecoregion have been glaciated, and those only by the southern extremity of the glaciers. Soils are mostly Inceptisols, generally low in nutrients, with a frigid soil temperature regime and udic soil moisture regime.
Wildlife: The region features black bear, white-tailed deer, bobcat, coyote, beaver, red fox, gray fox, raccoon, gray squirrel, mink, river otter, snowshoe hare, red-shouldered hawk, saw-whet owl, northern goshawk, wild turkey, ruffed grouse, warblers, gray tree frog.
Land Use/Human Activities: Land use activities are generally tied to forestry and recreation, but some coal, oil, and gas extraction occurs in the west. The region includes some national and state public forestland. Dairy farming occurs but vacation and suburban developments are increasing. Larger towns include Bradford, Warren, St. Marys, Oil City, Franklin, and Monticello.

5.4 Boreal Plains

5.4.1 Mid-Boreal Uplands and Peace-Wabaska Lowlands

Location: This ecoregioin extends from the Peace River area in British Columbia southeasterly to the inter-lakes region of Manitoba.
Climate: The climate has predominantly short, cool summers and cold winters. The mean annual temperature ranges from -1°C to 1°C. The mean summer temperature ranges from 13°C to 15.5°C and the mean winter temperature ranges from -13.5°C to -16°C. The mean annual precipitation ranges from 350 to 550 mm.
Vegetation: The region forms part of the continuous, mid-boreal mixed coniferous and deciduous forest extending from Ontario to the Rocky Mountains. Medium to tall, closed stands of trembling aspen and balsam poplar with white and black spruce, and balsam fir occurring in late successional stages, are most abundant. Deciduous stands have a diverse understory of shrubs and herbs; coniferous stands tend to promote feathermoss. Cold and poorly drained fens and bogs are covered with tamarack and black spruce.

Hydrology: Moderate density streams and rivers flow mainly in a northerly direction. Several lakes and ponds are present.
Terrain: Landforms consist mainly of uplands covered entirely by moraine and lacustrine deposits. Elevations range from 400 to over 800 masl. The dominant soils are well-drained Gray Luvisolic soils. Significant inclusions are peaty-phase Gleysols and Mesisols that occupy poorly drained depressions, and Dystric Brunisols on drier sites.
Wildlife: Wildlife includes moose, white-tailed deer, elk, black bear, timber wolf, coyote, lynx, snowshoe hare, cottontail, beaver, and muskrat. Bird species include common loon, red-tailed hawk, waterfowl, and neotropical migrants.
Land Use/Human Activities: The main land use activities are pulpwood and local sawlog operations, water-oriented recreation, hunting, trapping, and fishing. Agricultural activities are significant in southern parts of the region, particularly in Saskatchewan and Manitoba. Some oil and gas explorations are also present. Major communities include Athabasca, Meadow Lake, Lac la Biche, Fort Assiniboine, Trout Lake, Peerless Lake, La Loche, Buffalo Narrows, and Île-à-la Crosse.

5.4.2 Clear Hills and Western Alberta Uplands

Location: This ecoregion extends over two separate areas in west and central margins of Alberta and in parts lying across the British Columbia/Alberta border.
Climate: The mean annual temperature ranges from -0.5°C in the north to 2°C in the south. The mean summer temperature is 12.5°C; and the mean winter temperature ranges from -17.5°C in the north to -8.5°C in the south. The mean annual precipitation is approximately 400–600 mm.
Vegetation: This region represents a transition between boreal and cordilleran vegetation which occurs on the lower slopes of the Rocky Mountains and the western edge of the Alberta Plain. The forest has a mixture of lodgepole pine, trembling aspen, and white spruce with balsam poplar, paper birch, and balsam fir. Aspen and open stands of lodgepole pine occur on drier sites; black spruce and tamarack are associated with wet sites. Conifers are more prevalent on cooler, higher elevations in the foothills, whereas aspen is more dominant in its lower plains.
Hydrology: The ecoregion generally slopes and drains east and northwards via the upper reaches of the Peace, Saskatchewan, and Athabasca river systems.
Terrain: Elevations range from 550 to 1,500 masl. These rolling uplands with local relief of 100–200 m are covered by glacial morainal, and some peat and lacustrine deposits in lower areas and depressions. Northern regions may have over 50 percent of the area covered with organic soils. Permafrost is limited to isolated patches along the northern boundary of the region. Well-drained Gray Luvisolic soils are dominant in the region. Inclusions of peaty-phase Gleysols and organic Mesisols occur in wetter sites.
Wildlife: Wildlife includes moose, deer, elk, caribou, black bear, beaver, muskrat, mink, wolf, snowshoe hare, waterfowl, sandhill crane, ruffed and spruce grouse, and other birds.
Land Use/Human Activities: Land use activities include commercial pulpwood and sawlog forestry, water-oriented recreation, oil and gas exploration, and wildlife trapping and hunting. Some agriculture is also practiced in the region, mainly for forage and seasonal grain production. Major communities include Hinton, Edson, Nordegg, and Swan Hills.

5.4.3 Mid-Boreal Lowland and Interlake Plain

Location: This ecoregion extends northwestwards from the area just north of Winnipeg, Manitoba, to areas around Cumberland House in Saskatchewan.
Climate: The climate features warm summers and cold winters. The mean annual temperature is approximately 1°C. The mean summer temperature is 15.5°C and the mean winter temperature is -14.5°C. The mean annual precipitation ranges from 425 mm in the northwest to 575 mm in the southeast.
Vegetation: There is a mosaic of farmlands and forests. Native vegetation consists of tall to low trembling aspen stands with some balsam poplar, an understory of tall shrubs, and a ground cover of mixed herbs.

White spruce and balsam fir are the climax species but are not well represented. Open stands of tall jack pine occur on dry, sandy sites. Depressions are water-filled or are covered with sedges, willow, some black spruce, and tamarack.
Hydrology: The area is associated with Lake Winnipeg, Cedar Lake, and Lake Winnipegoisis and many other small lakes. The North Saskatchewan River is the main drainage network.
Terrain: The area is comprised of rolling to flat lowlands that are mantled by glacial moraine and lacustrine deposits. Luvisolic, Gleysolic, organic Mesisols and Dark Gray Chernozems are associated with the region.
Wildlife: The area provides habitat for white-tailed deer, black bear, moose, beaver, coyote, snowshoe hare, and eastern cottontail, as well as for waterfowl and colonial water birds like cormorant, gull, tern, heron, American white pelican, and grebe.
Land Use/Human Activities: Nearly 40 percent of the ecoregion is farmland. The main crops are spring wheat, other cereal grains, oilseeds, and hay. Major communities include Swan River, Gypsumville, Winnipegosis, The Pas, Steinbach, and Selkirk.

6.0 Northwestern Forested Mountains

6.1 Boreal Cordillera

*6.1.1 Interior Highlands and Klondike Plateau

Location: This ecoregion runs from just east of Fairbanks, Alaska, southeast across the international border into Yukon, Canada.
Climate: A continental subarctic climate prevails there, marked by short, warm summers and long, cold winters. The mean annual temperature for the area is approximately -6°C, with a summer mean of 10.5°C and -23°C for winter. The frost-free period ranges from 20 to 70 days. The western part of the region is generally moister; there, mean annual precipitation ranges from about 300 to 900 mm on the higher Alaskan peaks.
Vegetation: The highlands sustain primarily dwarf scrub vegetation, willow, and open spruce stands, although graminoid herbaceous communities occur in poorly drained areas. The highest elevations are mostly barren. Black spruce and paper birch prevail on slopes underlain by permafrost. Balsam poplar occurs in the floodplains. Vegetation is dominated by white spruce, birch and aspen on south-facing slopes, black spruce on north-facing slopes, and black spruce woodlands, tussock and scrub bogs in valley bottoms. Above treeline, low birch, ericaceous shrubs and *Dryas*-lichen tundra dominate. This region has one of the highest incidences of lightning strikes in Alaska and the Yukon, and wildfires are common.
Hydrology: Major drainage networks are associated with the Yukon River, which flows easterly in the upper reaches and then northwest along the main channel. There are some lakes and wetlands in broad valleys.
Terrain: A combination of steep rounded ridges, low mountains often surmounted by rugged peaks, some rolling plateaus, and incised valleys typify the region. Elevations are typically around 500 masl in the valleys, while mountains in most parts of this region rise to at least 1,200 masl and some up to 2,100 masl in Canada. Most of the higher peaks were glaciated during the Pleistocene. Geology is mostly Paleozoic and Precambrian metamorphic rocks, felsic volcanic rocks, and intrusive rocks with sedimentary rocks occurring in some areas. Bedrock is often exposed. Permafrost is extensive but discontinuous and with low ice content. Turbic Cryosols are found in colder areas and Eutric Brunisols in warmer sites. Some Regosols occur on the floodplains.
Wildlife: Characteristic wildlife includes caribou, grizzly and black bear, Dall's sheep, moose, beaver, fox, wolf, lynx, snowshoe hare, raven, rock and willow ptarmigan, peregrin falcon, golden eagle, arctic grayling, chinook, chum, and coho salmon.
Land Use/Human Activities: Land uses nclude wilderness recreation, tourism, hunting, trapping, fishing, and mining for coal and uranium. Major communities include Dawson, Beaver Creek, and Chicken.

6.1.2 Alaska Range

Location: This ecoregion spans a wide area of south central Alaska.
Climate: The Alaska Range has a subarctic continental climatic regime but because of the extreme height of many of its ridges and peaks, annual precipitation at higher elevations is similar to that measured for some ecoregions having a maritime climate. It is marked by cool summers and cold winters. The mean annual temperature ranges from approximately -6°C to 1°C. The mean annual precipitation ranges widely, from about 350 mm in lowlands to over 3,000 mm on high peaks in the western areas.
Vegetation: Much of the area is barren of vegetation. Dwarf scrub communities are common at higher elevations and on windswept sites where vegetation does exist. Mountain avens and ericaceous species are typical. Shrub communities of willow, birch, and alder occupy lower slopes and valley bottoms. Forests are rare and relegated to the low-elevation drainages, and contain white and black spruce.
Hydrology: Ice fields and glaciers are common. Streams are high gradient, often braided, carrying heavy glacial sediment loads. There ae some large lakes in glaciated valleys in the south, and a few rock-basin lakes or small ponds in ground moraine areas in the central and eastern part.
Terrain: High and steep mountains, with rocky slopes, ice fields, and glaciers. Elevations range from sea level to over 6,100 masl. The mountains have a complex mix of folded, faulted, deformed metamorphic rocks, along with some granitic batholiths. Large, active volcanoes occur in the region. Discontinuous permafrost underlies shallow and rocky soils.
Wildlife: Wildlife of the region includes brown bear, gray wolves, wolverines, caribou, and moose. Dall sheep and pikas are present on middle and upper slopes. Salmon run in the streams.
Land Use/Human Activities: Recreation, subsistence hunting and fishing, as well as mineral and energy-related mining are the primary activities. Some small but important towns include Talkeetna, Willow, and Cantwell.

6.1.3 Copper Plateau

Location: Nestled between the Alaska Range, Wrangell Mountains, and Pacific Coastal Mountains in south central Alaska is the Copper Plateau.
Climate: The ecoregion has a subarctic continental climate, with cool summers and cold winters. Surrounded by mountains, the region is a cold-air sink with very cold winter temperatures. The mean annual temperature is approximately -2°C and the mean annual precipitation ranges from 250 to 460 mm.
Vegetation: Black spruce forests and tall scrub, interspersed with wetlands, are the major types of vegetation communities. Black cottonwood, willow, and alder line rivers and streams.
Hydrology: Poorly defined drainage patterns are the norm. Streams and rivers mostly originate in surrounding mountainous ecoregions with spring floods being common along drainages. The region has many thaw lakes, ponds, and wetlands.
Terrain: This nearly level to rolling plain occupies the site of a large lake, Glacial Lake Ahtna, that existed during glacial times. Elevations range from 420 to 900 m. Fine-textured lacustrine deposits are ringed by coarse glacial tills. Soils are predominantly silty or clayey, formed from the glaciolacustrine sediments. Much of the region has a shallow permafrost table, and soils are poorly drained.
Wildlife: Wildlife includes black and brown bears, caribou, moose, wolverines, beaver, ruffed grouse, arctic grayling, burbot, and sockeye salmon.
Land Use/Human Activities: A few small settlements are present. The main activities are subsistence hunting and fishing. Some mining also occurs.

*6.1.4 Wrangell and St. Elias Mountains

Location: This region extends over most of the St. Elias Mountains in southwestern Yukon and the Wrangell Mountains in southeastern Alaska.
Climate: The mean annual temperature decreases with elevation, but for major valley bottoms it is approximately -6°C to -1°C, with a summer mean of 9.5°C and a winter mean of -14°C. The area has a

mostly dry continental climate, although the height of the Wrangell Mountains allows interception of moist air from the North Pacific Ocean. Mean annual precipitation patterns range from 300 mm at low elevations, increasing with elevation and moving west, to over 2,000 mm in the ice fields. Summers are short and winters cold.
Vegetation: The area is a combination of permanent ice and snowfields with smaller areas of rock outcrops, rubbly colluvium, and alpine tundra. The alpine tundra vegetation is composed of low-growing heather, dwarf birch, willow with scattered white spruce, alder, as well as herbs and lichens. Wet sites in the vegetated areas support cottongrass and sedge.
Hydrology: Moderate to low-density stream and river networks exist. Streams have a high-gradient flowing mainly in a northerly direction into the Yukon and Tanana river systems. Ice fields and glaciers are abundant; only a few lakes are present.
Terrain: Landforms include very steep, rugged mountains of volcanic origin that are extensively covered by ice fields and glaciers. The mountainous setting has some of the highest peaks in North America, ranging upward to 6,000 masl. The high-relief, highly dynamic topography has been exposed to active volcanism, avalanches, landslides, stream erosion, and glacial scouring. Thin and rocky soils have developed in the colluvial veneer that covers most surfaces. Permafrost is mostly discontinuous, and frost action features occur such as solifluction lobes, ice-wedge networks, and patterned ground. Eutric Brunisols are the most common soil types.
Wildlife: The area is largely a barren habitat for wildlife but some caribou, moose, grizzly bear, Dall's sheep, mountain goat, gray wolves, and wolverines can be observed.
Land Use/Human Activities: Much of the area consists of protected areas, including Kluane National Park Reserve, Kluane Game Preserve, and Tatshenshini-Alsek Wilderness Park. Land uses are dominated by recreational activities, including hiking, mountain climbing, river rafting and kayaking, fishing, and hunting. Mineral mining is also an important activity for the region. There are only a few permanent settlements.

6.1.5 Watson Highlands

Location: This region extends from west of Dawson in the Yukon southeast into northeastern British Columbia.
Climate: The mean annual temperature for the area is approximately -3.5°C, with a summer mean of 10.5°C and a winter mean of -19.5°C. Mean annual precipitation ranges from 225 to 1,000 mm, varying with elevation.
Vegetation: White spruce, in a matrix of dwarf willow, birch, ericaceous shrubs, and, occasionally, lodgepole pine, forms extensive open forests, particularly in the northwestern portion of the region. Black spruce, scrub willow, birch, and mosses are found on poorly drained sites. Alpine fir and lodgepole pine occur in higher subalpine sections, whereas alpine vegetation consists of mountain avens, dwarf willow, birch, ericaceous shrubs, graminoid species, and mosses.
Hydrology: This area forms some of the upper reaches of the Yukon and Liard river systems. Streams and rivers are of a moderate to low density. Some lakes and ponds exist.
Terrain: The terrain includes rolling uplands, small mountain groups, and nearly level tablelands dissected by valleys. Extensive discontinuous permafrost with medium ice content is widespread. Morainal and fluvioglacial materials mantle the landscape. The maximum elevation can reach up to 2,400 m. Respectively occurring from cooler to warmer sites, Dystric and Eutric Brunisols are dominant soil types. Some Turbic Cryosolic soils are found in higher elevations and cooler sites.
Wildlife: Includes caribou, grizzly and black bear, Dall's sheep, moose, beaver, fox, wolf, hare, raven, rock and willow ptarmigan, and golden eagle.
Land Use/Human Activities: Land uses reflect mining, recreation, hunting, and trapping values. Major communities in the area are Keno Hill, Mayo, Watson Lake, Ross River Whitehorse, and Teslin.

6.1.6 Yukon-Stikine Highlands/Boreal Mountains and Plateaus

Location: This region covers northwestern British Columbia, starting in the east with the footslopes of the Rockies and extending westwards to almost the border with Alaska.
Climate: Temperature and precipitation vary with elevation. The climate tends to be more moderate in the western half and more continental to the east. The typical mean annual temperatures range from -0.5°C to -2°C, with summer means of 10°C to 11.5°C and winter means of -13°C to -15°C. The mean annual precipitation ranges from 400 to 700 mm in lower elevations and plateaus, and up to 800 mm at higher elevations.
Vegetation: The vegetation patterns are a complex layering of communities, consisting of dwarf shrubs such as willow and birch, alpine grasses, sedges, *Dryas spp*., lichens, and mountain avens on bare bedrock above tree line; willow and birch shrubs along with alpine fir and white spruce dominating subalpine forests; and closed canopied forests of lodgepole pine, and white and black spruce dominating the boreal forests at lower, warmer elevations.
Hydrology: Networks feeding the Liard, Stikine and Fraser River systems emanate from this region. Drainage networks are of moderate to low density.
Terrain: The area's terrain is composed of a complex of rugged mountains, high plateaus, and lowlands. Outcrops, colluvium, and moraine cover the surface. Permafrost with low ice content occurs sporadically in the northern portion of the region and is confined to isolated patches in the southwest. With elevation, soils differ going from Turbic Cryosolic and Regosolic types in the alpine to Humo-Ferric Podzols and Dystric Brunisolic with some Cryosolic, Organic, and Gleysolic soils in the subalpine, and to Gray Luvisolic and Dystric Brunisolic soils in warmer lows.
Wildlife: Representative wildlife includes mountain goat, Stone's sheep, grizzly and black bear, elk, moose, ptarmigan, ground squirrel, wolf, wolverine, lynx, and caribou.
Land Use/Human Activities: Land uses include hunting, trapping, and recreation in alpine and subalpine regions to limited forestry and forage crop-based agriculture in the valleys. The main communities in the region are Atlin, Dease Lake, Carcross and Muncho Lake.

6.2 Western Cordillera

6.2.1 Skeena-Omineca-Central Canadian Rocky Mountains

Location: Covers the central section of the Rocky Mountains of central British Columbia.
Climate: The mean annual temperature for the area is approximately 1.5°C, with a summer mean of 11.5°C and a winter mean of -10°C. Mean annual precipitation ranges from 500 to 800 mm.
Vegetation: Vertically stratified complex of ecosystems range from sub boreal forests with trembling aspen, balsam poplar, paper birch, lodgepole pine, and black and white spruce; to extensive subalpine forests of Engelmann spruce, white spruce, and alpine fir. Alpine tundra vegetation consists of lowgrowing heather, heath, sedge, and mountain avens.
Hydrology: Low to moderate density stream and river networks prevail, flowing southeasterly as part of the upper Peace and Fraser watersheds.
Terrain: The Omineca Mountains form a complex belt of Palaeozoic and Mesozoic sedimentary and massive crystalline rocks. The Skeena Mountains composed of folded, Jurassic and Cretaceous sediments and volcanic strata, are similar in general elevation. Both ranges have peaks that reach about 2,400 to 2, 700 m. Permafrost occurs in isolated patches in the northwestern portion of the region. Gray Luvisolic, Dystric Brunisolic, and Podzolic soils have developed here.
Wildlife: Includes moose, woodland caribou, black and grizzly bear, beaver, wolf, red fox, marten, hare, and grouse in warmer, forested sections; and mountain goat on the more rugged subalpine and alpine sections.

Land Use/Human Activities: Land use ranges from forest harvesting in mountain and subalpine zones to mineral exploration, hunting, recreation, and tourism activities throughout the entire ecoregion. Main communities are Germansen Landing, Prince George, Fort St. James, Quesnel, and Mackenzie.

6.2.2 Chilcotin Ranges and Fraser Plateau

Location: This ecoregion extends over the interior foothills of the Coast Mountains of central British Columbia, from François Lake in the northwest to Bonaparte Lake in the southeast.
Climate: The mean annual temperature for the area is approximately 3°C, with a summer mean of 12.5°C and a winter mean of -7°C. Mean annual precipitation ranges from 250 to 600 mm, higher precipitation occurs at higher altitudes.
Vegetation: Vegetation is dominated by white spruce, lodgepole pine, trembling aspen, and Douglas fir forests. Opengrowing lodgepole pine and Douglas fir occur on drier mid-elevation sites. Engelmann spruce and alpine fir are found at subalpine elevations, usually above 1,250 masl. In addition, bunchgrass-dominated grasslands occur at valley bottom elevations along the Fraser and Chilcotin rivers.
Hydrology: Low to moderate density stream and river networks prevail. Rivers flow in an easterly direction, as part of the upper Fraser River watershed.
Terrain: This broad, rolling plateau generally lies between 1,150 and 1,800 masl. Surface deposits include moraine and some compound eskers, and areas of glacial lake deposits. Numerous depressions in the landscape are occupied by organic soils. Gray Luvisolic and Dystric Brunisolic are dominant soils. Dark Gray to Brown Chernozemic soils occur on warmer and more restricted valley sites.
Wildlife: Wildlife includes California bighorn sheep, moose, mule deer, caribou, wolf, coyote, black bear, blue and sharptailed grouse, waterfowl, and sandhill crane.
Land Use/Human Activities: Forestry and ranching are the main land uses, along with outdoor recreation including hunting and fishing. About five percent of the ecoregion is farmland. Major communities include Williams Lake, Anahim Lake, Smithers, Vanderhoof, and 100 Mile House.

*6.2.3 Columbia Mountains/Northern Rockies

Location: This topographically interesting region covers the “Interior Wet Belt” of British Columbia, from the Cariboo Mountains in the north, the Columbia Mountains, Selkirk Mountains, and the Northern Rocky Mountains of eastern Washington, northern Idaho, and northwest Montana.
Climate: The ecoregion has a severe, mid-latitude climate, more humid to the north. It is marked by relatively dry, warm summers and cold, snowy winters. The mean annual temperature varies from north to south but an average ranges from 0°C to 9°C; the mean summer temperature is 15°C; and the mean winter temperature is -4°C. Mean annual precipitation is 1,200 mm, with ranges of 400 mm in low, drier valleys to over 2,000 mm on high mountains that capture Pacific moisture. The frost-free period lasts about 30 to 160 days.
Vegetation: Forests here have some maritime influence. Pacific indicators species such as western hemlock, western red cedar, mountain hemlock, and grand fir occur, and are more numerous than in Ecoregions 6.2.4, 6.2.10, and 6.2.15. Douglas fir, alpine and subalpine fir, Englemann spruce, western larch, western white pine, lodgepole pine, and ponderosa pine are also typical.
Hydrology: Low to moderate density networks of streams and rivers flow in a southerly direction and largely feed the Columbia River watershed. Some areas of small glacial lakes, and lower elevation large lakes or reservoirs are also present.
Terrain: Rugged topography characterizes this region, with high and low mountains, narrow valleys and deep canyons. Some high peaks are over 3,000 masl. There is a considerable variety of ages and types of igneous and metamorphic rocks, and some folded sedimentary strata. Inceptisols, Andisols, and Alfisols soils are common. Soil temperature regimes include mesic, frigid and cryic. Soil moisture regimes are typically xeric or udic. Soils are mainly developed on colluvial and morainal deposits.
Wildlife: Characteristic wildlife includes grizzly and black bear, woodland caribou, mountain goat, grouse, and waterfowl, mule and white-tailed deer, American elk (wapiti), moose, bobcat, cougar,

snowshoe hare, grouse, osprey, bald eagle, boreal owl, Stellar's jay, gray jay, common raven, mountain bluebird, spotted frog, Pacific tree frog, trout and salmon.
Land Use/Human Activities: Common land uses for this ecoregion are forestry, mountain recreation, tourism, mining, hydroelectric power production, and localized agriculture and livestock grazing. Several areas exist as national forests, provincial or national parks, or tribal land. Some of the main communities are Revelstoke, Nelson, Blue River, Wells, Creston, Spokane, Polson, Colville and Sandpoint.

*6.2.4 Canadian Rockies

Location: Starting near Prince George, the area covers the Rocky Mountains of Alberta and British Columbia and extends southwards to regions around Missoula in Montana.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate with more subarctic climates at high elevations. The mean annual temperature for the region varies from north the south. A typical value for the mean annual temperature for major valley systems is approximately 2.5°C. Mean summer temperature is 12°C and the winter mean is -7.5°C. The mean annual precipitation ranges 500 to more than 2,500 mm, increasing with elevation. Climatic conditions in the major valleys are marked by warm, dry summers and mild, snowy winters. Subalpine summers are cool, showery, and prone to early frosts.
Vegetation: Vegetation is predominantly composed of subalpine and alpine ecosystems, characterized by mixed forests of lodgepole pine, Engelmann spruce, and alpine fir. In addition, stands of Douglas fir intermixed with trembling aspen and grassland ecosystems occur on the warmest, driest sites in the major valley systems of the Bow, Saskatchewan, and Athabasca rivers. At upper elevations, usually between 1,600 and 2,100 masl, open stands of alpine fir are found. Limber pine can be found there on rock outcrops. The alpine vegetation is characterized by lowgrowing heather with sedges and mountain avens occurring on warmer sites.
Hydrology: Low to moderate density networks of streams and rivers flow in various directions and feed the Fraser, Saskatchewan and Athabasca watersheds.
Terrain: The mountain ranges are linear with steep and precipitous faces. Elevations generally reach from 2,200 to 3,500 masl. Rocky outcrops characterize most peaks and ridges in the region and the slopes are mantled with colluvium and moraine. Isolated patches of permafrost occur at higher elevations. Regosolic, Eutric Brunisolic and some Podzolic soils have developed in the lower elevations. Dystric Brunisols are more common in the alpine areas.
Wildlife: Wildlife includes elk, bighorn sheep, mule deer, moose, elk, caribou, wolf, grizzly and black bear, mountain goat, cougar, marten, lynx, bobcat, wolverine, white-tailed deer, snowshoe hare, and boreal owl.
Land Use/Human Activities: Most of the region falls within national parks where tourism, recreation, and wildlife habitat are the major land uses. Outside of the park boundaries, big game hunting, some forestry, and resource exploration take place. The main communities are Jasper, Banff, and Lake Louise.

*6.2.5 North Cascades

Location: This region encompasses the northern end of the Cascade Range in northwest Washington State and southern British Columbia. It also includes a disjunct area enclosing the high Olympic Mountains to the west of the Puget Lowland (7.1.7).
Climate: It has a variety of climatic zones. A dry continental climate occurs in the east, while mild, maritime, rainforest conditions are found in the west. Marked by dry warm summers and mild to cold wet winters. High elevations receive abundant snowfall. The mean annual temperature varies from approximately 0°C at high elevations to 9°C in low western valleys; the mean summer temperature is 16°C and that of the winter is -1°C. The frost-free period ranges from 40 to 200 days. The mean annual precipitation is 1,761 mm, and ranges from 300 mm in the lower east, to more than 6,000 mm on the High Olympics in the west.

Vegetation: Lower western forests are composed of western hemlock, western red cedar, and Douglas fir. Subalpine forests include Engelmann spruce, subalpine fir, and lodgepole pine. Ponderosa pine, Douglas fir, and some pine grass parklands can be found in the east.
Hydrology: There is a high density of high-gradient, perennial streams. Numerous glacial lakes and some reservoirs are also present.
Terrain: The region's terrain is mostly high, rugged mountains and glaciated peaks with some U-shaped valleys. It contains the greatest concentration of active alpine glaciers in the conterminous United States. Topography is underlain by sedimentary and metamorphic rock, in contrast to the adjoining Cascades (6.2.7), which are composed of volcanics. Andisols, Inceptisols, and Spodosols soil types are common, with mesic, frigid, and cryic soil temperature regimes and xeric or udic soil moisture regimes.
Wildlife: The region's wildlife features black bear, bighorn sheep, mountain goat, black-tailed deer, mule deer, cougar, coyote, bobcat, beaver, fisher marten, osprey, bald eagle, grouse, pileated woodpecker, mountain chickadee, salmon, and steelhead.
Land Use/Human Activities: The principal land uses are recreation, tourism, forestry, woodland grazing, and water diversions for lower, drier adjacent ecoregions. Much of the region is in public national forest and wilderness land or provincial and national parks. Larger settlements include Keremeos, Hedley, Concrete, Rockport, Winthrop, Twisp, and Leavenworth.

6.2.6 Cypress Uplands

Location: This ecoregion spans an area in southeastern Alberta and in southwestern Saskatchewan.
Climate: The climate here is cooler and moister than that of the surrounding Northwestern Glaciated Plains ecoregion [9.3.1]. The mean annual temperature is approximately 3°C with a mean summer temperature of 15°C and a mean winter temperature of -9°C. The mean annual precipitation ranges from 325 to 450 mm.
Vegetation: This upland in the prairies is an outlier of the montane vegetative zone that occurs to the west. Mixed montane-type open forests of lodgepole pine, deciduous trees, and shrubs occur largely above 1,000 masl. Numerous species here, including larkspur, death camas, and wild lupine, are not found elsewhere on the prairies. At lower elevations, fescue and wheatgrass grasslands merge into the prairie setting.
Hydrology: The deeply incised Frenchman River and Battle and Swift Current creeks drain this region.
Terrain: The Cypress Hills, rising abruptly 400-500 m above the surrounding plains, are covered in part by glacial moraine, or Aeolian deposits on unglaciated upper plateau sections. The Cypress Hills slope eastwards from a maximum elevation of 1,465 masl at the west side. Luvisolic soils dominate the forested areas. Black and Dark Brown Chernozemic soils are more dominant in warmer and lower elevations.
Wildlife: Characteristic wildlife includes mule and white-tailed deer, pronghorn antelope, sage grouse, short-horned lizard, western diamondback rattlesnake, coyote, rabbit, and ground squirrel. Audubon's warbler is a unique bird, which is not found elsewhere on the prairies.
Land Use/Human Activities: Physical conditions allow free-range livestock grazing and limited production of cereals on smoother lower slopes. Wildlife hunting and recreation are also important uses on rougher upper slopes. Towns are rather dispersed in this small ecoregion; some of them include Walsh, Mapple Creek, and Cummings.

6.2.7 Cascades

Location: The region stretches from west-central Washington State through the spine of Oregon, and includes a disjunct area around Mt. Shasta in northern California.
Climate: The ecoregion has a mild to severe, mid-latitude climate, varying by elevation, with mostly dry, warm summers and relatively mild to cool, very wet winters. The mean annual temperature ranges from approximately -1°C to 11°C. The frost-free period ranges widely from 5 to 180 days, depending on elevation and latitude. The mean annual precipitation is 1,824 mm, ranging from 1,150 to 3,600 mm.
Vegetation: Vegetation in the region consists of extensive and highly productive coniferous forests. At lower elevations, Douglas fir, western hemlock, western red cedar, big leaf maple, red alder. At higher

elevations, Pacific silver fir, mountain hemlock, subalpine fir, noble fir, lodgepole pine. To the south, Shasta red fir, white fir. Subalpine meadows and rocky alpine zones occur at highest elevations.
Hydrology: Many intermittent and perennial streams participate in a dense drainage network; there are many alpine lakes, and some large reservoirs at lower elevations. Water quality is high.
Terrain: This mountainous ecoregion is underlain by Cenozoic volcanics and has been affected by alpine glaciations. It is characterized by steep ridges and river valleys in the west, a high plateau in the east, and both active and dormant volcanoes. Elevations range from about 250 masl upwards to 4,390 masl. Soils are mostly cryic and frigid temperature regimes, with some mesic at low elevations and in the south. Andisols and Inceptisols are common.
Wildlife: Roosevelt elk, black-tailed deer, black bear, mountain goats in the north, cougar, coyote, beaver, river otter, mountain quail, pileated woodpecker, northern goshawk, mountain chickadee, northern spotted owl, chinook salmon, steelhead trout, and bull trout are noteable species in the region.
Land Use/Human Activities: Principal land uses involve forestry, recreation, water supply for urban and agricultural areas in adjacent lowland ecoregions, and a few areas of ranching and livestock grazing. Large areas are in public lands (national forests, national parks) and population density is relatively low. No cities occur in the region. Larger towns include Stevenson, Cascade Locks, and Oakridge.

6.2.8 Eastern Cascades Slopes and Foothills

Location: The ecoregion is in the rainshadow of the Cascades ecoregion (6.2.7), stretching from central Washington to northern California.
Climate: A more continental climate prevails here than in ecoregions to the west, with greater temperature extremes and less precipitation. It has warm, dry summers and cold winters. The mean annual temperature ranges from 2°C to 11°C, varying greatly due to elevation and latitude. The frost-free period ranges from 10 to 140 days. The mean annual precipitation is 649 mm, but ranges from 500 to over 3,500 mm on high peaks.
Vegetation: Open forests of ponderosa pine and some lodgepole pine distinguish this region from the higher ecoregions to the west where fir and hemlock forests are common and lower dryer regions to the east where shrubs and grasslands are predominant. The vegetation is adapted to the prevailing dry continental climate and is highly susceptible to wildfire. Higher elevations have Douglas fir and other fir species such as grand fir and white fir. The lowest elevations grade to sagebrush and steppe vegetation.
Hydrology: Stream densities are variable, generally higher in the north, but fewer streams in some of the pumice areas. High, medium, and low gradient streams occur. A few large lakes and reservoirs occur.
Terrain: Gently to steeply sloping mountains and high plateaus are principal landforms in the region. Volcanic cones and buttes are common; some young lava flows are also present. More glacial features are found in the north. Elevations range from 300 to over 2,500 masl. Geology is mostly Pleistocene, Pliocene, and Miocene basalt, andesite, and tuffaceous rock. Deposits of volcanic ash, pumice, and cinders are thick in some areas. Soils are mostly xeric Andisols and Mollisols and include mesic, frigid, and cryic temperature regimes.
Wildlife: Black bear, black-tailed and mule deer, cougar, wolverine, coyote, yellow bellied marmot, bald eagle, golden eagle, Cooper's hawk, osprey, coho, chinook, chum, and pink salmon, rainbow trout, bull trout are some of the wildlife prominent in this region.
Land Use/Human Activities: Land uses here include forestry, recreation, hunting and fishing, livestock grazing. Much of the region is in national forest or other public land. Some tribal land is present. Larger cities include Hood River, Bend, Klamath Falls, Lakeview, and Alturas.

6.2.9 Blue Mountains

Location: This ecoregion is situated primarily in northeastern Oregon, with small areas extending into southeastern Washington and western Idaho.

Climate: The ecoregion has a severe, mid-latitude climate, with both continental and Mediterranean influences. It is marked by warm, dry summers and cold winters. The mean annual temperature ranges from approximately -1°C to 10°C. The frost-free period ranges from 30 to 160 days. As with temperature, the mean annual precipitation ranges widely depending upon elevation, ranging from about 220 mm in low valleys to over 2,050 mm at high elevations; 558 mm is the regional mean value.
Vegetation: At low elevations, grasslands of bluebunch wheatgrass, Idaho fescue, basin big sagebrush, mountain big sagebrush, and juniper woodlands are found. In forested areas, ponderosa pine, some Douglas fir, grand fir. At higher elevations, one sees subalpine fir, Engelmann spruce, whitebark pine, and lodgepole pine, with krummholz and alpine meadows in the alpine zone.
Hydrology: Perennial stream density varies by elevation, substrate and frequency of occurrence. Springs are scattered throughout the region. Alpine lakes are present in high elevation areas and there are a few large reservoirs. Large rivers that cross the region include the Deschutes and Snake.
Terrain: This ecoregion is distinguished from the neighboring Cascades (6.2.7) and Columbia Mountains/Northern Rockies (6.2.3) ecoregions because the Blue Mountains are generally not as high and are considerably more open. Like the Cascades, but unlike the Northern Rockies, the region is mostly volcanic in origin. Only the few higher ranges, particularly the Wallowa and Elkhorn Mountains, consist of intrusive rocks that rise above the dissected lava surface of the region. Elevations range from 305 masl to over 3,000 masl. Soil temperature regimes are mostly frigid, but include some mesic in warmer areas, and cryic at high elevations. Andisols and Mollisols are common, with mostly xeric and udic soil moisture regimes. Most soils are influenced by volcanic ash deposits.
Wildlife: Species include Rocky Mountain elk, mule deer, black-tailed deer, black bear, bighorn sheep, cougar, bobcat, coyote, beaver, racoon, golden eagle, chukar, sage thrasher, pileated woodpecker, nuthatches, chickadees, bluebirds, chinook and coho salmon, rainbow trout, bull trout, and brook trout.
Land Use/Human Activities: The main activities here are forestry and recreation. Unlike the bulk of the Cascades and Northern Rockies, much of this ecoregion is grazed by cattle. Some public lands exist. There are areas of irrigated agriculture for alfalfa and pasture, winter wheat, potatoes, mint, onions, garlic, and grass seed. Larger cities include Madras, Redmond, Prineville, La Grande, Baker City, and Enterprise.

6.2.10 Middle Rockies

Location: This ecoregion is located mostly in southwestern Montana, eastern Idaho, and northern Wyoming. It also includes the Black Hills in western South Dakota and northeastern Wyoming.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate that lacks the strong maritime influence prevailing in the Columbia Mountains/Northern Rockies (6.2.3). High elevations are more subarctic. The climate of the Middle Rockies lacks the strong maritime influence of the Columbia Mountains/Northern Rockies (6.2.3). Generally, it is marked by warm to cool summers and severe winters. The mean annual temperature varies greatly by elevation from approximately -5°C to 8°C. The frost-free period ranges from 25 to 140 days. The mean annual precipitation is 621 mm, ranging from 300 to over 2,500 mm.
Vegetation: Characteristic vegetation includes Douglas fir, lodgepole pine, aspen, subalpine fir, and Engelmann spruce forests. Forests can be open and Pacific tree species are never dominant. Alpine grasslands, meadows, and krummholz are also present. Ponderosa pine occurs in the Black Hills. Foothills are partly wooded or shrub- and grass-covered; intermontane valleys are grass- and/or shrub-covered.
Hydrology: Numerous high gradient perennial streams and rivers, small alpine glacial lakes, and some larger lakes are found here.
Terrain: The terrain consists of high alpine glaciated mountains, plateaus, and glacial and lacustrine intermontane basins. A variety of rock types and ages are found, including Quaternary and Tertiary volcanics, Mesozoic and Paleozoic sedimentary materials, and Precambrian metamorphic and igneous rocks. Granitics and associated management problems are less extensive than in the Idaho Batholith

region (6.2.15). Mollisols, Inceptisols, and Alfisols are common, with mostly cryic or frigid soil temperature regimes and udic and ustic soil moisture regimes.
Wildlife: Species in the region include black bear, moose, cougar, bobcat, mountain goat, mule deer, white-tailed deer, yellow-bellied marmot, northern flying squirrel, Cooper's hawk, golden eagle, Stellar's jay, trumpeter swan, mountain bluebird, blue grouse, Clark's nutcracker, and boreal toad.
Land Use/Human Activities: Recreation and tourism, forestry, mining, wildlife habitat, ranching and summer livestock grazing are common land uses. Some minor cropland is found in valleys, mostly planted to hay, alfalfa, and barley. Large areas are in public lands of national forests and national parks. Larger cities and towns include Missoula, Helena, Hamilton, Deer Lodge, Anaconda, Butte, Salmon, Dillon, Bozeman, Jackson, Deadwood, Custer, and Hot Springs.

6.2.11 Klamath Mountains

Location: This physically and biologically diverse ecoregion occurs between the Cascades (6.2.7) and the Coast Range (7.1.8) in northwestern California and southwestern Oregon.
Climate: The ecoregion has a mild, mid-latitude Mediterranean climate, marked by warm summers with a lengthy summer drought period, and mild winters. The mean annual temperature ranges from approximately 5°C at higher elevations to 14°C in valleys and in southern parts of the region. The frost-free period ranges from 90 days at high elevations to 240 days or more in lower, warmer areas. The mean annual precipitation is 1,438 mm, ranging from about 500 mm in low dry areas to over 3,000 mm on the wetter high mountains.
Vegetation: The region supports a vegetal mix of northern Californian and Pacific Northwest conifers and hardwoods. Mixed conifer forests feature Douglas fir, white fir, incense cedar, tanoak, Jeffrey pine, Shasta red fir, sugar pine, ponderosa pine, chinkapin, canyon live oak, and, in some lower areas, chaparral and western juniper. Oregon oak woodlands consist of Oregon white oak, madrone, California black oak, ponderosa pine, and grasslands.
Hydrology: There is a high density of moderate to high-gradient streams and rivers. Rivers are often deeply incised in canyons; most flow westward. Major rivers include the Umpqua, Rogue, Illinois, Klamath, Trinity, and Eel. Some glacial lakes are found at high elevations in the California portion of the region.
Terrain: Landforms are rugged, highly dissected and deeply dissected mountainous terrain with steep slopes. Along with the folded mountains, foothills, terraces, and floodplains also occur. Elevations range from about 120 m to over 2,600 masl. The region contains diverse and complex geology and soils. Paleozoic and Mesozoic marine sandstones and shales, granodiorite, gabbro, and other intrusive rocks, and volcanic rocks occur. Ultramafic parent material and soils with scattered areas of serpentinitic soils occur and influence vegetation patterns in some areas. Inceptisols and Alfisols are common, with mesic and frigid soil temperature regimes and xeric and some udic moisture regimes.
Wildlife: Black bear, Roosevelt elk, black-tailed deer, cougar, bobcat, coyote, river otter, beaver, California ground squirrel, peregrine falcon, osprey, red-tailed hawk, northern spotted owl, California quail, anadromous fish, numerous reptiles, various salamanders and other amphibians are to be found.
Land Use/Human Activities: Forestry, recreation and tourism, some ranching and grazing predominant, along with hay, pasture, and some truck farming in valleys. A few mining areas exist. There are also large areas of national forest land or other public land. Larger cities and towns include Roseburg, Grants Pass, Medford, Ashland, Yreka, and Weaverville.

6.2.12 Sierra Nevada

Location: The Sierra Nevadas are a high, north-south mountain range of eastern California with a small extension into far western Nevada near Lake Tahoe.
Climate: The ecoregion has a severe to mild, mid-latitude climate with Mediterranean characteristics. It has mild to hot, dry summers and cool to cold, wet winters. The mean annual temperature ranges from

approximately -3°C at high elevations to 17°C at low elevations on the southwest. The frost-free period ranges from 30 to 320 days. The mean annual precipitation is 1,070 mm, ranging from 150 mm in the eastern lowlands to over 2,500 mm on high elevation peaks.
Vegetation: The region contains very diverse temperate coniferous forests. The vegetation grades from chaparral and woodland to mostly ponderosa pine at the lower elevations on the west side, and lodgepole pine on the east side, to mixed conifer forests of ponderosa pine, sugar pine, Douglas fir, and white fir. Giant sequoias occur in some areas, the most massive trees on Earth. At higher elevations, white fir and red fir forests, and in the subalpine zone, lodgepole pine, Jeffrey pine, western white pine, limber pine, and aspen and spruce at the higher elevations. Alpine conditions prevail at the highest elevations.
Hydrology: Many high-gradient perennial streams and rivers, along with numerous alpine lakes and several reservoirs are found in the region. Rainfall and snowpack provide water for adjacent low elevation ecoregions.
Terrain: The Sierra Nevadas result from a deeply dissected block fault that rises sharply from the arid, basin and range ecoregions on the east and slopes gently toward the Central California Valley (11.1.2) to the west. It has hilly to steep mountain relief. The eastern portion of the range has been strongly glaciated and generally contains higher mountains than are found in the Klamath Mountains (6.2.11) to the northwest. Elevations range from about 400 m to 4,418 m on Mt. Whitney, the highest point in the lower 48 United States. The central and southern parts of the region are mostly underlain by granite, in comparison to the more typical sedimentary formations of the Klamath Mountains and volcanic rocks of the Cascades (6.2.7). There are some areas of metamorphic and volcanic rocks. Alfisols, Entisols, Inceptisols, Mollisols, and Ultisols occur. There are mesic, frigid, and cryic soil temperature regimes, and mostly xeric and udic soil moisture regimes.
Wildlife: Black bear, black-tailed deer, mule deer, Sierra Nevada bighorn sheep, cougar, coyote, bobcat, red fox, badger, ringtail, yellow-bellied marmot, crow, stellar jay, golden trout, Yosemite toad, and Kern salamander are among the region's wildlife.
Land Use/Human Activities: Activities and land uses include recreation and tourism, forestry, rural residential areas, some ranching, woodland grazing, and some mining. The higher elevations of this region are mostly public lands, with national forests, national monuments, and several national parks (Lassen, Yosemite, Kings Canyon, and Sequoia). Larger settlements include Susanville, Quincy, Nevada City, Grass Valley, Truckee, South Lake Tahoe, and Mammoth Lakes.

6.2.13 Wasatch and Uinta Mountains

Location: This region includes the Uinta Mountains, Wasatch Range, and Wasatch Plateau and stretches from southeastern Idaho and southwestern Wyoming through the length of Utah.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate. Winters can be severe, and summers warm to hot, with no pronounced dry season. The mean annual temperature ranges from approximately -2°C in the High Uintas to 8°C in low valleys. The frost-free period ranges from less than 40 days to nearly 200 days. The mean annual precipitation is 602 mm, ranging from 150 mm in dry valleys to more than 1,400 mm on the wettest high peaks. Some mountain peaks and canyons receive large amounts of powder snowfall. Avalanches are common in some northern areas.
Vegetation: The elevational banding pattern of vegetation is similar to that of the Southern Rockies (6.2.14) except that aspen, chaparral, and juniper-pinyon and oak are more common at middle elevations. There is much less lodgepole pine than in the Middle Rockies (6.2.10). In valleys, sagebrush, grasses, some pinyon and Utah juniper. Foothills have pinyon-juniper woodland, sagebrush, in the north some maple and Gambel oak scrub. Mid elevations have ponderosa pine at lower elevations, Douglas fir, aspen, subalpine fir, Englemann spruce, limber pine at higher elevations.
Hydrology: Many perennial and intermittent streams occur, along with glacial lakes and tarns at high elevations. Runoff from the deep snowpack is a major source of summer water for lower, more arid ecoregions (10.1.5, 10.1.6).
Terrain: Composed of a core area of high, precipitous mountains with narrow crests and valleys flanked in some areas by dissected plateaus and open high mountains. In the south, one finds rolling mountains

and thrust-faulted plateaus. The highest areas, particularly in the east-west trending Uinta Mountains, are extensively glaciated, with glacial features such as horns, arêtes, moraines, cirques, and U-shaped valleys. Elevations range from 1,460 to 4,123 masl. A complex mix of geology occurs, with Tertiary and Mesozoic sedimentary and igneous rocks and some Precambrian igneous and metamorphic rocks. Mollisols, Alfisols, and Inceptisols are typical soil orders with mesic, frigid, and cryic soil temperature regimes, and udic, aridic, and xeric soil moisture regimes.
Wildlife: Black bear, elk, cougar, coyote, bobcat, red-tailed hawk, golden eagle, mountain bluebird, pinyon jay, cutthroat trout, Utah mountains kingsnake, Utah tiger salamander are encountered.
Land Use/Human Activities: Forestry, ranching and livestock grazing, and recreation, with increasing residential development are primary uses of the land. Some agriculture occurs in the lower valleys. Large areas are public national forest land. Larger towns include Morgan, Park City, Heber City, and Panquitch.

6.2.14 Southern Rockies

Location: This ecoregion occupies the portion of the Rocky Mountains extending from southern Wyoming, through Colorado, and into northern New Mexico. Two small outliers occur in eastern Utah.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate, with a subarctic climate at high elevations. The region has warm to cool summers and severe winters, with no pronounced dry season. The mean annual temperature is approximately -4°C at highest elevations to 11°C in warmer lowlands. The frost-free period ranges from 25 to 150 days. The mean annual precipitation is 588 mm, ranging from 255 mm in low dry areas to over 1,750 on the wetter high peaks. Deep snowpacks occur at high elevations.
Vegetation: Coniferous forests cover much of the region, with a pattern of elevational banding. The lowest elevations are generally grass or shrub covered, with sagebrush, mountain mahogany, pinyon pine, juniper, or scattered Gambel oak woodlands. Low to middle elevations are covered by a variety of vegetation types including juniper oak woodlands, ponderosa pine, Douglas fir, and aspen. Middle to high elevation forests of Englemann spruce, subalpine fir, aspen. The highest elevations have alpine low shrubs, cushion plants, sedges, and krummholz vegetation of stunted spruce, fir, and pine.
Hydrology: Many medium- and high-gradient perennial streams and rivers are found, with numerous alpine lakes and several reservoirs. Rainfall and snowpack provide water for adjacent lower elevation ecoregions.
Terrain: High elevation, steep rugged mountains, with both linear ranges and complex masses of peaks. Middle to high elevations have been glaciated, with some high intermontane valleys. Elevations range from 1,550 to over 4,390 masl. More than fifty peaks have elevations of over 4,270 m. The region is a complex geologic mix featuring Precambrian metasedimentary, metavolcanic, and intrusive rocks, Tertiary and Cretaceous sedimentary rocks, and Tertiary volcanic rocks. Alfisols, Entisols, and Mollisols are the primary soil orders, with mostly frigid and cryic soil temperature regimes and udic and ustic soil moisture regimes.
Wildlife: The region fauna includes elk, mule deer, Rocky Mountain bighorn sheep, wolverine, Canada lynx, cougar, yellow-bellied marmot, shoeshow hare, pika, golden eagle, Clark’s nutcracker, gray jay, mountain bluebird, cutthroat trout.
Land Use/Human Activities: Forestry, gold, copper, and silver mining, tourism and recreation, ranching and livestock grazing, rural residential areas are found there. Large areas are in public land as national forests, national parks, or national monuments. Larger towns include Steamboat Springs, Estes Park, Kremmling, Glenwood Springs, Breckenridge, Leadville, Aspen, Gunnison, Telluride, Pagosa Springs, Tierra Amarilla, Los Alamos, and Mora.

6.2.15 Idaho Batholith

Location: This region spans central Idaho and western Montana.
Climate: The ecoregion has a severe, mid-latitude, slightly continental climate. It is marked by somewhat dry, warm summers and cold winters. The mean annual temperature ranges from approximately -2°C at high elevations to 8°C in lower areas. The frost-free period ranges from 30 to 140 days. The mean annual precipitation is 883 mm, ranging from 205 to 1,525 mm. Maritime influence lessens toward the south and is never as strong as in the Northern Rockies (6.2.3).
Vegetation: Grand fir, Douglas fir and, at higher elevations, Engelmann spruce, and subalpine fir occur; ponderosa pine, sagebrush and other shrubs, and grasses grow in very deep canyons.
Hydrology: Many perennial streams originate here, and are mostly high gradient. Lakes occur in some areas.
Terrain: The landform of the region is mostly a dissected, partially glaciated, mountainous plateau with some deep, dissected canyons. Deeply weathered, acidic, intrusive igneous rock is common and is far more extensive than in the Columbia Mountains/Northern Rockies (6.2.3) or the Middle Rockies (6.2.10). Soils derived from granitics tend to be droughty and low in nutrients. They are sensitive to disturbance—especially when the stabilizing vegetation is removed. Inceptisols, Mollisols, and Andisols are typical and are mostly of frigid and cryic soil temperature regimes and xeric and udic soil moisture regimes.
Wildlife: Black bear, mule deer, white-tailed deer, cougar, bobcat, gray wolf, coyote, mountain grouse, Cooper's hawk, golden eagle, bald eagle, bull trout, cutthroat trout, and Chinook salmon are found in the region.
Land Use/Human Activities: Land uses include logging, grazing, recreation, and wildlife habitat. Mining and related damage to aquatic habitat is widespread. Larger towns include McCall, Stanley, Idaho City, and Ketchum.

7.0 Marine West Coast Forest

7.1 Marine West Coast Forest

7.1.1 Ahklun and Kilbuck Mountains

Location: This region is located in southwestern Alaska adjoining Bristol and Kuskokwim Bays.
Climate: The ecoregion has a moist subarctic climate, affected by both maritime and continental influences. It is marked by cool summers and cold winters. The mean annual temperature is approximately -1°C. The mean annual precipitation ranges from about 500 to over 2,000 mm on higher peaks.
Vegetation: Dwarf scrub communities are the predominant vegetation cover in the mountains. Tall scrub and graminoid herbaceous communities are common in valleys and on lower mountain slopes, with willows, birches, and alders. Valley bottoms may support stands of white spruce and hardwood species, and in wet areas some sedge-tussock tundra meadows. Wildfire occurrence is very low.
Hydrology: Shallow, mostly high-gradient streams, with radial drainage patterns are found, often, incised in bedrock gorges. The region also features a few long, narrow, deep glacial lakes in U-shaped valleys.
Terrain: The dominant terrain consists of steep, sharp, often ringlike groupings of rugged mountains separated by broad, flat valleys and lowlands. Elevations range from sea level to over 1,500 masl. The region is composed of strongly deformed sedimentary and volcanic rocks, the mountains were glaciated during the Pleistocene epoch, but only a few small glaciers persist. The glaciers carved many broad U-shaped valleys. Mountain soils formed in stony and gravelly colluvium over bedrock, while valley soils formed in glacial till. Permafrost is discontinuous.
Wildlife: Moose, brown bear, black bear, beavers, arctic hares, rainbow trout, sockeye, chum, king, and silver salmon, walruses, sea lions, blackpol warblers, seabirds, tundra swans, emperor geese, sandhill cranes are found.
Land Use/Human Activities: Small settlements are mostly located along the coastal margin. Principal activities include subsistence and recreational hunting and fishing, and mineral mining.

7.1.2 Alaska Peninsula Mountains

Location: This region is primarily a peninsula extending to the southwest from the mainland, dividing Bristol Bay from the North Pacific Ocean. It also includes a large portion of Kodiak Island.
Climate: A cool marine climate prevails, with moderate seasonal temperatures; fog and clouds are common. The mean annual temperature ranges from approximately 1°C to 4°C. There is abundant year-around precipitation, mean annual amounts ranging from about 600 mm in the lowlands to over 4,000 mm at highest elevations.
Vegetation: Dwarf scrub communities of alpine tundra occur at higher elevations and on sites exposed to the wind. Low scrub communities are at lower elevations and in more protected sites with willow, birch, and alder interspersed with ericaceous heath and *Dryas*-lichen communities.
Hydrology: The region features numerous glacially-fed streams, mostly of high-gradient. Along northern boundary, several large lakes have filled behind glacial end moraines.
Terrain: Rounded, folded and faulted sedimentary ridges are intermittently surmounted by volcanoes. Elevations range from sea level to over 2,600 masl. The mountains were heavily glaciated during the Pleistocene epoch. Smooth glacial moraines and colluvial shields occur on the north side of the region, and rugged, deeply cut fjordlands are on the south side. Many soils formed in deposits of volcanic ash and cinder over glacial deposits and are highly erodible. The region is generally free of permafrost. Earthquakes and active volcanoes are common.
Wildlife: Moose, brown bears pink, chum, and silver salmon, sea mammals such as whales, sea otters, and Steller sea lions, numerous shorebirds.
Land Use/Human Activities: Subsistence and recreational hunting and fishing, commercial fishing and processing. Mineral mining, coal and petroleum extraction are also important activities in the region. Many small communities are found along the coast, including Kodiak and Chignik.

7.1.3 Cook Inlet

Location: This region occupies the south-central part of Alaska, adjacent to Cook Inlet.
Climate: The ecoregion has a mix of maritime and continental climates, but is one of the mildest climates in Alaska, with moderate fluctuations of seasonal temperature and abundant precipitation. The mean annual temperature ranges from approximately -3°C to 3°C. The mean annual precipitation ranges from 350 to 800 mm.
Vegetation: Mixed forests of white and Sitka spruce, aspen, and birch grow on better-drained sites and grade into tall shrub communities of willow and alder on slopes along the periphery of the basin. On wetter sites, black spruce forests and woodlands occur. Ericaceous shrubs are dominant in open bogs. Wildfire occurrence is low.
Hydrology: The region features numerous lakes, ponds, and wetlands as well as many small streams and a few large braided rivers.
Terrain: The terrain is mostly level to rolling topography. Unlike many of the other nonmontane ecoregions, the Cook Inlet Ecoregion was intensely glaciated during the Pleistocene and flooded by proglacial lakes several times. The basin floor is composed of fine-textured lacustrine deposits ringed by coarse-textured glacial tills and outwash. Ground moraines, drumlin fields, eskers, and outwash plains occur. The flat to gently-sloping, fine-textured surfaces give rise to wet, organic soils. The area is generally free from permafrost. HumoFerric and FerroHumic Podzolic mineral soils have developed here; Folisols soils have also developed on upland surfaces.
Wildlife: Moose, black bears, beavers, muskrats, ravens and large numbers of waterfowl, including trumpeter and tundra swans, shorebirds, and various species of fish, including king, sockeye, and silver salmon, Dolly Varden and whitefish occur in the region.
Land Use/Human Activities: A large portion of the settlement and development in Alaska has occurred here, due to the mild climate and coastal proximity. Largest towns include Anchorage, Kenai, Wasilla,

Palmer, Nikiski, and Soldotna. Recreation, hunting and fishing, mineral mining, oil and gas production, timber and wood products. Some agriculture occurs in the Susitna Valley and Kenai Peninsula.

*7.1.4 Pacific Coastal Mountains

Location: This region extends from Anchorage, Alaska, southeastwards to Stewart, British Columbia.
Climate: The ecoregion has a severe, mid-latitude, subarctic climate, transitional between maritime and continental influences. The mean annual temperature for this high elevation area is approximately -0.5°C, with a summer mean of 10°C and a winter mean of -11.5°C. Mean annual precipitation ranges from 1,000 mm in the eastern part of the Boundary Ranges up to 2,400 mm in the ice fields of the Fairweather Ranges and to over 6,000 mm on some of the northern high peaks.
Vegetation: Vegetation in the region is composed of three vegetative zones: alpine tundra of variable ground cover dominated by lowgrowing heather, dwarf birch, willow, grass, and lichen at elevations above the tree line; subalpine forests with alpine fir, mountain hemlock, and some Sitka spruce at middle elevations; and closed forests of western hemlock and some Sitka spruce at warmer, more humid, lower elevations. Many alpine areas are barren.
Hydrology: Moderate to low-density river and stream networks flow southwesterly into Pacific waters. Numerous glaciers and ice fields also occur.
Terrain: Steep rugged mountains rise from sea level to summits ranging from 2,100 to more than 4,500 masl and are capped by several large ice fields. In places, relief along sides of the valleys reaches 2,900 m. Arêtes, horns, cirques, and U-shaped valleys are abundant. Large glaciers move down tributaries to about 150 m with several reaching the sea in Alaska. Isolated patches of permafrost occur in mountain summits over 2,500 m. A variety of Paleozoic, Mesozoic, and Lower Tertiary sedimentary rocks are exposed, along with some intrusive rocks. Brunisolic and Regosolic soils occur in higher alpine regions; HumoFerric Podzolic and Gleysolic soils are most common in the low elevations.
Wildlife: Wildlife encountered in the region includes grizzly and black bear, mountain goat, wolf, wolverine, ptarmigan, moose, bald eagle, spruce grouse, and black-tailed deer in the river valleys.
Land Use/Human Activities: National and provincial parks cover large areas of this ecozone. Land use includes various forms of outdoor recreation in the major river valleys, and mountaineering in the higher elevations. Subsistence and recreational hunting and fishing are also significant land uses. Mining and mineral exploration also occur throughout the area. On the Canadian side, Stewart is the main community. In the United States, communities include Hyder, Hines, and Skagway.

*7.1.5 Coastal Western Hemlock-Sitka Spruce Forests

Location: The region extends in intermittent areas from Homer, Alaska, southwards along the Pacific coast to the west coast of Vancouver Island in British Columbia.
Climate: The ecoregion has a mild to severe, mid-latitude, marine West Coast climate. It is marked by cool to warm, moist summers and very wet but mildly cold winters. The mean annual temperature ranges from approximately 3°C in the far north to 8°C in the south. The summer mean is about 13°C and winter means range from 1° to 3.5°C. The frost-free period ranges from 120 days to 200 days. Mean annual precipitation ranges from 1,350 to more than 4,000 mm at higher elevations.
Vegetation: At low elevations, stands of western hemlock, Douglas fir, and amabilis fir are common. Drier sites support stands of western hemlock; western red cedar and Sitka Spruce. Forests of mountain hemlock, subalpine fir, and amabilis fir with some yellow cedar dominate subalpine regions. Alpine tundra sites have an abundance of dwarf willow, sedge, fescue grass, and forbs.
Hydrology: Moderate to low-density river and stream networks flow southwesterly into Pacific waters. Streams are moderate to high gradient. Lakes occur in a few areas.
Terrain: This is mountainous terrain. Numerous mountain peaks and ridges are divided by steepsided, transverse valleys as well as by ocean inlets and sounds. From coastlines, the mountains can reach up to 2,200 masl. These mountains have been sculptured by glaciers that have left deep, U-shaped valleys. Rocky headlands and sea cliffs are common along the coast. Soils range from HumoFerric and

FerroHumic Podzolic and Dystric Brunisolic on well-drained sites Gleysolic soils in poorly drained sites. Organic Folisols also soils developed on upland surfaces.
Wildlife: The region's wildlife includes black-tailed deer, American elk (wapiti), grizzly and black bear, wolf, mountain goat, mink, otter, raccoon, bald eagle, grouse, marbled murrelet, seabirds, shorebirds, waterfowl, rough-skinned newt, dolly varden, and sockeye salmon.
Land Use/Human Activities: The region covers some of the most productive forestlands on the northwest coast. Forest management is an important activity and harvested wood is used in both pulp and lumber production. Mining, water-oriented recreation, and tourism are also important land uses. There is also some commercial fishing and subsistence hunting, fishing, and gathering. Major communities are Tofino, Ucluelet, Port Hardy, Sandspit, Sewell Inlet, Homer, Ketchikan, Cordova, and Juneau.

7.1.6 Pacific and Nass Ranges

Location: The region extends along the Coast Mountains from the Fraser valley in British Columbia to the Nass River near the British Columbia-Alaska border.
Climate: The mean annual temperature for the major valleys is approximately 6.5°C, with a summer mean of 13.5°C and a winter mean of -1°C. Along the coast, where is warmer, mean annual temperatures range from 9°C to 7.5°C. Mean annual precipitation ranges from 1,500 mm in the lower elevations up to 4,500 mm at higher elevations. This ecoregion contains Canada's rainiest community, Ocean Falls, with a mean annual precipitation of 4,386 mm.
Vegetation: The region incorporates three main ecological zones: the coastal forest zone, which ranges from sea level to about 900 masl; the subalpine zone, from about 900 to 1,800 masl; and the alpine zone above 1,800 masl. Vegetative cover of the low-elevation slopes includes very productive stands of western hemlock, western red cedar and amabilis fir. Drier sites support stands of western hemlock and Douglas fir. The subalpine zone is dominated by forests of mountain hemlock and amabilis fir together with some yellow cedar.
Hydrology: Moderate river density networks flow westwards into the Pacific Ocean.
Terrain: Ranges are high and irregular, with steeply-sloping mountains forming the main southern part of the rugged Coast Mountains. Mountains are composed of crystalline gneisses and granitic rocks, ranging from sea level to 4,000 m. The higher peaks are surrounded by expansive ice fields; many large glaciers extend to low elevations but do not reach sea level. Numerous, large, steepsided, transverse valleys, inlets, or fjords dissect this mountainous coastal region. Rocky outcrops and ice fields occur at the highest elevations. Dystric Brunisolic and HumoFerric Podzolic soils dominate the milder, more humid sites. Mesisols, Humisols and Folisols are the typical soils formed on organic materials. At higher elevations, Regosolic and Brunisolic soils are found.
Wildlife: Region wildlife includes black-tailed deer, black and grizzly bear, mountain goat, wolf, mink, otter, seabirds, shorebirds, waterfowl, and blue grouse.
Land Use/Human Activities: This area contains some of the most productive forestlands in Canada. Important land uses include pulp and sawlog forestry, production of hydroelectric power, water-oriented recreation, and tourism. Main communities are Squamish, Whistler, Hope, Pemberton, Terrace, Hazelton Kitimat, Prince Rupert, Kemano, Bella Coola and New Hazelton.

*7.1.7 Strait of Georgia/Puget Lowland

Location: This region occupies eastern Vancouver Island and lands adjacent to the Strait of Georgia in British Columbia and along the Puget Sound to Tacoma in Washington State.
Climate: The ecoregion has a mild, mid-latitude maritime climate, marked by warm, dry summers and mild wet winters. Frosts are common in winter, but snow cover at sea level is ephemeral. The mean annual temperature is one of the mildest in Canada at approximately 9°C, with a summer mean of 15°C and a winter mean of 4°C. Mean annual precipitation ranges from 300 mm at lower elevations to 2,500 mm at higher elevations. The frost-free period ranges from 150 to 220 days.

Vegetation: Much of the land has been cleared. Today, forests are characterized by stands of Douglas fir, western hemlock, grand fir, western red cedar, red alder, bigleaf maple, and an understory of salal, Oregon grape, and moss. Mixed stands of Douglas fir and western hemlock with occasional Garry oak, dogwood, and arbutus are common in the driest portions of the coasts and islands.
Hydrology: Numerous perennial streams, mostly of low to moderate gradient flow into the Pacific waters. Some large lakes are also present.
Terrain: Landforms are mostly broad, rolling lowlands, some plains with low mountains, formed mainly on moraine and glaciomarine deposits. The ecoregion is composed of many islands, peninsulas, and bays along the Strait of Georgia and in the Puget Sound area. Inceptisols, Spodosols, and Andisols are common soil types, with mesic soil temperature and xeric and udic soil moisture regimes.
Wildlife: Region wildlife includes black-tailed deer, American elk (wapiti), wolf, black bear, raccoon, red fox, beaver, otter, bald eagle, turkey vulture, wood duck, mallard, shorebirds, seabirds, waterfowl, chinook salmon, and steelhead.
Land Use/Human Activities: Land uses are intensive. Residential, industrial, recreational, transportation (corridors) and agricultural uses all compete for land. Forestry, tourism and fishing are also important economic activities. Some major cities are Vancouver, Victoria, Campbell River, Nanaimo, Bellingham, Mt. Vernon, Everett, Seattle, Tacoma, Olympia, and Centralia.

7.1.8 Coastal Range

Location: This region spans the coastal mountains of western Washington, western Oregon, and northwestern California.
Climate: Marine west coast and Mediterranean-type climates prevail, with warm, relatively dry summers and mild, but very wet winters. The mean annual temperature ranges from approximately 7°C to 14°C, depending upon elevation and latitude. The frost-free period ranges from 100 to 280 days. The mean annual precipitation is 2,149 mm, ranging from about 1,000 to over 5,000 mm.
Vegetation: Coniferous forests predominate. Sitka spruce forests and coastal redwood forests originally dominated the fog-shrouded coast to the south, while a mosaic of western red cedar, western hemlock, and seral Douglas fir blanketed inland areas. Today, Douglas fir plantations are prevalent on the intensively logged and managed landscape. Other species include red alder, big leaf maple, vine maple, rhododendron, salal, salmonberry, and Oregon grape.
Hydrology: There is a high density of perennial streams, mostly high to medium gradient. Dendritic drainages are dominant. Some coastal lakes occur, as well as numerous bays and estuaries.
Terrain: Moderately to steeply sloping dissected mountains, some hills and low mountains, ranging to coastal headlands, high and low marine terraces, sand dunes, and beaches. Elevations range from sea level to over 1200 masl. Quaternary colluvium covers much of the Tertiary and Mesozoic sedimentary rocks or Tertiary volcanic basalts that are the most typical rock types. Soils are typically Inceptisols, Alfisols, and Andisols, with a mesic temperature, some isomesic along the coast, and some frigid soils at high elevations. Landslides and debris slides are common.
Wildlife: Black-tailed deer, Roosevelt elk, black bear, cougar, coyote, bobcat, beaver, Townsend's mole, northern spotted owl, marbled murrelet, shorebirds and waterfowl, chinook and coho salmon, steelhead are found in the region.
Land Use/Human Activities: Land uses involve forestry and forest products, recreation and tourism, fishing and hunting, commercial fish and mollusk processing. Larger cities include Aberdeen, Astoria, Seaside, Tillamook, Newport, Coos Bay, Crescent City, and Eureka.

7.1.9 Willamette Valley

Location: Located in northwestern Oregon, the Willamette Valley is distinguished from the adjacent Coastal Range (7.1.8) and Cascades (6.2.7) by lower precipitation, less relief, and a different mosaic of vegetation.
Climate: The ecoregion has a Mediterranean-type climate, with warm, dry summers and mild, but wet winters. The mean annual temperature is approximately 10° to 13°C. The frost-free period ranges from

165 to 210 days. The mean annual precipitation is 1,228 mm, ranging from 900 to 1,600 mm in the mountainous foothills.
Vegetation: Vegetation in the region is a mosaic of oak savanna, oak woodlands, prairies, and Douglas fir forests. Oregon white oak, Douglas fir, madrone, and some valley ponderosa pine are typical. Riparian areas contain black cottonwood, Oregon ash, bigleaf maple, Douglas fir, western red cedar, and various shrubs. Almost all of the native prairies have been converted to other uses.
Hydrology: Large rivers, and numerous streams flow from adjacent mountainous regions; numerous, seasonal wetlands and ponds and a few reservoirs.
Terrain: Mostly, the region is a rolling, broad, lowland valley. Elevations range from about 6 m to higher peaks of over 600 masl. Landforms consist of terraces and floodplains that are interlaced and surrounded by rolling hills. Relatively deep alluvium, colluvium, and glacio-lacustrine deposits overlie Miocene volcanic basalt and marine sandstone. Soils are productive, have a mesic temperature regime, and a variety of texture and moisture characteristics. Mollisols and Alfisols are typical in the valley with some Ultisols and Alfisols in the foothills.
Wildlife: Black-tailed deer, red fox, coyote, racoon, striped skunk, beaver, Oregon and grey-tailed vole, red-tailed hawk, Cooper's hawk, Canada geese, mallard and northern pintail ducks, great blue heron, white-breasted nuthatch, chipping sparrow, and a variety of amphibians and reptiles are encountered.
Land Use/Human Activities: Productive soils and a temperate climate make it one of the most important agricultural areas in Oregon. Vegetables, fruits, nut orchards, nursery products, and grass seed production are typical. Vineyards and Christmas tree farms are common in the foothills, along with some sheep and cattle grazing. Urban, suburban, and rural residential uses are spreading. This region contains most of Oregon's population, with larger cities including Portland, Gresham, Beaverton, Hillsboro, Salem, Albany, Corvallis, Eugene, and Springfield.

8.0 Eastern Temperate Forests

8.1 Mixed Wood Plains

*8.1.1 Eastern Great Lakes and Hudson Lowlands

Location: This ecoregion extends over the lowlands centered on the lower reaches of the St. Lawrence and Hudson Rivers, stretching from Quebec City to Georgian Bay in the north, and the Notre Dame and the Appalachian Mountains in New York State and Vermont.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate, marked by warm summers and cold, snowy winters. The mean annual temperature ranges from approximately 5°C to 9°C. Mean summer temperatures are 16°C to 19°C, and mean winter temperatures range from -7°C to -2°C. The frost-free period ranges from 120 to 170 days. The mean annual precipitation is 965 mm and ranges from 720 to more than 1,200 mm. Locations that are in closer proximity to the Great Lakes experience an increased growing season, more winter cloudiness, and greater snowfall.
Vegetation: Croplands dominate a landscape that was previously an area of mixed coniferous-deciduous wood forests. The remaining forests present sugar maple, yellow birch, eastern hemlock, basswood and eastern white pine; beech occurs on warmer sites. Dry sites are dominated by red oak and pine, eastern white pine and cedar. Wetter sites support red maple, black ash, white spruce, tamarack, and eastern white cedar.
Hydrology: Streamflow in the region is mostly perennial of low to moderate gradient. Large rivers, large lakes, and wetlands are common. The region drains to the east via the St Lawrence and Ottawa watersheds, and south by the Hudson River.
Terrain: This lowland area seldom exceeds 152 masl. The rolling to level terrain is covered with a wide variety of deep glacial (moraines, glaciofluvial) and marine deposits as well as some bedrock outcrops.

Paleozoic sedimentary rocks are most typical. Alfisols, Inceptisols, and Spodosols soil types are common. Soils have frigid and mesic soil temperature regimes and mostly udic and aquic soil moisture regimes.
Wildlife: Wildlife in the region includes white tailed deer, black bear, red fox, moose, coyote, wolf, snowshoe hare, red and gray squirrel, chipmunk, and other small mammals. Bird species include cardinal, wood thrush, screech owl, osprey, mourning dove, green heron, pileated and red-bellied woodpecker, Canada warbler, Canadian geese, mallard, wood duck, American and black ducks.
Land Use/Human Activities: Most of the region is intensively cultivated farmland (60 percent). Mixed, dairy, and cash crops are the dominant farming systems, and major crops include grains, corn, soybeans, hay, and fruit. Orchards, vineyards, and vegetable farming are also important for the region. Other significant land uses include urban development, industrial uses, recreation, and tourism. The region has a relatively dense road network. Major cities include Quebec City, Montreal, Ottawa/Hull, Kingston, Peterborough, Oshawa, Kitchener-Waterloo, Barrie, and Brantford in Canada; as well as Buffalo, Rochester, Syracuse, Schenectady, Albany, and Poughkeepsie in the United States.

8.1.2 Lake Erie Lowland

Location: The region extends in Ontario from Windsor to Toronto, including the Niagara Peninsula at the southern tip of the province.
Climate: The climate here features humid, warm to hot summers and mild, snowy winters. The mean annual temperature is approximately 8°C, reaching as high as 9°C in the Windsor area. The mean summer temperature is 18°C and the mean winter temperature is -2.5°C. The mean annual precipitation ranges from 750 to 900 mm. Precipitation is evenly distributed throughout the year.
Vegetation: The dominant land cover is cropped land with limited areas of mixed and deciduous forests. Urban development is the other significant land cover. Climax forest species are sugar maple, beech, white and red oak, shagbark hickory, black walnut, and butternut. Moist sites are characterized by white elm, eastern cottonwood, balsam poplar, red and black ash, and silver maple. Drier and warmer sites contain black, chestnut, and chinquapin oak. Tulip tree, sycamore, and bitternut hickory occur on moist slopes.
Hydrology: Moderate to low-density river and stream networks flow in various directions into the Great Lakes and St. Lawrence River system.
Terrain: The region is dominated by a variety of moraine, lacustrine and marine deposits. Most of the region lies southwest of the Niagara Escarpment, where the land surface slopes gradually southwestward through low-relief, rolling topography where elevations are generally below 550 m. Bedrock outcrops occur only in limited areas. Gleysolic and Gray Brown Luvisolic soils are dominant in this area.
Wildlife: Characteristic wildlife species include white-tailed deer, grey and red squirrel, and chipmunk. Bird species include cardinal, wood thrush, screech owl, mourning dove, green heron, pileated and red-bellied woodpecker, and wild turkey.
Land Use/Human Activities: Agriculture is the predominant land use, occupying 65 percent of the ecoregion, and major crops include corn, soybeans, tobacco, and tender fruit. The other dominant land use is urbanization, including residential, commercial, and industrial uses. Major cities include Toronto, Hamilton, St. Catharines, Niagara Falls, Windsor, Sarnia, London, Chatham, and Brantford.

8.1.3 Northern Appalachian Plateau and Uplands

Location: The region spans southern New York and northern Pennsylvania, just north of, and at lower elevations than, the North Central Appalachians (5.3.3). It is a transitional region between the less irregular, more agricultural and urbanized Erie Drift Plains (8.1.10) and Eastern Great Lakes and Hudson Lowlands (8.1.1) ecoregions to the north and west and the more mountainous and forested, less populated North Central Appalachians (5.3.3) and Northeastern Appalachian and Atlantic Maritime Highlands (5.3.1) ecoregions to the south and east.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate, marked by warm summers and severe winters. The mean annual temperature is approximately 7°C. The frost-free period ranges from 120 to 170 days. The mean annual precipitation is 969 mm, ranging from 890 to 1,200 mm.

Vegetation: Large areas are in Appalachian oak-hickory forests and and comprise such northern hardwoods as white, black, and red oaks; hickories; some areas with white pine; maples, beech, and birches.
Hydrology: Low to moderate gradient perennial streams and some small glacial lakes dot the region.
Terrain: The glaciated upland plateau contains rolling hills, open valleys, and low mountains. Its geology is mostly shales, siltstones, and sandstones from the Devonian Period. Inceptisols are typical, with mesic and frigid soil temperature regimes, and aquic or udic soil moisture regimes.
Wildlife: Black bear, white-tailed deer, red fox, gray fox, raccoon, beaver, striped skunk, gray squirrel, wild turkey, ruffed grouse, woodcock, wood duck, mallards, Canada geese, Cooper's hawk, cerulean warbler, red-backed salamander, timber rattlesnake, and wood turtle are found there.
Land Use/Human Activities: Much of this region is farmed and in pasture, with hay and grain for dairy cattle being the principal crops. Woodland and forest are also part of the landscape mosaic. Multiple towns and cities are present in this ecoregion.

8.1.4 North Central Hardwood Forests

Location: The North Central Hardwood Forests occur in central Minnesota, Wisconsin, and a small portion of Michigan. The ecoregion is transitional between the predominantly forested Northern Lakes and Forests (5.2.1) to the north and the agricultural ecoregions to the south.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate, marked by warm summers and severe winters, with no pronounced dry season. The mean annual temperature is approximately 5°C to 7°C. The frost-free period ranges from 130 to 160 days. The mean annual precipitation is 753 mm, ranging from 600 to 890 mm. Winters are snowy.
Vegetation: Oak savanna, oak-hickory forests, maple-basswood forests, northern hardwoods of maple, beech, and birch are the dominant forest types.
Hydrology: The region possesses a high density of perennial streams, wetlands, and lakes, but less than in ecoregion 5.2.1 to the north. Surface waters are generally less eutrophic than regions to the south, but more nutrient-rich than forested regions to the north.
Terrain: The topography features nearly level to rolling till plains, lacustrine basins, outwash plains, and rolling to hilly moraines.
Wildlife: Bison, elk, and wolf were once present in this region. White-tailed deer, coyote, gray fox, red fox, beaver, raccoon, fisher, otter, mink, gray squirrel, wild turkey, sandhill crane, turkey vulture, ruffed grouse, Canada goose, northern pike, walleye, carp, and sunfish remain.
Land Use/Human Activities: The region is a mosaic of forestland, cropland agriculture, pasture, and dairy operations, with some areas of urban, suburban, and rural residential land. Larger cities include Saint Cloud, Minneapolis, Saint Paul, Anoka, Stillwater, Eau Claire, Wausau, Wisconsin Rapids, and Stevens Point.

8.1.5 Driftless Area

Location: This region spans both sides of the upper Mississippi River valley—southeast Minnesota, southwest Wisconsin, northeast Iowa, and northwest Illinois.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate, marked by warm summers and severe winters, with no pronounced dry season. The mean annual temperature is approximately 7°C to 9°C. The frost-free period ranges from 140 to 170 days. The mean annual precipitation is 825 mm, and ranges from 760 to 965 mm. Snowfall is common in winter.
Vegetation: The region is a mosaic of prairie with little bluestem, Indiangrass, and sideoats grama, and forests of bur oak and white oak. In more mesic areas, forests of sugar maple, basswood, and red oak, and riparian forests with elm, river birch, silver maple, and ash.
Hydrology: The region has many perennial streams. Springs and spring-fed streams are also common. There are few natural lakes, but some small reservoirs and farm ponds.

Terrain: The hilly uplands of the Driftless Area easily distinguish it from surrounding ecoregions. Much of the area consists of a deeply dissected, loess-capped, bedrock dominated plateau featuring gently sloping to rolling summits with steeper valley walls and bluffs. Rock outcrops are common, with shale, sandstone, dolomite, and limestone. The region is also called the Paleozoic Plateau because the landscape's appearance is a result of erosion through rock strata laid down in the Paleozoic Era. Although there is evidence of glacial drift in the region, the influence of the glacial deposits has done little to affect the landscape compared to the subduing influences in adjacent ecoregions. Alfisols, Entisols, and Mollisols are dominant, with mesic soil temperature regimes and udic soil moisture regimes.
Wildlife: White-tailed deer, coyote, gray fox, red fox, beaver, raccoon, fisher, otter, mink, gray squirrel, red-shouldered hawk, turkey vulture, ruffed grouse, wild turkey, northern pike, walleye, largemouth bass are found in the region.
Land Use/Human Activities: Some pasture and cropland are featured on flatter uplands, woodlands and forest on steeper slopes and ravines. Livestock and dairy farming are major land uses and have had a major impact on stream quality. Corn, soybeans, feed grains, and hay are principal crops. Larger towns include Rochester, Winona, Decorah, Dubuque, Prairie du Chien, and La Crosse.

8.1.6 Southern Michigan/Northern Indiana Drift Plains

Location: This region occurs in southern Michigan and northern Indiana. It is bordered by Lake Michigan on the west and the Huron/Erie Lake Plains region (8.2.2) on the east.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate, marked by warm to hot summers and severe winters, with no pronounced dry season. The mean annual temperature is approximately 7°C to 10°C. The frost-free period ranges from 140 to 200 days. The mean annual precipitation is 862 mm, ranging from 750 to 990 mm.
Vegetation: Oak-hickory forests, northern swamp forests, and beech forests were typical. White oak, red oak, black oak, bitternut hickory, shagbark hickory, sugar maple, beech are the dominant tree species.
Hydrology: Numerous perennial streams course in the region, mostly of low to moderate gradient. There are many small and medium-size lakes. It is better drained and contains more lakes than the flat agricultural lake plains (8.2.2) to the east. Groundwater is abundant.
Terrain: Broad, glaciated plains, with deep till and outwash. The region has an assortment of landforms, soil types, and soil textures. Broad till plains with thick, complex deposits of drift, paleobeach ridges, relict dunes, morainal hills, kames, drumlins, meltwater channels, and kettles occur. Elevations are generally 168 m to more than 365 m. The deeply buried bedrock is mostly sandstone and shale. Soils are not as nutrient-poor as ecoregion 5.2.1 to the north. Alfisols, Histosols, and Mollisols are typical, with a mesic soil temperature regime and aquic or udic soil moisture regime.
Wildlife: White-tailed deer, coyote, red fox, gray fox, beaver, river otter, mink, Canada warbler, upland sandpiper, northern pike, walleye, salmon, steelhead, trout are native to the region.
Land Use/Human Activities: Land uses feature a mix of agricultural land, forest and woodland, pasture, and urban, suburban, and rural residential land uses. This ecoregion is less agricultural than those (8.2.3, 8.2.4) to the south. Corn, other feed grains, and hay for dairy cattle and other livestock are typical crops, along with some winter wheat, dry beans, and some fruits and vegetables. Larger cities include Muskegon, Grand Rapids, Lansing, Flint, Kalamazoo, Battle Creek, Jackson, South Bend, and Elkhart.

8.1.7 Northeastern Coastal Zone

Location: This ecoregion covers most of southern New England and the coastal areas of New Hampshire and southern Maine.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate, marked by warm summers and severe winters. The mean annual temperature ranges from approximately 8°C to 10°C. The frost-free period ranges from 150 to 230 days. The mean annual precipitation is 1,181 mm, ranging from 890 to 1,250 mm, and is generally evenly distributed throughout the year.

Vegetation: Appalachian oak forest and northeastern oak-pine forest are the natural vegetation types. These include white oak, red oak, hickories, white pine, and some maple, beech, birch and hemlock in cooler or more mesic areas.
Hydrology: Abundant perennial streams, lakes, ponds, and wetlands occur. Stream networks have a variety of patterns due to geologic variety and complex geomorphic history, including dendritic, deranged, and trellis. Streams mostly moderate to low gradient. Some of the surface waters are sensitive to acidification.
Terrain: Landforms include irregular plains, plains with low to high hills, and open hills. Elevations range from sea level to over 300 masl. Soils are mostly Inceptisols with some Entisols and Histosols and have a mesic soil temperature regime, and an aquic or udic soil moisture regime. Similar to the adjacent Northern Appalachian and Atlantic Maritime Highlands region (5.3.1), the Northeastern Coastal Zone contains fine to medium-textured, relatively nutrient poor soils. This ecoregion, however, contains considerably less surface irregularity than ecoregion 5.3.1. Bedrock geology is complex and varied, with mostly igneous and metamorphic rocks, but some areas of sedimentary also occur.
Wildlife: White-tailed deer, black bear, bobcat, coyote, beaver, gray squirrel, white-footed mouse are mammals native to the region.
Land Use/Human Activities: This region has much greater concentrations of human population than ecoregion 5.3.1. Although attempts were made to farm much of the Northeastern Coastal Zone after the region was settled by Europeans, land use now mainly consists of forests, woodlands, and urban and suburban development, with only some minor areas of pasture and cropland. Larger cities include Boston, Hartford, New Haven, Providence, Worcester, Springfield, Manchester, and Concord.

***8.1.8 Maine/New Brunswick Plains and Hills**

Location: This region extends from Chaleur Bay in New Brunswick southwards to Portland, in Maine.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate, marked by warm, moist summers and snowy, cold winters. Some maritime influence is noted in coastal areas. The mean annual temperature is approximately 4°C to 7°C. The mean summer temperature is 15°C and the mean winter temperature is -7.5°C. The frost-free period ranges from 110 to 175 days. The mean annual precipitation is 1,090 mm and ranges from 915 to 1,270 mm.
Vegetation: Mixed wood forests composed of closed stands of sugar maple, beech, and yellow birch on upland sites, whereas eastern hemlock, balsam fir, eastern white pine, and white spruce prevail in valleys. In the drier, northern part of the region, white, red and jack pine along with spruce and fir are more common. Forests are more temperate and diverse than in ecoregion 5.3.1 to the west.
Hydrology: Perennial streams of low to moderate gradient occur, along with some large rivers. Some dense concentrations of continental glacial lakes are also present.
Terrain: Landforms include hilly uplands, plains with hills, and rolling lowlands, ranging from 200 to 500 masl. The region is less rugged than the Highland ecoregion (5.3.1) to the westbut is mantled with stony moraine; bedrock outcrops are significant. Geology is complex, with metamorphosed pelites and sandstones, some igneous intrusives and volcanics, and a few areas of limestone and dolostone. Soils are predominantly Spodosols with some Inceptisols, with frigid soil temperature regimes and udic and aquic soil moisture regimes.
Wildlife: The region includes habitats for moose, black bear, white-tailed deer, red fox, bobcat, marten, snowshoe hare, porcupine, fisher, coyote, beaver, ruffed grouse, bald eagle, and waterfowl.
Land Use/Human Activities: Forestry and some agriculture are major land uses. Typical crops include, potatoes, oats, hay, buckwheat, barley, and broccoli. Tourism and recreation are important in coastal areas. Major communities include Campbellton, Edmundston, Woodstock, Grand Falls, St. John, Sussex, Presque Isle, Bangor, Augusta, and Lewiston.

8.1.9 Maritime Lowlands

Location: This region covers north central New Brunswick and northwards over Prince Edward Island.
Climate: Climate here is marked by warm summers and mild, snowy winters. The mean annual temperature is approximately 5°C. The mean summer temperature is 15.5°C and the mean winter temperature is -5.5°C. The mean annual precipitation ranges from 900 to 1,300 mm.
Vegetation: The closed, mixed wood forest is mainly composed of red spruce, balsam fir, red maple, hemlock, and eastern white pine. Sugar maple and yellow birch are found on the larger hills. Wetlands are extensive and support dwarf black spruce and eastern larch at their perimeters.
Hydrology: Low-density river and stream networks prevail, flowing into the Northumberland and St. Lawrence Gulf areas.
Terrain: The lowlands are underlain by flat to gently dipping sandstones, shales, and conglomerates and rise inland from sea level to 200 m. The region is blanketed with moraines. The dominant soils are HumoFerric Podzols and Gray Luvisols with significant areas of Gleysols, Fibrisols and Mesisols on wetter sites.
Wildlife: The area provides habitat for moose, black bear, white-tailed deer, red fox, snowshoe hare, porcupine, fisher, coyote, beaver, ruffed grouse, bobcat, marten, raccoon, and muskrat. Shorebirds and seabirds inhabit salt marshes and coastal habitats.
Land Use/Human Activities: Forestry, ocean-based fisheries, agriculture, coal mining, tourism, and recreation are dominant land uses. The major communities include Fredericton, Moncton, Chatham, Bathurst, New Glasgow, Shediac, Charlottetown and Summerside.

8.1.10 Erie Drift Plain

Location: This region lies south of Lake Erie in northeastern Ohio and extends eastward through northwestern Pennsylvania, and southwestern New York.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate, marked by warm summers and cold winters. The mean annual temperature is approximately 7°C to 10°C. The frost-free period ranges from 140 to 200 days. The mean annual precipitation is 1,023 mm, and ranges from 865 to 1,270 mm. Lake Erie's influence substantially increases the growing season, winter cloudiness, and snowfall in the northernmost areas.
Vegetation: Once this area was largely covered by beech-maple forests, or mixed oak forests with red oak, white oak, and shagbark hickory, and mixed mesophytic forests with sugar maple, yellow birch, beech, and hemlock. Some elm-ash swamp forests grew in the damper lowland areas.
Hydrology: The region features perennial and intermittent streams, generally low to moderate gradient, numerous wetlands, sphagnum bogs, and lakes in some areas.
Terrain: The glaciated Erie Drift Plain is mostly a gently to strongly rolling, dissected plateau characterized by low rounded hills, scattered end moraines, kettles, and areas of wetlands. This contrasts with the adjacent unglaciated ecoregions (8.4.3, 5.3.3) to the south and east that are hillier and less agricultural. Glacial outwash and till overlie Paleozoic sandstone and shale. Alfisols are dominant with mesic soil temperature regimes and aquic and udic soil moisture regimes.
Wildlife: White-tailed deer, rd fox, woodchuck, raccoon, opossum, beaver, striped skunk, eastern chipmunk, fox squirrel, bald eagle, osprey, red-tailed hawk, northern flicker, canvasback, wood duck, Canada warbler, eastern screech owl, snapping turtle, dusky salamander are regional wildlife.
Land Use/Human Activities: Much of the Erie Drift Plain is now in farms, many associated with dairy operations. Feed grains and forage crops are typical. Farm woodlots provide sawlogs for construction, firewood, and specialty products. Areas of urban development and industrial activity occur locally. Larger towns and cities include Wooster, Akron, Canton, Youngstown, New Castle, Meadville, and Jamestown.

8.2 Central USA Plains

8.2.1 Southeastern Wisconsin Till Plains

Location: This region lies adjacent to Lake Michigan in southeastern Wisconsin and northern Illinois.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate, marked by warm summers and severe winters. The mean annual temperature is approximately 7°C to 10°C. The frost-free period ranges from 150 to 190 days. The mean annual precipitation is 813 mm, ranging from 730-950 mm.
Vegetation: Supports a mosaic of vegetation types, representing a transition between the hardwood forests and oak savannas of the ecoregions (8.1.4, 8.1.5) to the west and the tall-grass prairies of the Central Corn Belt Plains (8.2.3) to the south. Forested areas feature red and white oak, and areas of beech, sugar maple, and basswood. Prairie areas, now rare, were mainly of little bluestem and big bluestem.
Hydrology: The region has a low to medium density of perennial streams, mostly low gradient. Some areas have numerous lakes and wetlands.
Terrain: The terrain is predominantly flat to rolling glacial plains with some till plains, lacustrine clay plains, pitted outwash plains, drumlins, and moraines. Elevations are generally 200 to 300 masl. Ordovician and Cambrian sandstone, shale, limestone, and dolomite underlie the glacial deposits. Alfisols, Hisosols, and Mollisols are typical, with a mesic soil temperature regime and aquic or udic soil moisture regime.
Wildlife: White-tailed deer, red fox, coyote, raccoon, red squirrel, gray squirrel, wild turkey, Canada goose, sandhill crane, perch, northern pike, and brook trout can be found in the region.
Land Use/Human Activities: Land uses are now mostly devoted to cropland, but the crops are largely forage and feed grains to support dairy operations, rather than corn and soybeans for cash crops as found in Corn Belt ecoregions (8.2.3, 9.2.3). Some potatoes, barley, fruit, sweet corn, and snap beans are grown here. Larger cities include Green Bay, Oshkosh, Sheboygan, Fond du Lac, Madison, Milwaukee, and Janesville.

8.2.2 Huron/Erie Lake Plains

Location: This region is located on the flat lake plains adjacent to Lake Huron and Lake Erie in Michigan and Ohio, with a small extension into Indiana.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate, marked by hot summers and severe winters. The mean annual temperature is approximately 8°C to 11°C. The frost-free period ranges from 150 to 200 days. The mean annual precipitation is 824 mm, ranging from 700 to 915 mm.
Vegetation: Originally, elm-ash swamp and beech forests were dominant, with oak savanna typically restricted to sandy, well-drained dunes and beach ridges. Mixed oak forests also occurred. Much of the natural vegetation has been cleared for agriculture, although some areas remain with red maple, white ash, American basswood, aspen, or with white oak, red oak, black oak, bitternut and shagbark hickories.
Hydrology: Low gradient perennial and streams and rivers are found in the region, although extensive swamps and marshes once existed. Drainage has been greatly modified. Stream habitat and quality have been degraded by channelization, ditching, and agricultural activities.
Terrain: Broad, nearly flat plains are punctuated by relic sand dunes, beach ridges, and end moraines. Fine lacustrine sediments and coarser moraine material occur. Bedrock is mostly Silurian, Devonian, and Mississippian limestone, dolomite, and shale. Originally, soil drainage was typically poorer than in the adjacent Eastern Corn Belt Plains (8.2.4). Alfisols and Inceptisols are common, with mesic soil temperature regimes and aquic and udic soil moisture regime.
Wildlife: White-tailed deer, raccoon, woodchuck, downy woodpecker, green-backed heron, wood duck, snapping turtle, northern water snake, flathead catfish, and greater redhorse occur.
Land Use/Human Activities: Highly productive farms producing corn, soybeans, winter wheat, hay, livestock, and vegetables are found throughout the region; urban and industrial areas are also extensive. Larger cities include Midland, Bay City, Saginaw, Port Huron, Detroit, Toledo, Bowling Green, and Sandusky.

8.2.3 Central Corn Belt Plains

Location: This region covers a large portion of northern Illinois and northwestern Indiana, with a small extension into southeastern Wisconsin.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate, marked by hot summers and severe winters. There is not a pronounced dry season but about two-thirds of the precipitation falls during the frost-free period. The mean annual temperature ranges from approximately 8°C to 12°C. The frost-free period ranges from 160 to 190 days. The mean annual precipitation is 942 mm, ranges 863 to 1,040 mm.
Vegetation: Nearly all of the natural vegetation has been replaced by agriculture. Extensive prairie communities intermixed with oak-hickory forests were native, in contrast to the hardwood forests that grew on the drift plains of ecoregions (8.1.6, 8.2.4) to the east. Mesic prairies had big bluestem, Indiangrass, prairie dropseed, switchgrass, dry upland prairies had little bluestem and sideoats grama, and woodlands contained white oak, black oak, and shagbark hickory. Some sugar maple and American elm were on more mesic sites.
Hydrology: The region's streams and rivers are intermittent and perennial, mostly low gradient. Stream density is relatively low. Many areas have been tiled, ditched, and tied into existing drainage systems. Agriculture has affected stream chemistry, turbidity, and habitat.
Terrain: The terrain is mostly glaciated, flat to rolling plains, with areas of sand dunes and lake plains. Elevations range from 135 to 365 masl. Paleozoic shale, siltstone, and limestone are mostly deeply buried. Dark, fertile soils occur, Mollisols and Alfisols are common. Soils derived from loess deposits occur in the western portion of the region, while the central and eastern soils are mostly derived from drift. Soils have a mesic soil temperature regime and udic or aquic soil moisture regime.
Wildlife: White-tailed deer, coyote, bobcat, meadow vole, Canada goose, mallard duck, black-capped chickadee, upland sandpiper, Illinois mud turtle, and Illinois chorus frog are found.
Land Use/Human Activities: Beginning in the nineteenth century, the natural vegetation was gradually replaced by agriculture. Farms are now extensive and produce mainly corn and soybeans; cattle, sheep, poultry, and especially hogs are also raised, but they are not as dominant as in the drier Western Corn Belt Plains (47) to the west. Larger cities include Kenosha, Rockford, Chicago, Joliet, Bloomington, Springfield, Decatur, and Danville.

8.2.4 Eastern Corn Belt Plains

Location: This region encompasses large portions of central and eastern Indiana and western Ohio, with a small extension into southern Michigan.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate, marked by hot summers and cold winters. The mean annual temperature is approximately 9°C in the north to 13°C in the south. The frost-free period ranges from 160 to 200 days. The mean annual precipitation is 985 mm, ranging from 864 to 1,143 mm.
Vegetation: Historically, beech forests were common on Wisconsinan soils, while beech forests and elm-ash swamp forests dominated the wetter pre-Wisconsinan soils.
Hydrology: The streams of the regiona are mostly perennial and intermittent, with low to moderate gradient. Agriculture has affected stream chemistry and turbidity. Some wetlands, lakes, and reservoirs are present. Groundwater is relatively abundant.
Terrain: The region is primarily a rolling till plain with local end moraines. Glacial deposits of Wisconsinan age are extensive. Till, outwash, and some thin loess overlie Paleozoic carbonates, shale, and sandstones. The region has lighter colored soils than the Central Corn Belt Plains (8.2.3) to the west, loamier and better drained soils than the Huron/Erie Lake Plains (8.2.2) to the north, and richer soils than the Erie Drift Plain (8.1.10) to the east. Some areas of pre-Wisconsinan till, which are restricted to the southern part of the region, tend to be more dissected. Alfisols and Mollisols are dominant, with mesic soil temperatures and udic and aquic soil moisture regimes.

Wildlife: White-tailed deer, coyote, red fox, gray fox, big eared bat, white-footed mouse, cottontail rabbit, eastern mole, indigo bunting, eastern bluebird, Canada warbler, American redstart, tree sparrow, bluebreast darter, redside dace are native to the area.
Land Use/Human Activities: Cropland is extensive with corn, soybeans, wheat, dairy and livestock production. Urban, suburban, industrial, and rural residential land uses mingle. Larger cities include Fort Wayne, Lafayette, Indianapolis, Muncie, Richmond, Dayton, and Columbus.

8.3 Southeastern USA Plains

8.3.1 Northern Piedmont

Location: This ecoregion lies between more mountainous regions to the west and coastal plains to the east, in northern New Jersey, southeast Pennsylvania, northern Delaware, central Maryland, and northern Virginia.
Climate: The ecoregion has a transitional climate, between mild, mid-latitude, humid subtropical to the south and severe mid-latitude to the north. It is marked by hot summers and mild to cold winters. The mean annual temperature is approximately 11°C. The frost-free period ranges from 160 to 230 days. The mean annual precipitation is 1,097 mm, ranging from 930 to 1,250 mm.
Vegetation: This region was once a predominantly Appalachian oak forest, as compared to the mostly oak-hickory-pine forests of the Piedmont ecoregion (8.3.4) to the southwest. Chestnut oak, white oak, red oak, hickories, ash, elm, and yellow-poplar occur, and eastern redcedar is common on abandoned farmland. Much of the natural vegetation has been removed.
Hydrology: Streams are mostly perennial, of low to moderate gradient. Some springs occur.
Terrain: The Northern Piedmont is a transitional region of low rounded hills, irregular plains, and open valleys in contrast to the low mountains of ecoregions 5.3.1, 8.4.1, and 8.4.4 to the north and west and the flatter coastal plains of ecoregions 8.3.5 and 8.5.1 to the east. It is mostly above the “fall line.” The region is underlain by a mix of metamorphic, igneous, and sedimentary rocks. Gabbro, granite, gneiss, schist, and slate are common and Triassic sandstone, shale, and conglomerate also occur. Some intrusive dikes and sills form relatively sharp low ridges. Elevations are mostly 100 m to 300 m but range to over 500 m. Soils are mostly Alfisols, Inceptisols, and some Ultisols, with a mesic soil temperature regime and udic soil moisture regime.
Wildlife: White-tailed deer, gray fox, red squirrel, raccoon, cottontail rabbit, mink, muskrat, ruffed grouse, meadowlark, field sparrow, and blue heron occur.
Land Use/Human Activities: Mostly agriculture and urban, suburban, and industrial uses prevail. The region now contains a higher proportion of cropland compared to the Piedmont (8.3.4). Feed and forage crops and soybeans are typical. Nurseries and horticultural products, and Christmas tree farms occupy some areas, as do woodlots and horse and hobby farms. Larger settlements include Paterson, Hackensac, Newark, Morristown, New Brunswick, Norristown, Lancaster, York, Gettysburg, Westminster, Frederick, Towson, Gaithersburg, Rockville, Manassas, Charlottesville, and western suburbs of Philadelphia, Wilmington, Baltimore, and Washington, DC.

8.3.2 Interior River Valleys and Hills

Location: Ecoregion 8.3.2 is located in the central part of the Mississippi basin where large rivers such as the Ohio and Missouri meet the Mississippi River. It spans southeast Iowa, southwestern and southern Illinois, eastern Missouri, southeastern Indiana, and western Kentucky.
Climate: Mostly, the ecoregion has a severe, mid-latitude, humid continental climate, marked by hot summers and cold winters. The mean annual temperature is approximately 10°C to 14°C. The frost-free period ranges from 170 to 220 days. The mean annual precipitation is 1,057 mm, ranging from 860 to 1,320 mm.

Vegetation: Bottomland deciduous forests and swamp forests were once extensive on poorly-drained, nearly level, lowland sites but most have been replaced by cropland and pastureland. Along the Mississippi were silver maple, American elm, and green ash, with pin oak, pecan, bur oak, sycamore, honey locust, hickories, and black walnut. Bottomland forests had pin oak, bur oak, Shumard oak, cherrybark oak, overcup oak, swamp white oak, and swamp chestnut oak, and sweetgum. Some upland forests contain mixed oak forests of post oak, southern red oak, white oak, black oak, and shagbark hickory, while mesic sites include beech, yellow-poplar, sugar maple, and northern red oak.
Hydrology: There are numerous perennial streams and rivers, low to moderate gradient. Silt and sand dominate lowland channels while upland streams are rockier. Streams typically have lower nutrient, alkalinity, and hardness levels than in ecoregion 8.3.3. Wetlands are common on lowlands and bottomlands. Some oxbow lakes and reservoirs are sited in the valleys.
Terrain: Many wide, flat-bottomed terraced valleys, valley slopes and river bluffs occur in this region. Illinois and Indiana contain dissected glacial till plains. The region is mostly underlain by Carboniferous period sedimentary rock and is lithologically distinct from the limestones, calcareous shales, and dolomites of the Interior Plateau (8.3.3) and the unconsolidated coastal plain sediments of the Mississippi Alluvial Plain (8.5.2). Broad, low gradient valleys occur and are filled with alluvium, loess, and lacustrine deposits. Alfisols and Mollisols are dominant, with mostly mesic soil temperatures and udic and aquic soil moisture regimes.
Wildlife: White-tailed deer, badger, weasel, raccoon, bobwhite quail, Carolina chickadee, redback salamander, copperbelly water snake, timber rattlesnake, eastern box turtle, snapping turtle, paddlefish, various darters are among the abundant wildlife that were native in this region.
Land Use/Human Activities: Less than half of this area is in cropland, about 30 percent is in pasture, and the remainder is in forest. Corn, soybeans, wheat, and hay are typical crops. There is some oil and gas production. In a few areas, extensive surface and underground coal mines occur and have significantly degraded downstream habitat and water quality, although underground coal mining probably peaked in this region about a century ago. Larger towns and cities include Moline, Rock Island, Galesburg, Quincy, Columbia, Jefferson City, St. Louis, Effingham, Cape Girardeau, Mt. Vernon, Carbondale, Marion, Terre Haute, Evansville, Owensboro, and Paducah.

8.3.3 Interior Plateau

Location: This is a diverse ecoregion extending from southern Indiana and Ohio into central Kentucky and Tennessee, and covering a portion of northern Alabama.
Climate: The ecoregion has mostly a mild, mid-latitude, humid subtropical climate, marked by hot summers and mild winters, with no pronounced dry season. The mean annual temperature ranges from approximately 12°C in the north to 16°C in the south. The frost-free period ranges from 160 to 220 days. The mean annual precipitation is 1,272 mm, ranging from 1,015 to 1,470 mm.
Vegetation: Natural vegetation is primarily oak-hickory forest, with some areas of bluestem prairie, cedar glades, and mixed mesophytic forest. White oak, northern red oak, black oak, hickories, yellow poplar, red maple, eastern red cedar are typical.
Hydrology: The perennial and intermittent streams here have mostly low to moderate gradients. The springs, lime sinks, caves, and hydrology contribute to this region's distinctive faunal distribution, including a diverse fish fauna. Large rivers include the Kentucky, Green, Cumberland, Duck, Elk, and Tennessee. Several large reservoirs are within the ecoregion.
Terrain: The region includes a variety of landforms, mostly rolling and irregular plains, karst plains, dissected plateaus and tablelands, open hills, and broad ridges, some steep slopes and ravines. Elevations range from 105 to 410 masl. Rock types are distinctly different from the coastal plain sediments and alluvial deposits to the west (8.3.5, 8.3.6, 8.5.2), and elevations and relief are lower than the Appalachian ecoregions (8.4.1, 8.4.2, 8.4.4, 8.4.9) to the east. Mississippian to Ordovician-age limestone, chert, sandstone, siltstone and shale are dominant rock types. Soils are mostly Ultisols and Alfisols with a thermic soil temperature regime, mesic to the north, and udic soil moisture regime.

Wildlife: Black bear, white-tailed deer, bobcat, gray fox, pine vole, cardinal, mockingbird, summer tanager, brown thrasher, snapping turtle, blackspot shiner, northern cavefish occur in the region.
Land Use/Human Activities: Land uses are a mix of forest, woodlots, pasture, and cropland with some expanding urban areas. Agricultural products include hay, cattle, cotton, corn, small grains, soybeans, and tobacco. Larger cities from north to south include Bloomington, Cincinnati, Louisville, Frankfort, Lexington, Bowling Green, Hopkinsville, Clarksville, Nashville, Murfreesboro, McMinnville, Columbia, Lawrenceburg, Florence, Huntsville, and Decatur.

8.3.4 Piedmont

Location: This ecoregion extends from Virginia in the north to Alabama in the south. It comprises a transitional area between the mostly mountainous ecological regions of the Appalachians to the northwest and the relatively flat coastal plain to the southeast. Its eastern border is the fall line, where erosion-resistant rocks give way to the sands and clays of the coastal plain.
Climate: The ecoregion has a mild, mid-latitude, humid subtropical climate. It has hot, humid summers and mild winters with little snow. The mean annual temperature is approximately 13°C in the north to 17°C in the south. The frost-free period ranges from 170 days to 250 days. The mean annual precipitation is 1,229 mm, ranging from 1,080 to 1,650 mm, and is fairly evenly distributed throughout the year.
Vegetation: The historic oak-hickory-pine forest was dominated by white oak, southern red oak, post oak, and hickory, with some shortleaf pine and loblolly pine.
Hydrology: There is a moderate to dense network of perennial streams and rivers, of generally moderate to low gradient. Stream drainage in the Piedmont tends to be perpendicular to the structural trend of the rocks across which they flow. Few natural lakes but numerous large reservoirs are to be found.
Terrain: The ecoregion's dominant landform is an erosional terrain of moderately dissected irregular plains with some hills, with a complex mosaic of Precambrian and Paleozoic metamorphic and igneous rocks. Most rocks of the Piedmont are covered by a thick mantle of saprolite, except along some major stream valley bluffs and on a few scattered granitic domes and flatrocks. Rare plants and animals are often found on the rock outcrops. The soils are mostly Ultisols and are generally finer-textured than those found in coastal plain regions with less sand and more clay.
Wildlife: Mammals include white-tailed deer, black bear, bobcat, gray fox, raccoon, gray squirrel, eastern chipmunk, pine vole. Birds include eastern wild turkey, northern cardinal, Carolina wren, wood thrush, tufted titmouse, prairie warbler, field sparrow. Herpetofauna includes eastern box turtle, common garter snake, copperhead, timber rattlesnake.
Land Use/Human Activities: Several major land cover transformations have occurred in the Piedmont over the past 200 years, from forest to farm, back to forest, and now in many areas, spreading urban- and suburbanization. Once largely cultivated with crops such as cotton, corn, tobacco and wheat, most of the Piedmont soils were moderately to severely eroded. Much of this region is now in planted pine or has reverted to successional pine and hardwood woodlands, with some pasture in the landcover mosaic. Larger cities include Lynchburg, Greensboro, Raleigh, Charlotte, Greenville, and Atlanta.

8.3.5 Southeastern Plains

Location: This region is an interior coastal plain that stretches from Maryland in the north to Mississippi and Louisiana in the south.
Climate: The ecoregion has a mild, mid-latitude, humid subtropical climate. It has hot, humid summers and mild winters. Mean annual temperatures range from 13°C in the north to 19°C in the south. The frost-free period ranges from 200 days in the north to 300 days in the south. The mean annual precipitation is 1,358 mm, and ranges from 1,140 to 1,520 mm. Precipitation is fairly evenly distributed throughout the year.
Vegetation: The natural vegetation was predominantly longleaf pine with smaller areas of oak-hickory-pine forest stands, and in the south, some southern mixed forest with beech, sweetgum, southern

magnolia, laurel and live oaks, and various pines. Floodplains include bottomland oaks, red maple, green ash, sweetgum, and American elm, and areas of bald cypress, pond cypress, and water tupelo.
Hydrology: There is a moderate to dense network of perennial streams and rivers, generally moderate to low gradient, often with sandy substrates. Few natural lakes but several large reservoirs are found.
Terrain: The predominant landform is of dissected, rolling to smooth plains. The Cretaceous or Tertiary period sands, silts, and clays of this region contrast geologically with the older metamorphic and igneous rocks of the Piedmont (8.3.4), and with the Paleozoic limestone, chert, and shale of the Interior Plateau (8.3.3). Elevations and relief are greater than in the Southern Coastal Plain (8.5.3) and Mississippi Alluvial Plain (8.5.2).
Wildlife: Mammals include white-tailed deer, black bear, bobcat, gray fox, raccoon, gray squirrel, swamp rabbit, eastern chipmunk, pine vole. Birds include eastern wild turkey, northern cardinal, Carolina wren, wood thrush, tufted titmouse, hooded warbler, summer tanager, herons, and egrets. Herpetofauna includes the American alligator, eastern box turtle, common garter snake, copperhead, eastern diamondback rattlesnake.
Land Use/Human Activities: The region presents a mosaic of cropland, pasture, woodland, and forestland cover. Large areas of pine plantations and successional pine and hardwood woodlands are found here. Agriculture includes corn, cotton, soybeans, peanuts, onions, sweet potatoes, melons, tobacco, poultry, and hogs. Cities include Richmond, Fayetteville, Columbia, Augusta, Columbus, Tallahassee, Montgomery, and Hattiesburg.

8.3.6 Mississippi Valley Loess Plains

Location: This region stretches from the Ohio River in western Kentucky south to Louisiana, running just to the east of the Mississippi River. A disjunct unit that includes Crowley's Ridge occurs west of the river in Arkansas and Missouri.
Climate: The ecoregion has a mild, mid-latitude, humid subtropical climate, marked by hot summers and mild winters. The mean annual temperature is approximately 14°C in the north and 20°C in the south. The frost-free period ranges from 200 to 290 days. The mean annual precipitation is 1,419 mm, from 1,140 mm in the north to 1,650 mm in the south.
Vegetation: In the more gently rolling plains portion to the east, upland forests are dominated by oaks, hickories, and both loblolly and shortleaf pine. To the west, in the more rugged Bluff Hills portion, oak-hickory forest, along with southern mesophytic forests that contain beech, maples, sweetgum, basswood, tulip poplar, southern magnolia, and American holly are found.
Hydrology: Streams are of low to moderate gradient, both perennial and intermittent, with sandy and silty substrates; there are few lakes.
Terrain: Irregular plains, with some gently rolling hills, and dissected hills, ridges, and bluffs near the Mississippi River compose the region's topography. The presence of thick deposits of loess is one of the distinguishing characteristics. The Bluff Hills in the western portion contain soils that are very deep, steep, silty, and erosive. Flatter topography is found to the east. Tertiary period deposits of sand, silt, and clay underlie the region. Alfisols, Inceptisols, Entisols, and Ultisols are dominant, with thermic soil temperatures and udic and some aquic soil moisture regimes.
Wildlife: White-tailed deer, red fox, raccoon, weasel, gray squirrel, wood thrush, Carolina wren, bobwhite quail, mourning dove, wild turkey, and bayou darter are found in the region.
Land Use/Human Activities: Agriculture is typical in the Kentucky and Tennessee portion of the region; while in Arkansas, Mississippi, and Louisiana there is a mosaic of forest, pine plantations, pasture, and cropland. Crops include soybeans, cotton, corn, wheat, and hay. There is some oil and gas production in the south. Larger towns and cities include Paragould, Jonesboro, Mayfield, Memphis, Holly Springs, Grenada, Vicksburg, Jackson, Brookhaven, McComb, and Baton Rouge.

8.3.7 South Central Plains

Location: The South Central Plains is a southern forest region covering northern and western Louisiana, southern Arkansas, east Texas, and southeastern Oklahoma.

Climate: The ecoregion has a mild, mid-latitude, humid subtropical climate, marked by hot summers and mild winters. The mean annual temperature is approximately 17°C in the north and 20°C in the south. The frost-free period ranges from 220 to 290 days. The mean annual precipitation is 1,282 mm, from 1,050 mm in the west to near 1,700 mm in the southeast.
Vegetation: The natural vegetation of the region's uplands was historically dominated by longleaf pine woodlands and savannas in the south, and shortleaf pine/hardwood forests in the north. Southern red oak, post oak, white oak, hickories, and loblolly pine were common, with small areas of beech and magnolia in the south. Southern floodplain forest of water oak, willow oak, swamp chestnut oak, sweetgum, blackgum, red maple, bald cypress and water tupelo typify bottomlands.
Hydrology: There is a high density of perennial streams, mostly of low to moderate gradient. Generally, the region lacks lakes, but some large reservoirs have been built.
Terrain: The terrain is mostly rolling plains that are broken by nearly flat fluvial terraces, bottomlands, sandy low hills, and low cuestas. Its terrain is unlike the flatter, less dissected Mississippi Alluvial Plain (8.5.2) or the Western Gulf Coastal Plain (9.5.1). Uplands are underlain mainly by poorly-consolidated Tertiary period coastal plain deposits, with some Cretaceous period geological formations in the north. Soils are mostly acidic sandy loams, silt loams, sands, and sandy clay loams. Alfisols and Ultisols are dominant, with a thermic soil temperature regime and udic or aquic soil moisture regime. Bottomlands and terraces are veneered with Quaternary period alluvium, terrace deposits, or loess. The lithologic mosaic is complex and distinct from the strictly Quaternary deposits of ecoregions 9.5.1 to the south and 8.5.2 to the east.
Wildlife: White-tailed deer, coyote, beaver, raccoon, muskrat, mink, river otter, swamp rabbit, cottontail rabbit, armadillo, mourning dove, red-cockaded woodpecker, white ibis, Mississippi kite, alligator, and Louisiana pine snake are distinctive fauna.
Land Use/Human Activities: The land is mostly in forests or woodland, with less than 20 percent in cropland. Commercial pine plantations are extensive. Timber production, livestock grazing, and oil and gas production are major land uses. Cropland dominates the leveed bottomlands of the Red River, with crops of cotton, corn, soybeans, rice, and pasture and hay land. Major towns and cities include Arkadelphia, Pine Bluff, Hope, Camden, Magnolia, El Dorado, Texarkana, Longview, Tyler, Nacogdoches, Lufkin, Shreveport, Minden, Ruston, Natchitoches, Alexandria, DeRidder, and Oakdale.

8.3.8 East Central Texas Plains

Location: Also called the Post Oak Savanna or the Claypan Area, this region occurs in east-central Texas, with a small portion extending just north of the Red River into southern Oklahoma.
Climate: The ecoregion has a mild, mid-latitude, humid subtropical climate, marked by hot summers and mild winters. The mean annual temperature ranges from approximately 17°C to 21°C. The frost-free period ranges from 230 to 300 days. The mean annual precipitation is 934 mm, ranging from 680 to 1,150 mm.
Vegetation: The land was originally covered by post oak savanna vegetation, in contrast to the more open prairie-type ecoregions to the north, south, and west, and the pine forests to the east. Oak savannas or oak-hickory forest stands with post oak, blackjack oak, black hickory, and grasses of little bluestem, purpletop, curly threeawn, and yellow Indiangrass. The forest understory is of yaupon, eastern red cedar, winged elm, American beautyberry, and farkleberry.
Hydrology: There is a low density of low to moderate gradient streams with sandy and some silty substrates. Few natural lakes are present, though there are some large reservoirs.
Terrain: The terrain is nearly level to rolling irregular plains, moderately dissected, and crossed by broad river systems. Soils are variable among the parallel ridges and valleys, but tend to be acidic, with sands and sandy loams on the uplands and clay to clay loams in low-lying areas. Alfisols and Vertisols are typical with a thermic soil temperature regime and udic and ustic soil moisture regimes. Many areas have a dense, underlying clay pan affecting water movement and available moisture for plant growth. The

geologic base is composed of Miocene, Oligocene, Eocene, and Paleocene epoch sands, silts, and clays with some Cretaceous sediments in the north.
Wildlife: White-tailed deer, javelina, coyote, ring-tail cat, raccoon, opossum, bobcat, armadillo, jackrabbit, cottontail rabbit, Cooper's hawk, mockingbird, scaled quail, white-winged dove, mourning dove, Texas horned lizard, Houston toad occur.
Land Use/Human Activities: Most of this region is now used for cattle production on pasture and range. Many pastured areas were formerly cultivated. Minor cropland areas grow hay, grain sorghum, corn, and wheat. Some open deciduous forest and woodland exists with some pine plantations along the eastern margin. Larger towns and cities include Paris, Clarksville, Sulphur Springs, Mt. Pleasant, Athens, Buffalo, Hearne, Bryan, College Station, Caldwell, Giddings, Bastrop, Luling, Gonzales, and Beeville.

8.4 Ozark, Ouachita-Appalachian Forests

8.4.1 Ridge and Valley

Location: This is a diverse ecoregion of long latitudinal stretch, sandwiched between generally higher, more rugged mountainous ecoregions 8.4.2, 8.4.4, and 8.4.9. It occurs in New York, Pennsylvania, Maryland, West Virginia, Virginia, Tennessee, Georgia, and Alabama.
Climate: The ecoregion has a humid continental climate, mild mid-latitude to the south, severe mid-latitude with cold winters to the north. Summers are hot and humid. The mean annual temperature varies from approximately 8°C in the north to 16°C in the south. The frost-free period ranges from 125 to 235 days. The mean annual precipitation is 1,138 mm, and ranges from 900 to 1,350 mm.
Vegetation: Generally, one finds Appalachian oak forest in the north, and oak-hickory-pine forest stands to the south.
Hydrology: Much of the drainage is in a trellised pattern, with small streams draining the ridge slopes, joining at right angles with larger, lower-gradient stream courses that meander along the parallel valley floors. The ecoregion has a diversity of aquatic habitats and species of fish. Springs and caves are relatively numerous and some large reservoirs in the south.
Terrain: This is a northeast-southwest trending region, relatively low-lying, with ridges, rolling valleys, and low irregular hills. As a result of extreme folding and faulting events, the region's roughly parallel ridges and valleys have a variety of widths, heights, and geologic materials, including limestone, dolomite, shale, siltstone, sandstone, chert, mudstone, and marble. Some ridges rise to 1,500 m in elevation. Ultisols and Inceptisols are typical, with mesic to thermic soil temperature regimes and udic soil moisture regimes.
Wildlife: White-tailed deer, black bear, bobcat, red fox, gray fox, raccoon, skunk, muskrat, mink, cottontail rabbit, eastern fox squirrel, bald eagle, wild turkey, bobwhite, red-eye vireo, cardinal, box turtle, timber rattlesnake, sculpins, minnows, and darters are present.
Land Use/Human Activities: The region is a mosaic of woodland, pasture, and cropland. Present-day forests still cover about 50 percent of the region. Some areas of pine plantations exist. Hay, pasture, and grain for beef and dairy cattle are common crops, along with some areas of corn, soybeans, tobacco, and cotton in the south. Areas of rural residential, urban, and industrial share the region. Larger cities include Scranton, Wilkes Barre, Reading, Harrisburg, and State College, in Pennsylvania; Hagerstown and Cumberland, in Maryland; Martinsburg, West Virginia; Winchester, Harrisonburg, Staunton, Roanoke, and Blacksburg, in Virginia; Johnson City, Knoxville, Oak Ridge, and Chattanooga, in Tennessee; Dalton and Rome, in Georgia; and Gadsden, Anniston, and Birmingham, in Alabama.

8.4.2 Central Appalachians

Location: The Central Appalachians ecoregion extends from central Pennsylvania through Maryland, West Virginia, Virginia, Kentucky, and into northern Tennessee. It is higher, cooler, steeper, more rugged, and more densely forested than the Western Allegheny Plateau (8.4.3) and the Interior Plateau (8.3.3) to the west.

Climate: The ecoregion has a severe, mid-latitude, humid continental climate, marked by warm to hot summers and cold winters. The mean annual temperature ranges from approximately 7°C in the north to 13°C in the south at lower elevations. The frost-free period ranges from 130 to 180 days. The mean annual precipitation is 1,180 mm, ranging from 980 to 1,500 mm.
Vegetation: The forest type in this region is a mostly mixed mesophytic forest, once dominated by the American chestnut, now with chestnut oak, red maple, white oak, black oak, beech, yellow-poplar, sugar maple, ash, basswood, buckeye, and hemlock. Some areas are of Appalachian oak forest, and others have more northern hardwood forests of maple, beech, birch, and hemlock. There are small areas of red spruce and hemlock at the highest elevations in the north-central portion of the region.
Hydrology: There is a high density of perennial, moderate- and high-gradient streams with bedrock and boulder substrates. Some waterfalls will be found. The region lacks lakes, but a few reservoirs occur.
Terrain: The terrain is rugged, with high hills and low mountains, steep, narrow ridges, narrow winding valleys, and deep coves. Relief varies from 150 m to 600 m. Primarily, much of the region is a highly dissected, rugged plateau composed of sandstone, shale, conglomerate, and coal from the Pennsylvanian period. Inceptisols and Ultisols are typical, with mostly mesic soil temperatures and udic soil moisture regimes.
Wildlife: Black bear, white-tailed deer, red fox, gray fox, bobcat, weasel, red squirrel, fox squirrel, big brown bat, wild turkey, ruffed grouse, blue jay, scarlet tanager, hermit thrush, tufted titmouse, box turtle, timber rattlesnake, sculpins, smallmouth bass, minnows and darters occur.
Land Use/Human Activities: Mostly forestland uses prevail, along with some small areas of pasture, livestock, or dairy operations. Surface and underground bituminous coal mines are common, reshaping ridges and hollows, and causing the siltation and acidification of many streams. Larger settlements include Johnstown and Somerset, in Pennsylvania; Kingwood, Summersville, Lewisburg, Beckley, and Princeton, in West Virginia; Pikeville, Hazard, and Middlesboro, in Kentucky; and Jellico, Tennessee.

8.4.3 Western Allegheny Plateau

Location: Southwest Pennsylvania, southeast Ohio, western West Virginia, and northeastern Kentucky compose the Western Allegheny Plateau.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate, marked by warm to hot summers and cold winters. The mean annual temperature is approximately 8°C in the north and 13°C in the south. The frost-free period ranges from 130 to 200 days. The mean annual precipitation is 1,063 mm, ranging from 900 to 1,150 mm.
Vegetation: The natural vegetation was mostly mixed mesophytic forest, in contrast with the oak–hickory forest stands of ecoregion 8.3.3 to the southwest, and the less diverse beech forest of ecoregion 8.2.4 to the west. Chestnut oak, red maple, white oak, black oak, beech, yellow-poplar, sugar maple, ash, basswood, buckeye, and hemlock occur. Appalachian oak forests are also found in the region.
Hydrology: There is a high density of perennial moderate- and high-gradient streams in the region. Mostly, it lacks lakes, but some reservoirs have been built. Nutrient and alkalinity levels are higher than in ecoregions 8.4.2 and 8.4.9 but are lower than in the carbonate-dominated, agriculturally intensive, and more populated portions of ecoregion 8.3.3.
Terrain: This area was unglaciated in the last Ice Age. It has the form of a dissected plateau and some rugged hills, underlain by horizontally bedded, often carboniferous, sedimentary rock. Its hills and ridges are more rugged than the limestone plains of ecoregion 8.3.3 to the west or the glaciated, till-covered plains of ecoregion 8.2.4 to the northwest. Maximum elevations and local relief are lower than in the Central Appalachians (8.4.2). Alfisols, Ultisols, and Inceptisols are typical, with a mesic soil temperature regime and udic soil moisture regime.
Wildlife: White-tailed deer, gray fox, woodchuck, gray squirrel, wild turkey, ruffed grouse, barred owl, pileated woodpecker, ovenbird, Kentucky warbler, northern water snake, dusky salamander are typical fauna.

Land Use/Human Activities: Mostly forested, the region's land uses feature some logging, some public national forest lands, areas of livestock and dairy farming, and some cropland with hay, corn, small grains, and some tobacco. Surface and underground coal mining is extensive, and has caused the sedimentation and acidification of many surface waters. Larger settlements include Butler, Pittsburgh, and Uniontown, Pennslyvania; Steubenville, Marietta, Athens, and Portsmouth, in Ohio; Wheeling, Morgantown, Fairmont, Clarksburg, Parkersburg, Charleston, and Huntington, in West Virginia; and Ashland and Morehead, in Kentucky.

8.4.4 Blue Ridge

Location: Adjacent to the Piedmont (8.3.4), the Blue Ridge ecoregion extends from southern Pennsylvania to northern Georgia.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate in the north, and mild, mid-latitude, humid subtropical climate in the south. It is marked by hot summers and cold to mild winters. The mean annual temperature is approximately 7°C at high elevations and 14°C in the southern low elevations. The frost-free period ranges from 130 to 210 days. The mean annual precipitation is 1,420 mm, ranging from 1,100 to 2,500 mm on high peaks to the south.
Vegetation: This region forms part of one of the richest temperate broadleaf forests in the world, with a high diversity of flora. It is mostly Appalachian oak forest, but a variety of oak, hemlock, cove hardwoods, and pine communities also occur within this forest type. Much of the forest land was once dominated by the American chestnut, an ecologically and economically important tree that provided food and shelter to many animal species and lumber for dwellings and fine furniture. The chestnut blight, introduced to the United States around 1904, had killed almost all of the chestnut trees by the 1930s. In place of the chestnut, other trees, such as tulip poplar, chestnut oak, white oak, black locust, red maple, and pine species have become important canopy dominants. At higher elevations, northern hardwoods of beech, yellow birch, yellow buckeye, and maples are typical. At the highest elevations, southeastern spruce-fir forests of Fraser fir, red spruce, yellow birch, and rhododendron are found.
Hydrology: The region features a high density of perennial, high gradient, cool, clear streams with bedrock and boulder substrates. It lacks lakes, but has a few large reservoirs.
Terrain: Terrain in the region varies from narrow ridges to hilly plateaus to more massive mountainous areas with high peaks reaching over 1,800 masl. Generally, one finds rugged terrain lying over primarily metamorphic bedrock (gneiss, schist, and quartzites). Minor areas of igneous and sedimentary geology also occur. Elevations range from 300 to 1,500 m, with Mount Mitchell, the highest point in the United States east of the Mississippi River, reaching 2,037 masl. Inceptisols and Ultisols are typical, with mesic soil temperatures and udic soil moisture regimes.
Wildlife: A region rich in fauna, one finds black bear, white-tailed deer, wild boar, bobcat, red squirrel, northern flying squirrel, cottontail rabbit, rock vole, wild turkey, raven, grouse, saw-whet owl, blackburnian warbler, brook trout, red-spotted newt, long-tailed salamander (one of the most diverse salamander populations in the world), many species of reptiles, thousands of species of invertebrates.
Land Use/Human Activities: Forest-related land uses occur along with some small areas of pasture and hay production, apple orchards, and Fraser fir Christmas tree farms. Recreation, tourism, and hunting are important activities. Some large areas of public lands that include national forests and national parks are present. Larger settlements include Mountain City, Erwin, and Gatlinburg, Tennessee; Boone, Asheville, Franklin, and Brevard, North Carolina; and Blue Ridge, Jasper, and Canton, Georgia.

8.4.5 Ozark Highlands

Location: This region covers a large portion of southern Missouri and northern Arkansas, and small portions of northeastern Oklahoma and southeastern Kansas.
Climate: The ecoregion is on the boundary between mild and severe mid-latitude climates, between humid continental and humid subtropical. It has hot summers and mild to severe winters with no pronounced dry season. The mean annual temperature ranges from approximately 12°C to 15°C and the

frost-free period ranges from 140 to 230 days. The mean annual precipitation is 1,101 mm, ranging from 965 to 1,244 mm. Some snowfall occurs in winter, but lasts only a few days.
Vegetation: Oak-hickory and oak-hickory-pine forest stands are typical. Some savannas and tallgrass prairies were once common in the vegetation mosaic. Post oak, blackjack oak, black oak, white oak, hickories, shortleaf pine, little bluestem, Indiangrass, big bluestem, eastern red cedar glades.
Hydrology: Numerous perennial and intermittent streams flow in the region, of low to moderate gradient, and mostly in a dendritic drainage pattern. There are numerous springs, few lakes, but some sinkhole ponds and several large reservoirs.
Terrain: The terrain here is more irregular in physiography than the adjacent regions, with the exception of the Boston Mountains (8.4.6) to the south. Mostly a dissected limestone plateau, the region has karst features, including caves, springs, and spring-fed streams. There are some steep, rocky hills, with elevations ranging from 80 to 560 masl, and some gently rolling plains. Limestone, chert, sandstone, and shale are common, with some small areas of igneous rocks in the east. Ultisols and Alfisols are typical with mesic and some thermic soil temperature regimes and udic soil moisture regimes.
Wildlife: White-tailed deer, coyote, bobcat, beaver, gray bat, wild turkey, eastern bluebird, bobwhite, warblers, collared lizard, many salamanders, Ozark cavefish occur in the region.
Land Use/Human Activities: Less than one-fourth of the core of this region has been cleared for pasture and cropland, but half or more of the periphery, while not as agricultural as bordering ecological regions, is in cropland and pasture. Livestock farming of cattle and hogs, poultry production, pasture and hay is common. Lead and zinc mining occurs. Forestry, recreation, rural residential, urban uses also occurs. There is some public national forest land. Larger towns and cities include Joplin, Springfield, Rolla, Farmington, Eminence, Poplar Bluff, West Plains, Tahlequah, Bentonville, Rogers, Springdale, Berryville, Harrison, Mountain Home, and Batesville.

8.4.6 Boston Mountains

Location: This region lies immediately north of the Arkansas Valley (8.4.7) and south of the Ozark Highlands (8.4.5) in northwestern Arkansas and northeastern Oklahoma.
Climate: The ecoregion has a mild, mid-latitude, humid subtropical climate marked by mild winters and hot summers, and with no pronounced dry season. The mean annual temperature is approximately 14°C. The frost-free period ranges from 180 to 235 days. The mean annual precipitation is 1,224 mm, ranging from 1,118 to 1,372 mm. Snowfall is uncommon.
Vegetation: Mostly oak-hickory forests are found here: red oak, white oak, post oak, blackjack oak, and hickories remain the dominant tree species in this region, although shortleaf pine and eastern red cedar are found in many of the lower areas and on some south- and west-facing slopes. Mesophytic forests in ravines and on north-facing slopes have sugar maple, beech, red oak, white oak, basswood, and hickory.
Hydrology: There is a high density of intermittent and perennial streams, of moderate to high gradient. There are fewer springs than in the Ozark Highlands (8.4.5) to the north.
Terrain: The region is a deeply dissected mountainous plateau, in contrast to the nearby Ouachita Mountains (8.4.8), which comprises folded and faulted linear ridges. Elevations range from 65 m to 853 m. Geology is mostly sandstone, shale, and siltstone from the Pennsylvanian period, in contrast to the limestone and dolomite of the adjacent Ozark Highlands (8.4.5). Ultisols and Inceptisols are common with a thermic soil temperature regime and udic soil moisture regime.
Wildlife: Black bear, white-tailed deer, coyote, red fox, gray fox, bobcat, beaver, skunk, mink, muskrat, gray squirrel, wild turkey, wood thrush, hooded warbler, box turtle, and many sensitive fish species occur.
Land Use/Human Activities: The region is sparsely populated and recreation and forestry are principal land uses, along with some livestock farming. Pasture and hayland occupies some flatter areas, along with a few peach and apple orchards. Some public national forest land occurs. Fayetteville, near the boundary with ecoregion 8.4.5, is the largest city.

8.4.7 Arkansas Valley

Location: This region lies in eastern Oklahoma and western Arkansas, just south of the Boston Mountains (8.4.6) and north of the Ouachita Mountains (8.4.8).
Climate: The ecoregion has a mild, mid-latitude, humid subtropical climate marked by mild winters and hot summers with no pronounced dry season. The mean annual temperature is approximately 15-17°C. The frost-free period ranges from 190 to 245 days. The mean annual precipitation is 1,160 mm, ranging from 1,040 to 1,575 mm.
Vegetation: Natural vegetation included oak savanna and oak-hickory-pine forests. Post oak, blackjack oak, southern red oak, hickory, shortleaf pine, some planted loblolly pine. Floodplains have bottomland oaks, sycamore, sweetgum, willow, eastern cottonwood, green ash, elm.
Hydrology: Moderate density of low to moderate gradient perennial streams and some intermittent streams. A few springs. Major rivers include the Canadian and the Arkansas. Several large reservoirs occur. Streams have considerably lower dissolved oxygen levels than those of most of the adjacent regions, and support different biological communities.
Terrain: Plains with hills, some open low mountains, and level to undulating floodplains and terraces. A region of valleys and ridges, the physiography is much less irregular than that of the Boston Mountains (8.4.6) to the north and the Ouachita Mountains (8.4.8) to the south, but more irregular than that of the ecological regions to the west and east. Elevations range from 75 to 839 m. Mostly, the rock and mineral formations are sandstone, shale, coal, and limestone from the Pennsylvanian period. Soils are mostly Ultisols and Inceptisols, with a thermic soil temperature regime and udic soil moisture regime.
Wildlife: White-tailed deer, coyote, bobcat, swamp rabbit, beaver, raccoon, armadillo, wild turkey, mourning dove, box turtle are examples of regional wildlife.
Land Use/Human Activities: Land uses include forestry, agriculture, farm pasture and woodlots, and livestock grazing. About one-fourth of the region is grazed and roughly one-tenth is cropland. Crops include soybeans, corn, grain sorghum, wheat, hay, and alfalfa, some orchards and vegetables, and poultry. There is some coal mining and natural gas production. Small areas of public national forest land are also present. Larger towns and cities include McAlester, Sallisaw, Poteau, Fort Smith, Waldron, Clarksville, Russellville, Morrilton, Conway, Heber Springs, and Searcy.

8.4.8 Ouachita Mountains

Location: The Ouachita Mountains lie in eastern Oklahoma and western Arkansas, just south of the Arkansas Valley (8.4.7).
Climate: The ecoregion has a mild, mid-latitude, humid subtropical climate. It is marked by mild winters and hot summers with no pronounced dry season. The mean annual temperature is approximately 15-17°C. The frost-free period ranges from 190 to 240 days. The mean annual precipitation 1,327 mm, ranging 1,090 to 1,675 mm. Snow is uncommon.
Vegetation: Once covered by oak-hickory-pine forests, most of this region is now in loblolly and shortleaf pine. The remaining hardwood forest species include southern red oak, black oak, post oak, white oak, and hickories
Hydrology: Numerous perennial streams flow in the region, mostly they are moderate to high-gradient. Several large reservoirs and some springs are in the region.
Terrain: Mostly featuring open high hills and low mountains, the region is made up of sharply defined east-west trending ridges, formed through erosion of compressed sedimentary rock formations. Narrow valleys are common. Elevations range from 88 to 820 m. The folded and faulted geology is mostly Paleozoic and Mesozoic sandstones and shales. Soils are Ultisols, Inceptisols, and Alfisols, with a thermic soil temperature regime and udic soil moisture regime.
Wildlife: Regional wildlife includes white-tailed deer, black bear, coyote, bobcat, gray fox, gray squirrel, muskrat, mink, eastern fox squirrel, pine vole, wild turkey, wood thrush, red-eyed vireo, Carolina wren, box turtle, timber rattlesnake, Fourche Mountain salamander, Ouachita madtom, and leopard darter.
Land Use/Human Activities: Commercial logging is the major land use in the region, along with woodland grazing, and some pasture and hayland. There is some broiler chicken production. Outdoor

recreation is increasing in importance. Public national forest land covers part of the region. Larger towns include Mena, Mt. Ida, Perryville, Hot Springs, and the western part of Little Rock.

8.4.9 Southwestern Appalachians

Location: This region occurs in Kentucky, Tennessee, Georgia, and Alabama.
Climate: The ecoregion has a mild, mid-latitude, humid subtropical climate, marked by hot humid summers and mild winters. The mean annual temperature is approximately 12°C in the north and 16°C in the south. The frost-free period ranges from 170 to 230 days. The mean annual precipitation is 1,447, ranging from 1,200 to 1,700 mm.
Vegetation: Upland forests are dominated by mixed oaks with shortleaf pine, and include white oak, southern red oak, and some hickories. Mixed mesophytic forests with maple, buckeye, beech, ash, basswood, sweetgum, and oaks are restricted mostly to the deeper ravines and escarpment slopes.
Hydrology: There is a moderate to high density of small and medium perennial streams, mostly moderate to high gradient, with waterfalls occurring along some escarpments. Some springs are found in the region. Natural lakes are rare, but some large reservoirs occur.
Terrain: There is some undulating and rolling tableland on the plateau surfaces, which are weakly to moderately dissected. In other places there are long, steep mountainsides with cliffs, ravines, and gorges as well as some moderate to highly dissected plateau surfaces that open to rugged hills; also, there is the long, narrow Sequatchie Valley. The eastern boundary of the ecoregion, along the more abrupt escarpment where it meets the Ridge and Valley ecoregion (8.4.1), is relatively smooth and only slightly notched by small, eastward-flowing streams. The western boundary, next to the Interior Plateau (8.3.3), is more crenulated, with a rougher escarpment that is more deeply incised. Ultisols and Inceptisols are typical, with mesic and thermic soil temperatures and udic soil moisture regimes.
Wildlife: White-tailed deer, black bear, bobcat, gray fox, raccoon, mink, gray squirrel, pine vole, big eared bat, wild turkey, bobwhite, mourning dove, red-eyed vireo, scarlet tanager, cardinal, hooded warbler, northern copperhead, timber rattlesnake, chorus frog, green salamander occur in the region.
Land Use/Human Activities: Mostly forest and woodland uses prevail, with some smaller areas of cropland and pasture. Soybeans, corn, hay, wheat, and tobacco are grown. Some areas in the south are devoted to poultry and egg production. Ecoregion 8.4.9 has less agriculture than the adjacent Interior Plateau (8.3.3). Coal mining occurs in several parts of the region. Larger settlements include London and Corbin, Kentucky; Oneida, Jamestown, Monterey, and Crossville, Tennessee; and Stevenson, Scottsboro, Albertville, Cullman, and Jasper, Alabama.

8.5 Mississippi Alluvial and Southeast USA Coastal Plains

8.5.1 Middle Atlantic Coastal Plain

Location: This ecoregion covers parts of the outer coastal plain, from southern New Jersey to the South Carolina/Georgia border.
Climate: The ecoregion has a mild, mid-latitude, humid subtropical climate, marked by hot, humid summers and mild winters. The mean annual temperature ranges from approximately 14°C in the north to 17°C in the south. The frost-free period ranges from 190 to 300 days. The mean annual precipitation is 1,229 mm, ranging from 1,020 to 1,420 mm.
Vegetation: Forest cover in the region was once dominated by longleaf pine, with more oak-hickory-pine to the north. It is now mostly loblolly and some shortleaf pine, with patches of oak, sweetgum, and cypress near major streams. On southern barrier islands, one finds some maritime forests of live oak, sand laurel oak, and loblolly pine. Cordgrass, saltgrass, and rushes grow in coastal marshes; beach grass and sea oats on dunes.
Hydrology: The region contains low gradient streams and rivers, numerous swamps, marshes, and estuaries, and a few large lakes. Carolina bays and pocosins occur in some areas.

Terrain: Low elevation flat plains, low terraces, dunes, barrier islands, and beaches are underlain by unconsolidated sediments. Poorly drained soils are common, and the region has a mix of coarse and finer textured soils. The terrain here is typically lower, flatter, less dissected, and more poorly drained, than in ecoregion 8.3.5 (Southeastern Plains) to the west. Ultisols, Entisols, and Histosols are dominant, with mostly thermic soil temperatures (some mesic in the north) and aquic and udic soil moisture regimes.
Wildlife: Black bear, white-tailed deer, bobcat, gray fox, raccoon, cottontail rabbit, gray squirrel, wild turkey, bobwhite, mourning dove, cormorants, herons, northern cardinal, prothonotary warbler, and box turtle occur in the region, with alligator in the south.
Land Use/Human Activities: Pine plantations for pulpwood and lumber are typical, with some areas of cropland, especially in the central and northern parts of the region. Crops include wheat, corn, soybeans, potatoes, cotton, blueberries, and peanuts. Chicken, turkey, and hog production has a high density in some areas. There is recreation and tourism along coastal strips. Larger cities from north to south include Wilmington, Dover, Salisbury, Norfolk, Virginia Beach, Elizabeth City, Greenville, New Bern, Jacksonville, Wilmington, and Myrtle Beach.

8.5.2 Mississippi Alluvial Plain

Location: This riverine ecoregion extends from southern Illinois, at the confluence of the Ohio River with the Mississippi River, south to the Gulf of Mexico.
Climate: The ecoregion has a mild, mid-latitude, humid subtropical climate. Winters are mild and summers are hot and humid, with temperatures and precipitation increasing from north to south. The mean annual temperature ranges from approximately 14°C in the north to 21°C in the south. The frost-free period ranges from 200 days in the north to 355 days near the Gulf of Mexico. The mean annual precipitation is 1,395 mm, ranging from 1,140 to 1,760 mm.
Vegetation: Bottomland deciduous forest covered the region before much of it was cleared for cultivation. It is one of the most altered ecoregions in the United States. Floodplain forest communities are affected by hydroperiod. River swamp forests contain baldcypress and water tupelo. Hardwood swamp forests include more water hickory, red maple, green ash, and river birch. Higher, seasonally flooded areas, add sweetgum, sycamore, laurel oak, Nuttall oak, and willow oak.
Hydrology: The Mississippi River watershed drains all or parts of thirty-one states, two Canadian provinces, and approximately 3,219,368 km^2 before the river finally reaches the Gulf. The ecoregion formerly contained one of the largest continuous wetland systems in North America. Now, however, extensive areas have been modified by channelization and navigation and flood control engineering. Streams are low gradient. Oxbow lakes and ponds occur.
Terrain: Terrain in this region is mostly a broad, flat alluvial plain with river terraces, swales, and levees providing the main elements of relief. Thick deposits of Pleistocene to Holocene sandy to clayey alluvium occur. Soils are typically finer-textured and more poorly drained than the upland soils of adjacent ecoregions 8.3.6 and 8.3.7, although there are some areas of coarser, better-drained soils. Alfisols, Vertisols, Inceptisols, and Entisols occur and have a thermic soil temperature regime, with some hyperthermic in the far south. Soil moisture regimes are aquic and udic.
Wildlife: The widespread loss of forest and wetland habitat has impacted wildlife and reduced bird populations, although it is still a major bird migration corridor. White-tailed deer, black bear, bobcat, gray fox, raccoon, swamp rabbit, migratory waterfowl, wild turkey, cormorants, egrets, herons, mourning dove, wood thrush, yellow-throated vireo, alligators, and “big river” species such as alligator gar and pallid sturgeon occur in this ecoregion.
Land Use/Human Activities: This region features extensive agricultural land use. Almost all the region is in cropland, with soybeans, cotton, corn, rice, wheat, pasture, and some sugarcane in the south. Catfish and crawfish are commercially produced in ponds. Larger settlements include Kennett, New Madrid, Blytheville, Clarksdale, Cleveland, Greenville, Yazoo City, Monroe, Morgan City, Houma, and New Orleans.

8.5.3 Southern Coastal Plain

Location: This ecoregion extends from South Carolina and Georgia through much of central Florida, and along the Gulf coast lowlands of the Florida Panhandle, Alabama, Mississippi, and eastern Louisiana.
Climate: The ecoregion has a mild, mid-latitude, humid subtropical climate, characterized by hot humid summers and warm to mild winters. The mean annual temperature is approximately 19° to 22°C. The frost-free period ranges from 280 to 360 days. The mean annual precipitation is 1,338 mm, ranging from 1,170 mm to 1,650 mm.
Vegetation: Once covered mainly by longleaf pine flatwoods and savannas, this ecoregion also had a variety of other communities that supported slash pine, pond pine, pond cypress, beech, sweetgum, southern magnolia, white oak, and laurel oak forest. Southern floodplain forests with bald cypress, pond cypress, water tupelo, bottomland oaks, sweetgum, green ash, water hickory.
Hydrology: Numerous low-gradient, perennial streams and large rivers, wetlands, and lakes are found here.
Terrain: Mostly consisting of flat plains, the region also includes barrier islands, coastal lagoons, marshes, and swampy lowlands along the Gulf and Atlantic coasts. In Florida, an area of more rolling discontinuous highlands contains numerous lakes. This ecoregion is lower in elevation with less relief and wetter soils than the Southeastern Plains (8.3.5) ecoregion to the north. Ultisols, Spodosols, and Entisols are common, with thermic and hyperthermic soil temperature regimes and aquic and some udic soil moisture regimes.
Wildlife: Black bear, white-tailed deer, bobcat, marsh rabbit, fox squirrel, manatee, egret, blue heron, red-cockaded woodpecker, indigo bunting, Florida scrub jay, box turtle, gopher tortoise, southern dusky salamander, scrub lizard, cottonmouth, and alligator will be found here.
Land Use/Human Activities: Pine plantations and forestry, pasture for beef cattle, citrus groves, tourism and recreation, and fish and shellfish production are major land uses. Some large areas of urban, suburban, and industrial uses coexist. Larger cities from north to south include Georgetown, Charleston, Savannah, Waycross, Brunswick, Jacksonville, Hammond, Slidell, Gulfport, Biloxi, Pascagoula, Mobile, Pensacola, Gainesville, Ocala, Orlando, Tampa, St. Petersburg, and Fort Myers.

8.5.4 Atlantic Coastal Pine Barrens

Location: This region includes the Pine Barrens area of New Jersey, Long Island, New York, and Cape Cod and nearby islands in Massachusetts.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate, moderated by maritime influences. It is marked by hot summers and cold winters. The mean annual temperature is approximately 11°C. The frost-free period ranges from 190 to 225 days. The mean annual precipitation is 1,141 mm, and is fairly evenly distributed throughout the year. The climate is milder than the Northeastern Coastal Zone ecoregion (8.1.7) to the north, with its Appalachian oak and northern hardwood forests, and cooler than the coastal region (8.5.1) to the south.
Vegetation: Vegetation here mostly consists of pine-oak forest stands, with pitch pine, scarlet oak, black oak; also some shortleaf pine and chestnut oak. In inland areas, historically occurred some mixed oak forests, with white and black oaks, American beech, pignut and mockernut hickories, black walnut, tulip tree, and red maple. Most of this has been cleared. Some Atlantic white cedar swamps occur. Near the coast, there are dune woodlands composed of American holly, black cherry, red cedar, red maple, pitch pine, hackberry, and sassafras. Some low, shrub thickets of bayberry, beach plum, shadbush, and highbush blueberry are found. On outer dunes, there is a sparse cover of dune grass, sea rocket, dusty miller, saltwort, and seaside spurge. The region represents the northern limit for many southern plant species.
Hydrology: A few perennial streams occur, as well as numerous lakes on Cape Cod, some swamps to the south, bogs, and salt and freshwater marshes.

Terrain: The ecoregion is not as flat as that of the Middle Atlantic Coastal Plain (8.5.1), but it is not as irregular as that of the Northeastern Coastal Zone (8.1.7). Elevation and relief is generally less than 60 m. The region has mostly Quaternary and Tertiary sediments with some Cretaceous geology in the inner coastal plain of New Jersey. Terminal moraines, outwash plains, and coastal deposits have been reshaped by wind and water. Deep deposits of gravel, sand, silt, and clay are typical. Sandy beaches, dunes, bays, barrier islands, and marshes occur. Entisols and some Ultisols are typical soils, with mesic soil temperatures and udic soil moisture regimes.
Wildlife: White-tailed deer, fox, raccoon, cottontail rabbit, gray squirrel, pheasant, bobwhite quail, piping plover, black skimmer, least tern, loggerhead turtle occur.
Land Use/Human Activities: Large areas are dominated by urban and suburban development and transportation infrastructure. In the Pine Barrens of New Jersey, one finds some forestry, cranberries, highbush blueberries, and residential developments. Agricultural areas are devoted to corn, wheat, soybeans, vegetables, dairy, and poultry farming. Tourism and recreation is important. Larger settlements include Plymouth, Falmouth, Barnstable, Dennis, Chatham, Nantucket, Riverhead, Islip, Brentwood, Leavittown, Long Beach, Brooklyn, Queens, Trenton, Vineland, and Atlantic City.

9.0 Great Plains

9.2 Temperate Prairies

*9.2.1 Aspen Parkland/Northern Glaciated Plains

Location: This region extends in an arc-like manner from Calgary, Alberta, across Saskatchewan and southwestern Manitoba, and south into North Dakota, South Dakota, and a small portion of western Minnesota.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate, bordering in places on a dry mid-latitude steppe climate. It is marked by short, warm summers and long, cold winters, with nearly continuous snow cover to the north. The mean annual temperature varies from approximately 1.5°C in the north to 8°C in the south. The mean summer temperature ranges from 15°C in the north to 19°C in the south, and mean winter temperatures are -12.5°C in the north and -4°C in the south. The mean annual precipitation ranges from 400 to 610 mm. The frost-free period ranges from 90 to 150 days.
Vegetation: Most of the region is now farmland but in its native state, the landscape was characterized by trembling aspen, oak groves, mixed tall shrubs, and intermittent fescue grasslands. Bur oak and grassland communities occupied drier sites. Many areas had transitional grassland containing tallgrass and shortgrass prairie, including big and little bluestem, green needlegrass, blue grama, western wheatgrass, and switchgrass.
Hydrology: There is a low density of streams and rivers across the area. High concentrations of temporary and seasonal wetlands create favorable conditions for waterfowl nesting and migration.
Terrain: The region features flat to gently rolling plains composed of glacial moraine. There are areas of lacustrine and hummocky to ridged fluvioglacial deposits; the typical bedrock is composed of Tertiary and Cretaceous sandstones and shales. Soils are very fertile; Mollisols are common, with mostly frigid soil temperature regimes and udic and aquic soil moisture regimes.
Wildlife: There are major habitats in the region for waterfowl. It provides a major breeding habitat for waterfowl and includes habitat for white-tailed deer, coyote, snowshoe hare, cottontail, red fox, northern pocket gopher, Franklin's ground squirrel, and bird species like sharp-tailed grouse and black-billed magpie.
Land Use/Human Activities: This region represents some of the most productive agricultural lands in the Prairies. It produces a wide diversity of crops, including spring wheat, flax, rye, barley, oats, corn, soybeans, and sunflowers, as well as forages and several specialty crops. However, agricultural success is subject to annual climatic fluctuations. Large cities and communities include Calgary, Edmonton, Brandon, Minot, Jamestown, Aberdeen, Watertown, Brookings, Huron, and Yankton.

*9.2.2 Lake Manitoba and Lake Agassiz Plain

Location: This ecoregion stretches southeastward from the Dauphin Lake area in Manitoba to south of the Fargo area in North Dakota and to Minnesota.

Climate: The ecoregion has a severe, mid-latitude, humid continental climate, marked by warm summers and cold winters. It is one of Canada's most humid and warm prairie regions, although one of the coldest for the Great Plains of the United States. The mean annual temperature ranges from approximately 2°C in the north to 6°C in the south. The mean summer temperature is about 17°C, and the mean winter temperature is approximately -10°C. The frost-free period ranges from 95 to 145 days. The mean annual precipitation is 560 mm, with a range of 450-700 mm. Most of the precipitation falls during growing season thunderstorms.

Vegetation: In the north, transitional boreal forest occurred, with some aspen parkland to the south. The Canadian portion is a mosaic of trembling aspen/oak groves and rough fescue grasslands. In the United States, riparian areas have cottonwood, willow, bur oak, green ash, and elm. The historic tallgrass prairie has been replaced by intensive row crop agriculture.

Hydrology: Low density, low-gradient stream and river networks cross the area and are part of the Red River watershed; late winter flooding is common. In some areas, ditching and channelization has been done.

Terrain: The terrain is characterized by flat to low rolling plains with elevations ranging from about 410 to 218 m. Moraine and lacustrine deposits cover this low-relief area; calcareous glacial till occurs in the north. The glacial Lake Agassiz was the last in a series of proglacial lakes to fill the Red River valley in the three million years since the beginning of the Pleistocene. Thick beds of lake sediments on top of glacial till create the extremely flat floor of the Lake Agassiz Plain. Mollisols and Vertisols soils are typical, with a frigid soil temperature regime and aquic and udic soil moisture regime.

Wildlife: Wildlife in the region includes significant waterfowl, as well as white-tailed deer, coyote, red fox, jackrabbit, cottontail rabbit, raccoon, muskrat, sharp-tailed grouse, ring-tail pheasant, geese, ducks, perch, walleye, and ground squirrel.

Land Use/Human Activities: Cropland is extensive, with potatoes, beans, sugar beets, wheat, spring wheat, barley, canola, sunflowers, corn, and soybeans. Some hunting and water-oriented recreation are also significant land uses. Major communities include Winnipeg, Portage la Prairie, Emerson, Dauphin, Grand Forks, and Fargo.

9.2.3 Western Corn Belt Plains

Location: The Western Corn Belt Plains stretches across southern Minnesota, most of central and western Iowa, eastern South Dakota, eastern Nebraska, northwest Missouri, and northeast Kansas.

Climate: The ecoregion has a severe, mid-latitude, humid continental climate, marked by hot summers and cold winters. The mean annual temperature is approximately 6°C in the north to 12°C in the south. The frost-free period ranges from 140 to 200 days. The mean annual precipitation is 800 mm, ranging between 610 and 1,000 mm and occurring mainly in the growing season.

Vegetation: Once a tallgrass prairie covered with little bluestem, big bluestem, Indiangrass, switchgrass, numerous forbs, and with small areas of bur oak and oak-hickory woodlands, the region has nearly all been converted to agricultural land.

Hydrology: There are intermittent and perennial streams, many of which have been channelized. A few areas have natural lakes. Surface and groundwater contamination from fertilizer and pesticide applications as well as from concentrated livestock production is a regional issue.

Terrain: The topography consists of nearly level to gently rolling glaciated till plains and hilly loess plains. Thick loess and glacial till cover the Mesozoic and Paleozoic shale, sandstone, and limestone. Mollisols and Alfisols are dominant with mesic soil temperatures and udic soil moisture.

Wildlife: Regional wildlife includes white-tailed deer, beaver, raccoon, red-tailed hawk, barn owl, bobwhite quail, western meadowlark, Canada goose, pheasant, gray partridge, mallard, teal, Great Plains toad, walleye, northern pike, bluegill, sunfish.
Land Use/Human Activities: Over 75 percent of the Western Corn Belt Plains is now used for cropland agriculture and much of the remainder is in forage for livestock. It is one of the most productive areas in the world for growing corn and soybeans. Hog and cattle production and some dairies also occur. Larger towns and cities include Mankato, Worthington, Albert Lea, Austin, Sioux Falls, Sioux City, Fort Dodge, Mason City, Ames, Des Moines, Marshalltown, Waterloo, Cedar Falls, Cedar Rapids, Iowa City, Omaha, Council Bluffs, Lincoln, Atchison, Maryville, and St. Joseph.

9.2.4 Central Irregular Plains

Location: This ecoregion spans southern Iowa, northern and western Missouri, eastern Kansas, and northeastern Oklahoma.
Climate: The ecoregion has a severe, mid-latitude, humid continental climate in the north and a milder humid subtropical climate to the south. It is marked by hot summers and mild to cold winters. The mean annual temperature is approximately 10°C to 16°C, with a frost-free period of between 165 and 235 days. The mean annual precipitation is 983 mm, ranging from 865 to 1,145 mm. Most of the rain falls during the growing season though there is snow in winter.
Vegetation: The historical vegetation is a grassland/forest mosaic with wider forested strips along the streams, compared to ecoregion 9.2.3 to the north. The grassland was an allgrass prairie with little bluestem, big bluestem, switchgrass, and Indiangrass, and the forests are oak-hickory woodlands with red oak, white oak, bur oak, chinkapin oak, post oak, shagbark hickory, and bitternut hickory.
Hydrology: Perennial streams are common; in some areas many are channelized. Some large rivers cross the region. A few large reservoirs occur. Groundwater is highly mineralized in some areas.
Terrain: Rolling and irregular plains are common in this area, with some cuestas and low hills: topographically it is more irregular than the Western Corn Belt Plains (9.2.3) to the north, The region, however, is less irregular than the ecoregions to the south and east. Geology is mostly Pennsylvanian period sandstone, shale, limestone, and coal. Loess overlies clayey glacial drift in the north; Mollisols and Alfisols are typical, with mesic and thermic soil temperatures and udic and aquic soil moisture regimes.
Wildlife: White-tailed deer, badger, raccoon, skunk, muskrat, cottontail rabbit, mink, Canada geese, bobwhite quail, western meadowlark, ring-neck pheasant.
Land Use/Human Activities: The region presents a mosaic of land uses, with cropland, woodland, and grassland. Agriculture here includes the production of corn, soybeans, wheat, alfalfa, hay, grain sorghum, cattle, and broiler chickens. There is some oil and gas production and mining of high-sulfur bituminous coal occurs, although less now than formerly. The disturbance of coal strata in southern Iowa and northern Missouri has degraded water quality and affected aquatic biota. Larger towns and cities include Ottumwa, Kirksville, Mexico, Warrensburg, Topeka, Lawrence, Fort Scott, Independence, Miami, Claremore, Tulsa, Broken Arrow, and Muskogee.

9.3. West Central Semi-Arid Prairies

*9.3.1 Northwestern Glaciated Plains

Location: From Saskatoon and Calgary in the north, the region covers portions of southwestern Saskatchewan, southeastern Alberta, northern Montana, all along the Missouri River in the central Dakotas, and a small portion of northern Nebraska.
Climate: The ecoregion has mostly a dry, mid-latitude steppe climate. It is marked by warm to hot summers and cold winters. The mean annual temperatures range from 2.5°C in the north to 7°C in the south. The mean summer temperatures are 15.5°C to 16°C and the mean winter temperatures are -10°C to -11°C. The frost-free period ranges from 95 days to 170 days. The mean annual precipitation ranges from 250 to 350 mm in drier areas and from 350 to 550 mm in moist areas.

Vegetation: Spear grass, blue grama grass, and wheat grass were once dominant native grasses that covered many parts of the landscape. A variety of shrubs and herbs were also common as well as some sagebrush. On the driest sites yellow cactus and prickly pear can be found. Scrubby aspen, willow, cottonwood, and box elder occur to a limited extent on shaded slopes of valleys and river terraces. Local saline areas support alkali grass, wild barley, greasewood, red sampire, and sea blite.
Hydrology: Streams in the region are mostly intermittent, though some are perennial, and there are some larger rivers. The region is drained by the Missouri River system to the south and to the north by the South Saskatchewan River. In some areas, a high concentration of semi-permanent and seasonal wetlands can be found, locally referred to as Prairie Potholes.
Terrain: This is a transitional region between the generally more level, moister, more agricultural Northern Glaciated Plains (9.2.1) to the east and the generally more irregular, dryer, Northwestern Great Plains (9.3.3) to the south and southwest. The western and southwestern boundary in the US portion roughly coincides with the limits of continental glaciation. The rolling hills and gentle plains are mantled almost entirely by moraine, outwash, and glaciolacustrine sediments. Mollisols and some Entisols soils are common, with frigid soil temperature regimes, mesic in the south, and ustic soil moisture regimes.
Wildlife: White-tailed deer, pronghorn antelope, bobcat, jackrabbit, sage grouse, short-horned lizard, western diamondback rattlesnake, coyote, ground squirrel, prairie dog, golden eagle, ferruginous hawk, and lark bunting are common species in the region.
Land Use/Human Activities: Land uses include rangeland for cattle grazing, and some cropland. The production of spring wheat and other cereal grains occurs by employing a grain-fallow rotation. Oilseed crops are also important. Waterfowl hunting is common, and recreation is important around several large reservoirs. Major communities include Lethbridge, Saskatoon, Moose Jaw, Regina, Medicine Hat, Swift Current, Great Falls, Bismarck, Havre, Mobridge, and O'Neill.

9.3.3 Northwestern Great Plains

Location: This region encompasses the Missouri Plateau section of the Great Plains in southeastern Montana, northeastern Wyoming, and the western portion of the Dakotas.
Climate: The ecoregion has a dry mid-latitude steppe climate. It is marked by hot summers and cold winters with a mean annual temperature of approximately 5°C in some northern areas rising to 8.5°C in the south. The frost-free period ranges from 90 days to 155 days. The mean annual precipitation is 393 mm, ranging from 250 to 510 mm.
Vegetation: Grasslands persist in rangeland areas, especially on broken topography, but have been replaced by cropland on some areas of level ground. Shortgrass and mixedgrass prairies contain blue grama, western wheatgrass, green needlegrass, prairie sandreed, and buffalograss. There are areas of sagebrush steppe with fringed sage, Wyoming big sagebrush, rabbitbrush, and sand sagebrush; some areas have scattered ponderosa pine and Rocky Mountain juniper.
Hydrology: Mostly ephemeral and intermittent streams are found here, with a few larger perennial rivers that cross the region from the western mountains. Many small impoundments occur, and there are some large reservoirs on the Missouri River.
Terrain: The region is an unglaciated, rolling plain of shale and sandstone punctuated by occasional buttes. Some areas are of dissected, badland terrain and river breaks. Entisols, Mollisols, Aridisols, and Inceptisols occur. Frigid and mesic soil temperature regimes and ustic and aridic soil moisture regimes are typical.
Wildlife: White-tailed deer, pronghorn antelope, bobcat, cougar, prairie dog, jackrabbit, golden eagle, ferruginous hawk, meadowlark, sage grouse, sage thrasher, northern pintail, prairie rattlesnake are common species.
Land Use/Human Activities: The region's grassland and shrubland are used for livestock grazing, mostly of cattle and sheep. Agriculture is restricted by the erratic precipitation and limited opportunities for irrigation. Some areas grow wheat, alfalfa, and barley. A few areas are used for coal mining. Larger

settlements include Billings, Lewiston, Livingston, Miles City, Dickinson, Mandan, Belle Fourche, Pierre, Rapid City, Sheridan, Gillette, and Casper.

9.3.4 Nebraska Sand Hills

Location: The Nebraska Sandhills of north-central and northwestern Nebraska, in the heart of the Great Plains, comprise one of the most distinct and homogenous ecoregions in North America.
Climate: The ecoregion has a dry, mid-latitude steppe climate, marked by hot summers and cold winters. The mean annual temperature is approximately 9°C. The frost-free period ranges from 130 to 155 days. The mean annual precipitation is 518 mm, ranging from 440 to 580 mm.
Vegetation: One of the largest areas of grass-stabilized sand dunes in the world, this region is mostly treeless except for some riparian areas in the north and east. Mid and tallgrass prairie communities include little bluestem, sand bluestem, prairie sandreed, needle-and-thread grass, sand lovegrass, blue grama, and hairy grama. In alkaline wetlands are found alkali sacaton, alkaline bulrush, and inland saltgrass.
Hydrology: Large portions of this ecoregion contain numerous lakes and wetlands and have a lack of streams. A few large streams or small rivers cross the region, including the Niobrara, North and Middle Loup, Dismal, Calamus, and Elkhorn. Groundwater resources are important. The Nebraska Sand Hills are a major recharge area for the Ogallala Aquifer.
Terrain: The predominant terrain is of rolling to steep, irregular sand dunes, some gently sloping valleys. Tertiary sandstones and conglomerates are deeply covered by Quaternary aeolian sand and some loess. Elevations range from 580 to 1,250 m. Entisols and Mollisols are typical, with mesic soil temperature regimes and ustic, aridic, and aquic soil moisture regimes.
Wildlife: Historically, bison and wolves were important mammalian species. Today, one finds mule deer, white-tailed deer, and pronghorn occur, along with bobcat, red fox, cottontail and jackrabbits, prairie dogs, upland sandpiper, western meadowlark, greater prairie-chicken, and blue-wing teal.
Land Use/Human Activities: In contrast to some adjacent regions, the Nebraska Sand Hills are generally devoid of cropland agriculture. Large ranches occupy the region, with livestock grazing a primary activity. A few small valleys have irrigated corn or hay crops. The human population is low. Small settlements include Ainsworth, Mullen, Thedford and Valentine.

9.4 South Central Semi-Arid Prairies

9.4.1 High Plains

Location: This region covers a large latitudinal extent, from southeastern Wyoming, western Nebraska, eastern Colorado, western Kansas, through the panhandles of Oklahoma and Texas, and into eastern New Mexico.
Climate: The ecoregion has a dry mid-latitude steppe climate. It is drier than the Central Great Plains (region 9.4.2) to the east, and is marked by hot summers and cold winters. The mean annual temperature varies by latitude, from approximately 8°C in the north to 17°C in the far south. The frost-free period ranges from 120 to 230 days. The mean annual precipitation is 433 mm, and ranges from 305 to 530 mm.
Vegetation: Historically, the region had mostly short and midgrass prairie vegetation; much of it is now greatly altered. Shortgrass prairie featured blue grama, buffalograss, and fringed sage, and mixed grass areas had sideoats grama, western wheatgrass, and little bluestem. Sandsage prairies had sand sagebrush, sand bluestem, prairie sandreed, little bluestem, Indian ricegrass, and sand dropseed. Shinnery sands areas in the south featured Havard shin oak, fourwing saltbush, sand sagebrush, yucca, and mid- and shortgrasses.
Hydrology: Mostly intermittent and ephemeral streams prevail here. A few larger rivers that originate in the Southern Rockies (6.2.14) cross the region, such as the Platte, Arkansas, and Cimarron. The southern portion has few to no streams. Surface water there occurs in numerous ephemeral pools or playas. These serve as recharge areas for the important Ogallala Aquifer. Water withdrawals from the aquifer usually exceed recharge, however.

Terrain: The region's landforms are mostly smooth to slightly irregular plains. In the southern portion, there is a distinct, elevated plateau, also known as the Llano Estacado. Elevations throughout the region range from 725 to 2,035 m. The terrain is mostly Tertiary and Cretaceous sandstones, siltstones, claystones, and caliche layers. Mollisols, Alfisols, Entisols, and Aridisols occur, with mesic and thermic soil temperature regimes, and ustic and aridic soil moisture regimes.
Wildlife: Bison, black-tailed prairie dogs, black-footed ferrets, gray wolf, and cougar were once prominent wildlife elements. Now, some pronghorn, coyote, swift fox, jackrabbit, cottontail rabbit, ferruginous hawk, lesser prairie-chickens are found. Numerous waterfowl on the Central Flyway of the continent depend on the playa lake habitats.
Land Use/Human Activities: Cropland and grazing land are the principal land uses. The northern boundary of this ecological region is the approximate northern limit of winter wheat and sorghum and the southern limit of spring wheat. In the south, some cotton, corn, winter wheat, grain sorghum, cattle feedlots. Oil and gas production occurs in many areas of the region. Larger cities and towns include Torrington, Cheyenne, Fort Collins, Loveland, Denver, Aurora, Scottsbluff, Sidney, Garden City, Liberal, Clovis, Portales, Lovington, Hobbs, Amarillo, Lubbock, Midland, and Odessa.

9.4.2 Central Great Plains

Location: Lying across central Nebraska, Kansas, Oklahoma, and north-central Texas, this is a transitional prairie region between the tallgrass regions to the east and the shortgrass regions to the west.
Climate: The ecoregion borders different climate zones: severe to mild, mid-latitude climates north to south and more humid to dry steppe climates from east to west. It is marked by hot summers and mild to severe winters. The mean annual temperature ranges from approximately 10°C in the north to 18°C in the south. The frost-free period ranges from a low of 150 days in the north to 240 days in the south. The mean annual precipitation is 658 mm, ranging from 455 to 940 mm.
Vegetation: Once a transitional, mostly mixed-grass prairie, with some scattered low trees and shrubs in the south, much of this ecological region is now cropland. Little bluestem, big bluestem, sideoats grama, blue grama, Indiangrass, sand bluestem, sand dropseed were typical. To the south are Texas wintergrass, buffalograss, white tridens, along with some honey mesquite, lotebush, sand sagebrush, and yucca.
Hydrology: Mostly intermittent and a few perennial streams are found here. Some larger rivers cross the region, typically with braided, sandy channels, and often turbid water. Some springs occur but few natural lakes.
Terrain: Nearly level to irregular plains, broad alluvial valleys, and some more hilly, dissected plains are the typical terrain. The region features slightly lower elevations and is somewhat more irregular than the High Plains (region 9.4.1) to the west. Cretaceous limestone and shale, and Tertiary sandstone are found in the north; to the south are Permian shale, sandstone, gypsum, and dolomite. Mollisols, Entisols, and Alfisols are dominant, with some Vertisols in the south. There are mostly thermic soil temperature regimes, mesic in the north, and ustic soil moisture regimes.
Wildlife: Bison, wolves, black-tailed prairie dogs, and black-footed ferret were once common. Today, white-tailed deer, mule deer, pronghorn, coyote, jackrabbit, cottontail rabbit, plains pocket mouse, sandhill crane, burrowing owl, prairie falcon, lark sparrow, and the Great Plains toad are the common species.
Land Use/Human Activities: The region's land uses are dominated by dryland and irrigated cropland. Some pastureland and rangeland also occur. The eastern boundary of the region marks the eastern limits of the major winter wheat growing area of the United States. Other crops include corn, grain sorghum, alfalfa, and cotton. Oil and gas production also occurs. Larger towns and cities include North Platte, Kearney, Grand Island, Columbus, Hastings, Hays, Salina, McPherson, Hutchinson, Wichita, Ponca City, Stillwater, Oklahoma City, Norman, Lawton, Wichita Falls, Abilene, and San Angelo.

9.4.3 Southwestern Tablelands

Location: Lying mostly between the High Plains (9.4.1) and the Southern Rockies (6.2.14), this region covers parts of southeastern Colorado, eastern New Mexico, the panhandles of Texas and Oklahoma, with a small area in southwest Kansas.

Climate: The ecoregion has a dry mid-latitude steppe climate, marked by hot summers and cool winters. The mean annual temperature is approximately 9°C to 15°C. The frost-free period ranges from 90 to 200 days. The mean annual precipitation is 448 mm, ranging from 255 to 710 m.

Vegetation: Mostly, the region's vegetation is that of the shortgrass and some midgrass prairie, with blue grama, black grama, sideoats grama, sand dropseed, threeawns, little bluestem, western wheatgrass, buffalograss, galleta, and alkali sacaton, with some sand sagebrush, yucca, and cholla. Some sandy areas have Havard shin oak, fourwing saltbush, sand bluestem, and big sandreed. There are also areas of pinyon pine, Rocky Mountain juniper and oneseed juniper, scrub oaks, and some escarpments with redberry juniper, skunkbush sumac, mountain mahogany. Riparian woodlands have cottonwood, willow, elm, and hackberry.

Hydrology: Water is generally scarce; streams are mostly ephemeral and intermittent. A few perennial rivers cross the region that originate in the Southern Rockies, i.e., the Arkansas, Canadian, and Pecos.

Terrain: There are elevated tablelands with red-hued canyons, mesas, badlands, gorges, and dissected river breaks in a topography that is mostly broad, rolling plains, piedmonts, and flat plains. Elevations range from 350 to 2,650 m. It is generally more rugged than ecoregions 9.4.1 or 9.4.2 of the Great Plains. Areas are mantled with loess, windblown sand, alluvium, or colluvium. Alfisols, Entisols, Aridisols, and Mollisols occur. Mesic soil temperature regimes occur in the north and thermic to the south, with mostly ustic or aridic soil moisture regimes.

Wildlife: Historically, bison, wolves, prairie dog, and black-footed ferret were dominant here. Currently, mule deer, pronghorn, coyote, ringtail, black-tailed prairie dog, desert cottontail, kangaroo rat, Plains pocket mouse, scaled quail, Swainson’s hawk, burrowing owl, lark sparrow, rattlesnake, and prairie skink are found.

Land Use/Human Activities: Unlike most adjacent Great Plains ecological regions, little of the Southwestern Tablelands is in cropland; most is semiarid rangeland, with ranching and livestock grazing as the dominant land uses. There are small areas of agriculture where hay, alfalfa, corn, grain sorghum, or wheat are cultivated. There is some oil and gas production in the southern part of the Texas portion. Larger towns and cities include Castle Rock, Colorado Springs, Pueblo, La Junta, Lamar, Trinidad, Raton, Las Vegas, Santa Rosa, Tucumcari, and Snyder.

9.4.4 Flint Hills

Location: The Flint Hills in eastern Kansas and the Osage Hills in north-central Oklahoma mark the western edge of the tallgrass prairie.

Climate: The ecoregion has a severe, mid-latitude, humid continental climate, marked by hot summers and mild to severe winters. The mean annual temperature is approximately 12°C to 15°C. The frost-free period ranges from 170 to 200 days. The mean annual precipitation is 880 mm; it ranges from 710 to 1,065 mm.

Vegetation: The Flint Hills mark the western edge of the tallgrass prairie, and contain the largest remaining intact tallgrass prairie in the Great Plains. Big bluestem *(Andropogon gerardii)*, switchgrass *(Panicum virgatum)*, Indiangrass *(Sorghastrum nutans)*, and little bluestem (*Schizachyrium scoparium)* are the dominant grasses.

Hydrology: Intermittent and perennial streams are found here, of low to moderate gradient. Several springs occur to increase summer base flow in some streams. Few lakes are present in the region.

Terrain: Dominant landforms are rolling hills, cuestas, and relatively narrow steep valleys, with elevations ranging from 245 to 495 masl. The region is composed mostly of Pennsylvanian and Permian period shale and cherty limestone with rocky soils. The flint-like cherty beds of limestone contributed to the areas name. Mollisols are typical, with a mesic or thermic soil temperature regime and udic or ustic soil moisture regime.

Wildlife: Historically, bison and elk were hunted by prairie wolves. Today, some bison have been reintroduced. Common species now include white-tailed deer, coyote, bobcat, red fox, badger, raccoon, cottontail rabbit, fox squirrel, plains pocket gopher, prairie vole, meadowlarks, and Cooper's hawk.
Land Use/Human Activities: In contrast to surrounding ecological regions that are mostly in cropland, the Flint Hills were difficult to plow. Most of the Flint Hills region is grazed by beef cattle. Small areas of cropland occur in some river valleys. Part of the region is now in national preserve land and other conservation land. Larger towns include Manhattan, Emporia, and El Dorado.

9.4.5 Cross Timbers

Location: This region occurs in north-central Texas, central Oklahoma, and southeastern Kansas. It is a transitional area between the former prairie, now winter wheat-growing regions to the west, and the forested low mountains of eastern Oklahoma.
Climate: The ecoregion has a mild, mid-latitude, humid subtropical climate, marked by hot summers and mild winters. The mean annual temperature ranges from approximately 13°C in the north to 19°C in the south. The frost-free period ranges from 200 to 280 days. The mean annual precipitation is 856 mm, ranging from 610 to 1,060 mm.
Vegetation: Transitional "cross-timbers" vegetation consists of little bluestem grassland with scattered blackjack oak and post oak trees. Big bluestem, Indiangrass, switchgrass, elm, black hickory, greenbriar, and Virginia creeper also occur. A dense woody understory forms in the absence of fire.
Hydrology: Intermittent and perennial streams, low to moderate gradient. Several large rivers cross the region from west to east. Some reservoirs are present.
Terrain: Landforms and soil types are rolling plains, with some rounded hills, ridges, and cuesta topography with Pennsylvanian sandstone, mudstone, and claystone, and Cretaceous limestone and claystone. Alfisols, Inceptisols, and Mollisols occur, with thermic soil temperatures and ustic soil moisture regimes.
Wildlife: White-tailed deer, bobcat, gray fox, raccoon, cottontail rabbit, black-tailed jackrabbit, prairie-chicken, wild turkey, mourning dove, eastern meadowlark, lark sparrow, box turtle, and rattlesnake are the dominant species.
Land Use/Human Activities: Rangeland and pastureland predominate, along with areas of woodland. Oil extraction has been a major activity in this region for over eighty years.
The region does not possess the arability and suitability for crops such as corn and soybeans that are common in the Central Irregular Plains (9.2.4) to the northeast. However, some small areas of cropland sown with peanuts, grain sorghum, small grains, hay, cotton, and peaches occur. Larger towns include Sapulpa, Shawnee, Ada, Duncan, Ardmore, Denton, Fort Worth, and Arlington.

9.4.6 Edwards Plateau

Location: The Edwards Plateau lies in central Texas, in the transition zone between eastern mesic and western arid regions.
Climate: The ecoregion has some transitional climates, with dry subtropical steppe in the south, mid-latitude steppe to the north, and mild, mid-latitude, humid subtropical on the east. It has hot summers and mild winters. The mean annual temperature is approximately 18°C. The frost-free period ranges from 220 to 280 days. The mean annual precipitation is 706 mm, ranging from 410 mm in the west to 860 in the east.
Vegetation: Originally, the Plateau was covered by a juniper-oak savanna and mesquite-oak savanna. The savanna, with grassland of little bluestem, yellow Indiangrass, and sideoats grama, had scattered groves of plateau live oak, Texas oak, and Ashe juniper. With its rapid seed dispersal, low palatibility to browsers, and in the absence of fire, Ashe juniper has increased in some areas, reducing the extent of grassy savannas. More sparse and shrubby vegetation occurs to the more arid west. In the east, the Balcones Canyonlands contain more mesic species and a variety of endemic and rare plants.

Hydrology: The region contains a sparse network of perennial streams, but they are relatively clear and cool compared to those of surrounding areas, and are often spring-fed. Streams are low to moderate gradient with mostly bedrock, cobble, gravel, and sandy substrates. The region has a karst system of sinkholes and underground fissures and caverns that fill with groundwater to create aquifers.
Terrain: Largely a dissected limestone plateau that is hillier in the south and east where it is easily distinguished from bordering ecological regions by a sharp fault line, the region features rolling terrain and broad valleys, with ridges and canyons common in some areas. Soils in this region are mostly Mollisols with shallow and moderately deep soils on plateaus and hills, and deeper soils on plains and valley floors. There is a thermic soil temperature regime and ustic soil moisture regime.
Wildlife: White-tailed deer, javelina, bobcat, coyote, badger, ringtail, porcupine, armadillo, brown mink, Llano pocket gopher, Mexican free-tailed bat, Rio Grande turkey, scaled quail, mourning dove, golden-cheeked warbler, black-capped vireo, Texas map turtle, Rio Grande perch, Guadalupe bass, widemouth blindcat, Comal blind salamander are found here.
Land Use/Human Activities: Most of the region is used for grazing beef cattle, sheep, goats, and wildlife. Hunting leases are a major source of income. Tourism and recreation are also important in the region. Larger towns include Sonora, Junction, Menard, Mason, Llano, Fredericksburg, Johnson City, Kerrville, Bandera, and western portions of Austin.

9.4.7 Texas Blackland Prairies

Location: In eastern Texas, the region stretches over 300 miles from near the Oklahoma border in the north to San Antonio in the south. It also includes the separate Fayette Prairie region to the southeast.
Climate: The ecoregion has a mild, mid-latitude, humid, subtropical climate, marked by hot summers and mild winters. The mean annual temperature ranges from approximately 17°C in the north to 21°C in the south. The frost-free period ranges from 240 to 290 days. The mean annual precipitation is 954 mm, ranging from 760 to 1,170 mm. Temperature increases and precipitation decrease to the south.
Vegetation: Historically, the region was a tallgrass prairie of little bluestem, big bluestem, yellow Indiangrass, tall dropseed, eastern gamagrass and many forbs, such as asters, clovers, and black-eyed susan. Almost the entire prairie has now been converted to other uses. Riparian areas have bur oak, Shumard oak, sugar hackberry, elm, ash, eastern cottonwood, and pecan.
Hydrology: Low to moderate gradient intermittent and perennial streams are found here. The region lacks lakes, but many reservoirs have been built.
Terrain: The prevailing landform is that of nearly level to gently sloping plains, lightly to moderately dissected and underlain mostly by Cretaceous chalk, claystone, marl, and shale, and some Miocene sandstone and shale. Mostly fine-textured clayey soils occur. Gilgai microtopography and mima mounds are found here. Vertisols, Mollisols, Alfisols are dominant with thermic soil temperatures and ustic and some udic soil moisture regimes.
Wildlife: Once the region had bison, pronghorn, wolves, cougar, ocelot, and greater prairie-chickens, but little habitat remains to support a diversity of wildlife. Species today include coyote, ringtail cat, armadillo, raccoon, skunk, cottontail rabbit, plains pocket gopher, turkey vulture, lark sparrow, northern cardinal, mourning dove, Texas toad, and Texas horned lizard.
Land Use/Human Activities: Mostly, this prairie is now devoted to cropland, pasture, rangeland, and urban uses. Crops include cotton, grain sorghum, corn, small grains, and hay. It contains a higher percent of cropland than adjacent regions, although much of the land has been recently converted to urban, suburban, and industrial uses. Larger cities include Sherman, Dallas, Waco, Temple, Austin (eastern portions), San Marcos, and San Antonio.

9.5 Texas-Louisiana Coastal Plain

**9.5.1 Western Gulf Coastal Plain (*Planicie de la costa occidental del Golfo*)

Location: Includes southwestern Louisiana, coastal Texas, and northeastern Tamaulipas. The boundaries of this ecoregion are the Mississippi Delta to the north and the Gulf of Mexico coastal plains to the south.

Climate: The ecoregion has a mild, mid-latitude, humid subtropical climate, marked by hot summers and mild winters. The mean annual temperature ranges from approximately 20°C to 25°C. The frost-free period ranges from 270 to 365 days. The mean annual precipitation is 1,069 mm, ranging from 580 to 1,625 mm.
Vegetation: Most of the region is now cropland but originally had tallgrass prairies in the north, with bluestems, yellow Indiangrass, and brownseed paspalum mixed with other herbaceous species. Central areas also had tall dropseed, silver bluestem, common curleymesquite, and plains bristlegrass. The southern sand plains of Texas had southern oak, honey mesquite, Texas persimmon, colima, granjeno, seacoast bluestem, little bluestem, and sand dropseed. Coastal marshes present cordgrass, saltgrass, needlerush, and saltmarsh bulrush. Barrier islands present seacoast bluestem, gulfdune paspalum, and sea oats. In Mexico, the ecozone presents associations of xerophytic scrub, hydrophyle vegetation, [matorrales de tipo xerófilo y vegetación hidrófila] halophytes associated to the Laguna Madre system, [sistema de Laguna Madre con pastizales halófilos y vegetación arbustiva halófila] tropical decidous thorn forest (such as the Tamaulipan thornscrub), [selvas bajas espinosas caducifolias, matorral espinoso tamaulipeco] and barren areas**.**
Hydrology: Low gradient intermittent and perennial streams are found here, some channelized. Main features include the Rio Grande (Rio Bravo) and the Laguna Madre coastal lagoon system in Texas and Tamaulipas.
Terrain: The terrain includes flat coastal plains, barrier islands, dunes, beaches, bays, estuaries, and tidal marshes. The sedimentary materials that form the coastal plain include Pleistocenic marine sand, silt, and clay. Alfisols, Vertisols, Entisols, and Mollisols are dominant soil types, with hyperthermic soil temperatures (thermic in the north) and ustic, udic, and aquic soil moisture regimes.
Wildlife: White-tailed deer, ocelots, jaguarundi, coyote, ringtail cat, armadillo, javelina, swamp rabbit, American alligator, ferruginous pygmy-owl, green jay, Altimira oriole, Attwater's prairie-chicken, whooping cranes, ducks and geese are found here.
Land Use/Human Activities: In the United States portion, much of the region is cropland with rice, soybeans, sugarcane, cotton, corn, grain sorghum, wheat, hay, vegetables, melons, and citrus fruits. In Mexico primarily, crops are sorghum fodder and milo [cultivos principalmente de sorgo forrajero y mijo]. Grasslands and shrub rangeland provide fodder for livestock grazing in both countries. Oil and gas production are important activities for the entire region as well. Recent urbanization and industrialization have brought regional concerns, though. The largest cities include Lafayette, Crowley, Lake Charles, Port Arthur, Beaumont, Houston, Galveston, Victoria, Corpus Christi, Kingsville, McAllen, Brownsville, San Fernando, Ciudad Reynosa, Matamoros, Rio Bravo, and Valle Hermoso.

9.6 Tamaulipas-Texas Semi-Arid Plain (*Planicie semiárida de Tamaulipas-Texas*)

**9.6.1 Southern Texas Plains/Interior Plains and Hills with Xerophytic Shrub and Oak Forest (*Planicies del sur de Texas / Planicies y lomeríos interiores con matorral xerófilo y bosque de encino*)

Location: This is a border region, spanning southern Texas, northeast Coahuila, northern Nuevo León, and northern Tamaulipas.
Climate: The ecoregion has a dry subtropical steppe climate, with hot summers and mild winters. The mean annual temperature is approximately 20°C to 24°C. The frost-free period ranges from 270 to 360 days. The mean annual precipitation is 592 mm, and ranges from 450 to 750 mm. Spring and fall are when most of the rains occur.
Vegetation: Lowlands were once mostly covered with grassland and savanna vegetation and areas of shrubs. Having been subject to long, continued grazing, thorny brush is now the predominant vegetative type. Honey mesquite, brasil, colima, lotebush, granjeno, kidneywood, coyotillo, Texas paloverde, anacahuita, and various species of cacti occur in the region. Some areas also present blackbrush, guajillo, cenizo, tall and mid grasses. Some scattered live oak and post oak occur in the far northern portion. Rio

Grande/Rio Bravo riparian plants include sugar hackberry, Mexican ash, cedar elm, black willow, black mimosa, and common reed. The highest elevations in Mexico present oak and mixed oak/pine forests.
Hydrology: Surface waters are mostly a sparse network of ephemeral and intermittent streams, with a few larger perennial rivers crossing the region. Lakes are rare, but some reservoirs occur.
Terrain: Lightly to moderately dissected irregular plains. Sediments are mostly Miocene, Oligocene, and Eocene sands, silts and clays of varying hardness. Aridisols, Alfisols, Mollisols, and Vertisols occur, with a hyperthermic soil temperature regime and ustic aridic to aridic soil moisture regimes. In Mexico, this region gives birth to the Sierra Madre Oriental, with altitudes of 600 to 1,600 m, the highest habitats for this ecozone.
Wildlife: White-tailed deer, javelina, coyote, ringtail cat, ocelot, armadillo, Texas pocket gopher, Mexican ground squirrel, chachalaca, green kingfisher, greater roadrunner, Mississippi kite, northern bobwhite, white-winged dove, green jay, mourning dove, mesquite lizard, and Laredo striped whiptail live here.
Land Use/Human Activities: Principal land use activities include agriculture, ranching, livestock grazing, as well as oil and gas production. Main crops are corn, cotton, small grains, citrus fruits, and vegetables. The largest towns and cities include Uvalde, Del Rio, Eagle Pass, Laredo, Ciudad Acuña, Ciudad Victoria, Piedras Negras, Sabinas, Nuevo Laredo, Sabinas Hidalgo, Cadereyta, and Monterrey. This region is heavily populated in both countries and is highly impacted by migration to the north.

10.0 North American Deserts

10.1. Cold Deserts

10.1.1 Thompson-Okanagan Plateau

Location: The Thompson-Okanagan Plateau extends over the warmest and driest areas in Canada from the Okanagan Valley in the east to the Lillooet and Lytton areas in the west.
Climate: Winters are cold and summers are warm to hot. The mean annual temperature of the major valleys is approximately 6°C, with a summer mean of 15°C and a winter mean of -3.5°C. The mean annual precipitation experiences strong gradient ranges of 250 to 300 mm in the major valleys, to over 1,100 mm in subalpine and alpine areas.
Vegetation: Valley lowlands support open stands of Douglas fir and pine grass or parklands of scattered ponderosa pine and lodgepole pine in a matrix of bluebunch wheat grass and sagebrush. In the driest areas south of Penticton and around Kamloops, grasslands of bluebunch wheat grass, blue grass, June-grass, sagebrush, rabbitbrush, and antelopebush occur. At higher elevations, stands of Engelmann spruce, subalpine fir, and lodgepole pine grow.
Hydrology: Parts of the Okanagan, Thompson, Nicola and Fraser rivers flow southwards through the area and there are several large lakes like Lake Okanagan.
Terrain: The region is characterized by the drier rolling plateaus and major valleys of the Okanagan, Thompson, Nicola and Fraser rivers, typically ranging from 1,220 to 2,300 m. It has a gently rolling surface, for the most part covered mainly by glacial moraine, but can be hillier and mountainous in the west sections. Soils vary from HumoFerric Podzols and Dystric Brunisols at the higher elevations, to Gray Luvisols and Eutric Brunisolic soils on calcareous morainal and lacustrine deposits at middle elevations, and to Eutric Brunisolic and Dark Gray Chernozemic soils at lower elevations. Dark Brown and Brown Chernozemic soils are usually associated with valley bottoms along the lower Fraser River and its tributaries.
Wildlife: Typical wildlife includes California bighorn sheep, mule and whitetailed deer, elk, black bear, coyote, bobcat, cougar, blue grouse, waterfowl, longbilled curlew, rattlesnake, and various raptors.
Land Use/Human Activities: Grazing, forage production, orchards, water-oriented recreation, and residential developments are common land uses at lower elevations whereas woodland grazing, forestry, hunting, and recreation uses are more typical of mid and high elevations. Major communities are Penticton, Kelowna, Kamloops, Lillooet, and Lytton.

10.1.2 Columbia Plateau

Location: This region occurs between the Cascade Range to the west and Rocky Mountains to the east. It covers much of central and southeastern Washington, north-central Oregon, and a small part of northwestern Idaho.

Climate: The ecoregion has dry, mid-latitude desert and mid-latitude steppe climates, marked by hot, dry summers and cold winters. The mean annual temperature ranges from approximately 7°C to 12°C. The frost-free period ranges from 70 to 190 days. The mean annual precipitation is 334 mm, and ranges from 150 to about 600 mm, increasing from southwest to northeast. It is lowest in the western basins where the rain-shadow effect of the Cascade Range limits precipitation.

Vegetation: The ecoregion is characterized as arid sagebrush steppe and grassland, in contrast to surrounding ecological regions that are predominantly forested and mountainous. Grassland vegetation consists of bluebunch wheatgrass, needleandthread, Sandberg bluegrass, and Idaho fescue. Basin big sagebrush, Wyoming big sagebrush, and bitterbrush are also common. Alien cheatgrass covers some large areas.

Hydrology: Streams originating within the ecoregion are generally ephemeral, flowing only several days a year, or sometimes not at all. Most summer precipitation is evaporated or transpired, leaving little water for streamflow. Perennial streams and rivers originate in adjacent mountainous ecoregions. Some wetlands and marshes occur, but many have been drained to make room for agriculture.

Terrain: The tablelands are of moderate to high relief, taking the form of irregular plains with open hills. Elevations range from about 60 masl where the Columbia River exits the region to the west, to over 1,500 masl on some hills in the east. Episodic geologic events of epic proportions such as lava flows and massive floods have shaped the topography. This region is one of the best examples of plateau flood basalts, and many areas are underlain by basalt over 1.8 kilometers thick. Deep loess soils covered much of the plateau. Pleistocene floods cut through the thick deposits of windblown soil, leaving islands of loess separated by scablands and bedrock channels.

Wildlife: Mule deer, pronghorn antelope, coyote, black-tailed jackrabbit, ground squirrels, American kestrel, golden eagle, red-tailed hawk, western meadowlark, sage thrasher, savanna sparrow, and western diamondback rattlesnake live here.

Land Use/Human Activities: Cropland with dryland and irrigated agriculture, rangeland for livestock grazing, and wildlife habitat are typical land uses in the region. Some areas are extensively cultivated for winter wheat, particularly in the eastern portions of the region where precipitation amounts are greater. Other crops include barley, alfalfa, potatoes, onions, hops, lentils, and dry peas. Fruit orchards and vineyards are extensive in some areas. Some military and restricted government land is present along with some tribal land. Larger cities include Yakima, Richland, Kennewick, Pasco, Walla Walla, Hermiston, Pendleton, and The Dalles.

10.1.3 Northern Basin and Range

Location: This ecoregion forms part of the northern Great Basin, covering southeast Oregon, northern Nevada, southern Idaho, and a small portion of northern Utah. It is drier and less suitable for agriculture than the Columbia Plateau (10.1.2) and higher and cooler than the Snake River Plain (10.1.8).

Climate: The ecoregion is arid, with mid-latitude steppe and mid-latitude desert climates marked by hot summers and cold winters. The mean annual temperature ranges from approximately 5°C to 9°C. The frost-free period ranges from 30 to 140 days. The mean annual precipitation is 351 mm, ranging from 150 to over 1,000 mm on high elevations of the Steens Mountains.

Vegetation: Non-mountain areas have sagebrush steppe vegetation and some cool season grasses. Mountain big sagebrush, Wyoming big sagebrush, low sagebrush, bluebunch wheatgrass, rabbitbrush, Idaho fescue, Thurber needlegrass are dominant species with some scattered juniper. Ranges are generally covered in mountain sagebrush, mountain-mahogany, juniper, and Idaho fescue at lower and mid-

elevations; Douglas fir and aspen are common at higher elevations, some scattered limber pine and whitebark pine occur in Nevada.
Hydrology: Mostly ephemeral and intermittent streams flow here, with some perennial streams at higher elevations fed by snowmelt or springs. Larger rivers include the Owyhee, Malheur, and Bruneau. Some scattered lakes and ephemeral pools are found, along with internally drained basins and playa lakes.
Terrain: The region contains tablelands, intermontane basins, dissected lava plains, scattered north-south trending mountains, and valleys with long, gently sloping alluvial fans. Elevations range from about 800 masl in deep canyons to over 3,000 masl on highest mountain peaks. Tertiary volcanic rocks are common, with some Paleozoic sedimentary rocks exposed in some mountains. Aridisols and Mollisols are common, with mesic and frigid soil temperature regimes and xeric and aridic soil moisture regimes.
Wildlife: Prominent species include mule deer, pronghorn, and coyotes. A waterfowl migration route crosses the region and is used by tundra swans, lesser snow geese, American widgeons, pintail, canvasback, and ruddy ducks, sandhill cranes, white pelican, golden eagle, gray flycatcher, northern sage sparrow. There are endemic desert fish species in basin lakes and springs.
Land Use/Human Activities: Ranching and livestock grazing is common and dryland and irrigated agriculture occur in eastern basins. Other land uses include recreation and wildlife habitat. Population is low and settlements are few. Larger towns include Burns, Soda Springs, and Jackpot.

10.1.4 Wyoming Basin

Location: The Wyoming Basin covers a large part of central and western Wyoming, with small extensions into Montana, Colorado, Utah, and Idaho, and is mostly surrounded by mountainous ecoregions (6.2.10, 6.2.13, and 6.2.14)
Climate: The ecoregion has dry, mid-latitude steppe and desert climates, with warm to hot summers and cold winters. The mean annual temperature ranges from approximately 0°C to 8°C with a frost-free period ranging from 30 to 130 days. The mean annual precipitation is 296 mm, ranging from 130 to 500 mm. The region is somewhat drier than the Northwestern Great Plains (9.3.3) to the northeast.
Vegetation: Dominated by arid grasslands and shrublands in contrast to the surrounding forested mountainous ecoregions, sagebrush steppes here feature Wyoming big sagebrush, black sagebrush, fringed sage, rabbitbrush, western wheatgrass, needle-and-thread grass, blue grama, and junegrass. In the desert shrublands one encounters greasewood, Gardner saltbush, shadscale, bud sage, and at higher elevations, big sagebrush and pinyon-juniper woodland.
Hydrology: Mostly intermittent and ephemeral streams are found here. Perennial streams originate in adjacent mountain ecoregions. Some areas have seasonal playas.
Terrain: The region is a broad intermontane basin interrupted in places by high hills and low mountains. Some piedmont plains and pediments slope from adjacent mountains. There are areas of badlands. Elevations range from about 1,220 to 2,850 masl. Geologic materials are mostly Tertiary and Cretaceous sandstone, claystone, shale, and some limestone. Entisols and Aridisols are dominant soil orders, with frigid and mesic soil temperature regimes and aridic and ustic soil moisture regimes.
Wildlife: Mule deer, cougar, bobcat, coyote, pronghorn, jackrabbit, white-tailed prairie dog, golden eagle, prairie falcon, sage grouse, and Wyoming toad live here.
Land Use/Human Activities: There is some livestock grazing in the region, although many areas lack sufficient vegetation to support this activity. Some public rangeland and wildlife habitat are present. The region contains major producing natural gas and petroleum fields, and mining of coal, trona, bentonite, clay, and uranium. Some small areas of irrigated cropland of hay, alfalfa, barley, and wheat. Larger cities and towns include Cody, Riverton, Evanston, Green River, Rock Springs, Rawlins, Laramie, and Craig.

10.1.5 Central Basin and Range

Location: In the central Great Basin, the region occupies a large portion of Nevada and western Utah, with small extensions into California and southern Idaho.
Climate: The ecoregion has a dry, mid-latitude desert climate, marked by hot summers and mild winters. It has a hotter and drier climate than the Snake River Plain (10.1.8) and Northern Basin and Range

(10.1.3) ecoregions to the north. The region is not as hot as the Mojave Basin and Range (10.2.1) and Sonoran Desert (10.2.2) ecoregions to the south. The mean annual temperatures vary widely due primarily to differences in elevation, ranging from 2°C on high mountains to 14°C in southern lowland areas. The frost-free period ranges from about 15 days at cold, high elevations to 200 days in warmer areas. The mean annual precipitation is 277 mm, ranging from 4 mm in the lower drier areas to over 1,000 mm in the wetter high mountains. Most of the rainfall occurs during convective thunderstorms in the warm season. The light precipitation in winter is mostly in the form of snow.
Vegetation: Basins are covered by Great Basin sagebrush or saltbush-greasewood vegetation. The region has fewer cool season grasses than in the Snake River Plain (10.1.8) and Northern Basin and Range (10.1.3) to the north. Shadscale, winterfat, black sagebrush, Wyoming big sagebrush, ephedra, rabbitbrush, Indian ricegrass, and squirreltail are typical. Greasewood, Nuttall saltbush, seepweed, and alkali sacaton occur in more saline areas. Lower mountains have singleleaf pinyon, Utah juniper, sagebrush, bitterbrush, serviceberry, snowberry, and bluebunch wheatgrass. High mountains may contain some Douglas fir, white fir, limber pine, whitebark pine, or aspen.
Hydrology: The Central Basin and Range ecoregion is internally drained. Sinks and playa lakes occur in the basins. Streams are mostly intermittent and ephemeral. A few perennial streams flow from mountainous areas within or adjacent to the region. Some large lakes occur near the margins and adjacent mountainous ecoregions, including Great Salt Lake, Utah Lake, Mono Lake, Pyramid Lake, and Walker Lake. Springs are important in some areas.
Terrain: North-south trending mountain ranges are separated by broad xeric basins and valleys. The basins may have playas, salt flats, low terraces, sand dunes, or scattered low hills, and are often bordered by long gently sloping alluvial fans. Most of the mountains are uplifted fault blocks with steep side slopes. Elevations range from 1,020 m to more than 4,000 m. Aridisols and Entisols are common, with some Mollisols in higher elevations. Soil temperature regimes are mostly mesic and frigid, with aridic to xeric soil moisture regimes. Some saline-sodic soils occur.
Wildlife: Mule deer, pronghorn, bighorn sheep, coyote, bobcat, black-tail jackrabbit, bald eagle, and sage sparrow florish here, along with endemic desert fish species such as Lahontan cutthroat trout, White River springfish, Pahranagat roundtail chub, Monitor Valley speckled dace, and Independence Valley tui chub.
Land Use/Human Activities: Ranching and livestock grazing, mining for gold, silver, and mercury, and land set aside for wildlife habitat or recreation are common land uses. Public rangelands and national forests, military lands, and some tribal lands are also present. Populations are concentrated along the margins. Larger cities include Carson City, Reno, Sparks, Ely, Salt Lake City, Ogden, and Provo.

10.1.6 Colorado Plateaus

Location: Located between the Southern Rocky Mountains on the east and the Wasatch Range to the west, the region occupies most of eastern and southern Utah, western Colorado, and small portions of northern Arizona and northwestern New Mexico.
Climate: The ecoregion has a dry, mid-latitude steppe climate. It is marked by hot summers with low humidity, and cool to cold dry winters. The mean annual temperature ranges from approximately 5°C at high elevations in the north to 15°C in southern deep canyons along the Colorado River. The frost-free period ranges from 50 days to more than 220 days. The mean annual precipitation is 298 mm, ranging from 130 mm in arid canyons to more than 800 mm at high elevations.
Vegetation: Low elevation basins and canyons are sparsely vegetated with blackbrush, shadscale, fourwing saltbush, and galleta grass. Uplands and higher valleys have Wyoming big sagebrush, black sagebrush, pinyon-juniper woodlands and at higher elevations some areas of Gambel oak, mountain mahogany, aspen, and some Douglas fir. There is generally less grassland than in the Arizona/New Mexico Plateau (10.1.7) to the south.

Hydrology: Many ephemeral and intermittent streams flow here. Perennial streams originate in adjacent mountainous ecoregions. Several large rivers cross the region, i.e., the Green, Colorado, and San Juan. There are very few lakes or reservoirs, except Lake Powell on the Colorado River.
Terrain: Rugged tableland topography with precipitous side-walls mark abrupt changes in local relief, often from 300 to 600 meters. The region is more elevated than the Wyoming Basin (10.1.4) to the north; however, it also has large low-lying areas in river canyons. The uplifted, eroded, and deeply dissected tableland of sedimentary rock contains benches, mesas, buttes, cliffs, canyons, and salt valleys. Elevations range from about 900 m to over 3,000 m. Entisols and Aridisols are typical soil orders, with mostly mesic and frigid soil temperature regimes and aridic and ustic soil moisture regimes.
Wildlife: Elk, mule deer, pronghorn, coyote, kit fox, white-tailed prairie dog, cottontail rabbit, sage grouse, turkey vulture, burrowing owl, pinyon jay, common raven, western diamondback rattlesnake, Colorado pike minnow, razorback sucker, bonytail chub are encountered here.
Land Use/Human Activities: Ranching and livestock grazing, oil and gas production, coal mining, recreation, and tourism are common activities. Tribal lands are present, as well as national park and monument lands. There are a few small areas of irrigated agriculture with pinto beans, hay, alfalfa, winter wheat, and fruit orchards. Larger towns include Vernal, Price, Moab, Grand Junction, Montrose, Cortez, and Shiprock.

10.1.7 Arizona/New Mexico Plateau

Location: This region covers a large portion of northern Arizona, northwestern New Mexico, and the San Luis Valley of southern Colorado. Higher, more forest covered, mountainous ecoregions border the region on the northeast (6.2.14) and southwest (13.1.1).
Climate: The ecoregion has dry, mid-latitude steppe, and desert climates. It is marked by hot summers with low humidity, and cool to cold dry winters. The mean annual temperature is mostly about 11°C, but ranges from approximately 5°C in the San Luis Valley of Colorado in the northeast to 16°C in deep canyons along the Colorado River in the west. The frost-free period ranges from 50 days to more than 250 days. The mean annual precipitation is 293 mm, ranging from 125 to 380 mm at higher elevations.
Vegetation: At arid lower elevations, shadscale, fourwing saltbush, greasewood, galleta grass, blue and black gramas. At higher elevations are pinyon-juniper woodlands; in the northeast, big sagebrush, rabbitbrush, winterfat, western wheatgrass, blue grama.
Hydrology: Water is scarce, and streams are mostly ephemeral and intermittent. Perennial streams originate in adjacent mountainous ecoregions. Several important rivers cross the region, i.e., the Colorado, San Juan, and Rio Grande. There are very few lakes or reservoirs.
Terrain: Plateaus and mesas, cliffs, deep canyons, and valleys, and some irregular plains are the landforms of the region. Rocks representing almost the Earth's entire geological timespan are exposed in this region. Sedimentary rocks of sandstone, shale, mudstone, limestone, and dolomite, and volcanic rocks of basalt and andesite are extensive. Some volcanic cones north of Taos reach elevations over 3,000 masl. Local relief in the region varies from a few meters on plains and mesa tops to well over 300 meters or more along tableland side slopes.
Wildlife: Mule deer, pronghorn, cougar, bobcat, weasels, badgers, Gunnison prairie dogs, jackrabbits, desert pocket mouse, greater roadrunner, Swainson’s hawk, burrowing owls, rattlesnake, Rio Grande silvery minnow are found here.
Land Use/Human Activities: Low-density livestock grazing, oil and gas production, coal mining, recreation and tourism are important land uses. Large areas of tribal lands, as well as national parks, national monument lands, and some public rangelands exist. There are a few small areas of irrigated agriculture in the San Luis Valley, and along parts of the Rio Grande and San Juan River. Larger towns and cities include Tuba City, Winslow, Gallup, Farmington, Albuquerque, Santa Fe, Taos, and Alamosa.

10.1.8 Snake River Plain

Location: Located primarily in southern Idaho, this is the northeastern portion of the xeric intermontane basin and range area of the western United States.

Climate: The ecoregion has a dry, mid-latitude steppe climate, marked by warm summers and cold winters. The mean annual temperature is approximately 10°C in the west and 6°C in the eastern portion. The frost-free period ranges widely from 50 to 170 days, decreasing from west to east and with elevation. The mean annual precipitation is 316 mm, ranging from 110 to about 650 mm.
Vegetation: Sagebrush steppe natural vegetation with Wyoming and basin big sagebrush, mountain sagebrush, bluebunch wheatgrass, Idaho fescue, Indian ricegrass, rabbitbrush, fourwing saltbush.
Hydrology: The Snake River traverses the region. Surface waters are sparse in a few parts. Streams are generally lower gradient, warmer, with finer substrates than in adjacent mountain ecoregions. Canals and reservoirs are common in and near agricultural areas. Springs occur in some areas.
Terrain: The terrain is lower and more gently sloping than the surrounding ecoregions, and consists of alluvial valleys, scattered barren lava fields, plains, and low hills. Elevations range from 640 to about 1,980 masl, with the eastern portion being higher. Most of the region contains nearly horizontal sheets of basalt. Older flows are of Miocene and Pliocene age, while large areas consist of Quaternary basalt. Soils are mostly Aridisols and Mollisols and have mesic and some frigid temperature regimes and aridic and xeric moisture regimes.
Wildlife: Historically, the region had bison, bighorn sheep, grizzly bear, gray wolf. Today, one finds Rocky Mountain elk, mule deer, pronghorn, black bear, coyote, cougar, bobcat, yellow pine chipmunk, Great Basin pocket mouse, dark phase pika, migratory waterfowl, prairie falcon, ravens, sage thrasher, mountain chickadee, mountain bluebird, bats, rainbow, brown and brook trout.
Land Use/Human Activities: Mostly because of the amount of water available for irrigation, a large percent of the alluvial valleys bordering the Snake River are in agriculture, with sugar beets, potatoes, alfalfa, small grains, and vegetables being the principal crops. Cattle feedlots and dairy operations are also common in the river plain. Other areas of the ecoregion are used as rangeland for cattle grazing. Large cities include Boise, Nampa, Pocatello, Idaho Falls, and Twin Falls.

10.2 Warm Deserts

10.2.1 Mojave Basin and Range

Location: The Mojave Basin and Range is located in southeastern California, southern Nevada, southwestern Utah, and northwestern Arizona.
Climate: The ecoregion has a dry, subtropical desert climate, marked by hot summers and warm winters. The mean annual temperature is approximately 5°C at high elevations, and 24°C in the lowest basins. Death Valley, in the central part of the region, is one of the hottest places on the continent, with summer temperatures sometimes reaching over 56°C. The frost-free period ranges from 150 days in colder areas to 350 days in the warmer valleys. Mean annual precipitation is 167 mm, and ranges from 50 to over 900 mm on the wetter high peaks. Snow occurs in the mountains, but is uncommon at lower elevations.
Vegetation: The desert vegetation is sparse, predominantly creosote bush, compared to the mostly saltbush-greasewood and Great Basin sagebrush of ecoregion 10.1.5 to the north, or creosote bush, sage and palo verde-cactus shrub and saguaro cactus in the Sonoran Desert (10.2.2) to the south. In the Mojave, creosote bush, white bursage, Joshua-tree and other yuccas, and blackbrush are typical. On alkali flats, saltbush, saltgrass, alkali sacaton, and iodinebush are found. In the mountains, sagebrush, juniper, singleleaf pinyon, ponderosa pine, white fir, limber pine, and some bristlecone pine (the world's longest-living trees) occur.
Hydrology: Surface water is scarce; if present, streams are mostly intermittent and ephemeral. The Colorado River crosses the eastern portion of the region. Some springs, seeps, and ponds occur.
Terrain: This ecoregion contains scattered north-south trending mountains that are generally lower than those of the Central Basin and Range (10.1.5). Broad basins, valleys, and old lakebeds occur between the ranges, with long alluvial fans. Elevations range from 85 m below sea level in Death Valley, to more than 3,300 masl on the highest mountain peaks. Deep Quaternary alluvial deposits are present on valley floors

and alluvial fans. Geology is complex, with intrusive granitics and other igneous rocks, recent volcanics, metamorphic, and sedimentary rocks, including some carbonates. Typical soils are Aridisols and Entisols with a thermic and hyperthermic soil temperature regime and aridic soil moisture regime.
Wildlife: Representative wildlife include desert bighorn sheep, pronghorn, coyote, kit fox, black-tail jackrabbit, desert cottontail rabbit, greater roadrunner, Gambel's quail, mourning dove, desert tortoise, and rattlesnake.
Land Use/Human Activities: Most of this region is federally owned and there is relatively little grazing activity because of the lack of water and forage for livestock. Public and federal land is in the form of national parks and numerous military reservations. Another economic activity is mining of silver, gold, talc, boron, and borate minerals. Recreation and tourism are also important. Heavy use of off-road vehicles and motorcycles in some areas has caused severe wind and water erosion problems. Large cities include Lancaster, Palmdale, Barstow, Bullhead City, Kingman, Las Vegas, and St. George.

****10.2.2 Sonoran Desert (*Desierto sonorense*)**
Location: This region includes southeastern California, southwestern Arizona, northeastern Baja California, northwestern Sonora, and the northern tip of Sinaloa.
Climate: The ecoregion has a dry subtropical desert climate, marked by very hot summers and mild winters. The mean annual temperature ranges from approximately 19°C to 25°C and the frost-free period ranges from 200 to 365 days. The mean annual precipitation is 206 mm, ranging from 75 to 560 mm. The driest areas present an annual mean of only 100 mm. Winter rainfall decreases from west to east, while summer rainfall decreases from east to west. Evaporation rates are quite high in the entire ecozone.
Vegetation: This vegetation is composed of desert types such as microphyllous scrubland, cactus, as well as areas without any visible vegetation. Representative vegetation includes large areas of palo verde-cactus shrub, giant saguaro cactus, creosotebush, white bursage, ocotillo, brittlebrush, catclaw acacia, cholla, desert saltbush, pricklypear, ironwood, and mesquite. In the middle of the subregion, the Central Sonoran Desert, plant communities are more closely linked to a subtropical climate, while in the southern part they are more tropical, with more influence of deciduous thorn forests.
Hydrology: Streams are mostly ephemeral and intermittent. Few surface water resources occur in the region. The largest is the Colorado River, which has a mountainous, distant source. The southern portion is irrigated by the Yaqui, Mayo, and Fuerte Rivers, which descend from the Western Sierra Madre. Some springs and a few reservoirs are also present. Historically, many agricultural areas have been abandoned, either due to soil salinity problems, marine water intrusion, or to ground water depletion. Water resource use in the region is intense, both from rivers and ground water.
Terrain: Similar to the Mojave Basin and Range (10.2.1) to the north, this ecoregion contains fault-block mountain ranges, scattered low mountains, alluvial fans, and alluvial valleys. Elevations range from sea level to over 1,400 masl. Quaternary alluvium, boulder deposits, playa and eolian deposits are common. Rocks are Precambrian to Mesozoic igneous and metamorphic, with Tertiary volcanics and sedimentary layers in other areas. Aridisols and Entisols soils are dominant, with hyperthermic soil temperatures and extremely aridic soil moisture regimes. The driest, most extreme section is the Upper Gulf desert region, which includes the San Felipe endorheic valleys and mountains in Baja California, the Pinacate and Altar deserts, as well as San Ignacio, Asuncion and Sonoyta basins in northwest Sonora.
Wildlife: Characteristic fauna of the region includes desert bighorn sheep, southern mule deer, coyote, bobcat, kit fox, gray fox, ringtail cat, javelina, black-tailed jackrabbit, kangaroo rat, desert pocket mouse, desert tortoise, kingsnake, western diamondback rattlesnake, red-spotted toad, desert horned lizard, elf owl, Gila woodpecker, red-tail hawk, Gambel's quail. This ecoregion is linked to the marine, island and coastal ecosystems of the Sea of Cortez.
Land Use/Human Activities: There are multiple areas of intensive, irrigated cropland, with cotton, alfalfa, hay, lettuce, melons, onions, sweet corn, grain sorghum, citrus fruits, and winter vegetables. There is some limited livestock grazing in wetter periods and a few cattle feedlots are present. The ecoregion is highly susceptible to droughts, which have seriously affected the region's economy in repeated occasions. Coastal and deepsea fishing is also very important to the region's economy in Mexico. Publicly owned

land includes military training land, national monuments, national parks, national wildlife refuges, a biosphere reserve in Mexico and wilderness land in the United States. Some tribal lands are also present. Some of the largest cities include Blythe, El Centro, Indio, Yuma, Gila Bend, Casa Grande, Phoenix, Tempe, and Tucson in the United States, as well as Mexicali, Hermosillo, Ciudad Obregon, San Luis Rio Colorado, Guaymas, and San Felipe in Mexico.

10.2.3 Baja Californian Desert (*Desierto bajacaliforniano*)

Location: This ecoregion consists of the coastal plains and central mountainous systems of the Baja California peninsula. It borders with the Sonora desert (10.2.2) at the Sierra de Santa Isabel and San Fermín plains. Toward the north it borders with subregion 11.1.1 at the Sierra de San Miguel. And toward the south it borders with subregion 14.6.1 along the mountain range formed by the tectonic plates of the El Novillo sierras, from the Bay of Peace to Todos Los Santos.

Climate: Mean annual precipitation is minimal, with 100 to 200 mm at the lowest elevations and up to 300 mm in the highest sierras. Temperatures are extreme; however, a significant portion of the region, including the coasts along the Sebastián Vizcaíno bay (and part of the Vizcaíno desert), is under the influence of the Californian Current, resulting in a mean annual temperature of 18°C. Toward the interior, the mean annual temperature is somewhat higher, at 20°C and up to 22°C in the Magdalena desert, even though cold air currents generate fogs that permit the growth of vegetation. At the highest elevations, mean annual temperatures drop to 18º and 16°C.

Vegetation: Xerophytic, desert-like vegetation is predominant, and this clearly results from the effect of cold ocean surface currents to the west and interaction with ortographic barriers and other factors determined by the presence of the Sea of Cortez to the east. This subregion's flora and fauna continue to be unique because of its partial isolation throughout nearly its entire geological history. Representative species include the Vizcaíno agave (*Agave vizcainoensis*), cirio (*Fouqueria columnaris*), creeping devil cactus (*Stenocereus eruca*), sour pitaya (*Stenocereus gummosus*) and red barrel cactus (*Ferocactus peninsulae*). Vegetative distribution ranges from rosette and sarcocrasicaul shrub in the hills and sierras of the extreme northern part of this subregion to microphyllous shrub and sandy desert vegetation are dominant in the central plains area. An important characteristic of the Baja Californian desert vegetation is the impact of moisture from ocean fog, which favors the development of coastal rosette shrubland to the north of Vizcaíno, and fog-associated sarcocrasicaul shrubland to the south. In the highest parts and the canyons of the sierras and individual mountains forming the Sierra de La Giganta corridor, there are communities of oak forests and tropical deciduous forests, as well as riparian plant communities and palm groves.

Hydrology: This subregion is located in the Central-West (RH02) and Southwest (RH03) hydrological regions of Baja California. Its water basins are made up of numerous intermittent streams that form when there is erratic torrential rainfall. In general, the area lacks any perennial surface water, although it is common to find natural springs at the bottom of canyons and low-lying slopes in the sierras. One of the few streams with continuous water flow is the San Ignacio.

Along the Sea of Cortez and the Pacific Ocean there are many bays, both shallow and deep, as well as lagoons, capes and channels, with salt-water lagoons predominating. Conditions tend toward high evaporation in these coastal areas, and therefore saltworks can be found. The Guerrero Negro lagoon is a notable example.

Terrain: Outcrops of primarily volcanic Mesozoic material form the region's mountainous massifs. This material, combined with Mesozoic and Cenozoic marine sedimentary rock that emerged in more recent

times, as well as Quaternary soils, led to the mountain ranges created when the peninsula was formed and its drift toward the northwest. The geological history of this ecoregion is relatively recent.

Wildlife: Examples include the peninsular pronghorn antelope (*Antilocapra americana peninsularis*), bighorn sheep (*Ovis canadensis*), desert fox (*Vulpes macrotis devia*), and Baja Californian kangaroo rat (*Dipodomys peninsulares)*. The biological wealth in the Baja Californian Desert also lies in its marine wildlife, both resident and migratory, which use the numerous Baja Californian islands and coastal lagoons as their refuges and nesting sites. Some examples are the harbor seal (*Phoca vitulina*), California sea lion (*Zalophus californianus*) and gray whale (*Eschrichtius robustus*).

Land Use/Human Activities: This subregion is relatively sparsely populated, with a total land area of 91,753 km^2. Major cities include La Paz, Ciudad Constitución, Ciudad Insurgentes, Loreto, Ejido Presidente Díaz Ordaz, El Vizcaíno and Guerrero Negro. The Baja California Desert is one of the best conserved regions in Mexico.

10.2.4 Chihuahuan Desert (*Desierto chihuahuense*)

Location: Beginning in north central New Mexico, this desert ecoregion extends through West Texas and then more than 500 miles south into Mexico.

Climate: The ecoregion has a dry desert to steppe climate, marked by hot summers and mild winters. The mean annual temperature ranges from approximately 17 to 20 °C. The frost-free period ranges from 150 days at high elevations in the north to more than 320 days in warmer areas of the south. The mean annual precipitation is 340 mm and ranges from 200 to 635 mm, depending on elevation, occurring mostly in summer.

Vegetation: Vegetative cover is predominantly desert grassland and arid shrubland, except for high elevation islands of oak, juniper, and pinyon pine woodland. These communities form “islands” that are often composed of species endemic to the Chihuahuan desert. The extent of desert shrubland is increasing across lowlands and mountain foothills due to gradual desertification caused in part by historical grazing pressure. Creosotebush, tarbush, acacia, mesquite, ocotillo, honey mesquite, smooth mesquite, lechuguilla, striated agave, and yuccas are common in the basins. Some desert grassland with black, blue, and sideoats grama, bush muhly, and dropseeds occur.

Hydrology: Streams are mostly ephemeral, a few springs occur. Outside of the major river drainages, such as the Rio Grande/Rio Bravo, Rio Conchos, and Pecos River, the landscape is largely internally drained. Playa lakes occur.

Terrain: The region includes broad basins and valleys bordered by sloping alluvial fans and terraces. Isolated mesas and mountains occur. The physiography is generally a continuation of basin and range terrain that is typical of the Mojave Basin and Range (10.2.1) and the Central Basin and Range (10.1.5) ecoregions to the west and north, although the pattern of alternating mountains and valleys is not as pronounced as in those regions. The mountain ranges are a geologic mix of Tertiary volcanic and intrusive granitic rocks, Paleozoic sedimentary layers, and some Precambrian granitic plutonic rocks.

Wildlife: This is an area with great diversity and endemism of species adapted to desert conditions, as well as a great number of relictual communities and evolving refuges for plants and animals. The most representative species include desert bighorn sheep, mule deer, pronghorn, coyote, bobcat, kit fox, collared peccary, jackrabbit, Montezuma quail, black-throated sparrow, and Texas horned lizard.

Land Use/Human Activities: Common land uses include ranching, livestock grazing, agriculture, and military and public land. Agriculture occurs along major rivers with crops of hay, alfalfa, onions, chili peppers, cotton, pecans, and corn for silage. The region is also sustained by its manufacturing industry and international trade. Mining continues to be an important activity but it has had serious impacts on the environment.

Major cities include Las Cruces, Roswell, Carlsbad, Pecos, and El Paso in the US; as well as Ciudad Juarez, San Luis Potosi, Torreon-Gomez Palacio, Saltillo, Monclova, Ciudad Delicas, Matamoros, and Matehuala in Mexico. This is a heavily populated region with a large migratory population.

11.0 Mediterranean California

11.1 Mediterranean California

**11.1.1 California Coastal Sage, Chaparral, and Oak Woodlands (*Bosques de encino, chaparral y matorral costeros californianos*)

Location: This ecoregion occupies south central California and northwestern Baja California, as well as the Channel Islands, Isla de Cedros and Isla Guadalupe.

Climate: The ecoregion has a Mediterranean climate of hot dry summers and mild winters. The mean annual temperature ranges from approximately 14°C to 18°C. The frost-free period ranges from 180 to 365 days. The mean annual precipitation is 548 mm and ranges from 200 to more than 1,400 mm on higher peaks in the northern portion. Coastal fogs provide some moisture in the dry season.

Vegetation: Mainly chaparral and oak woodlands; grasslands occur in some lower elevations and patches of pine are found at higher elevations. In the south, coastal sage scrub with chamise, white sage, black sage, California buckwheat, golden yarrow, and coastal cholla occur. Small areas of Torrey pine occur near San Diego. Inland chaparral includes ceanothus, buckeye, manzanita, scrub oak, and mountain-mahogany. Coast live oak, canyon live oak, poison oak, and California black walnut also occur. Blue oaks, and some Coulter pine, Digger pine, Jeffrey pine, or big-cone Douglas fir occur at high elevations. Also characteristic of this subregion are riparian forms of palms found in springs and oases at the bottom of canyons, together with other riparian plant communities. The Guadalupe and Cedros islands are an important part of this subregion, characterized by chaparrals and coastal rosette scrub, and containing two endemic species: the Guadalupe Island cypress (*Cupressus guadalupensis)* and Monterey pine (*Pinus radiata)*..

Hydrology: Streamflow in the region is mostly ephemeral and intermittent. A few perennial streams enter the region from adjacent highland ecoregions. The region generally lacks lakes, but a few ponds and reservoirs occur.

Terrain: The terrain consists of coastal terraces, some open low mountains or foothills, parallel ranges and valleys, and areas of irregular plains in the south and near the border of the adjacent Central California Valley ecoregion (11.1.2). Cenozoic marine and non-marine sedimentary rocks, Mesozoic granitic rocks. Coarse sediments are found on colluvial slopes. Dominant soil orders include Alfosols, Entisols, and Mollisols, with a thermic soil temperature regime and xeric soil moisture regime.

Wildlife: Mule deer, gray fox, cougar, coyote, bobcat, raccoon, skunk, jackrabbit, brush rabbit, kangaroo rat, California pocket mouse, turkey vulture, roadrunner, mockingbird, mountain quail, acorn woodpecker, wrentit, brown pelican, various shorebirds, western species of rattlesnake, western fence lizard, and Monterey salamander are representative species.

Land Use/Human Activities: Urban, suburban, and industrial areas are found in the region, and dominant land uses and human activities involve recreation, tourism, agriculture and some livestock grazing. Croplands are diversified with lettuce, artichokes, spinach, celery, tomatoes, strawberries, citrus, avocados, onions, vineyards, olive trees, and nursery products. Large cities include San Francisco, Oakland, San Jose, Los Angeles, Long Beach, Riverside, Santa Ana, Anaheim, and San Diego in the United States; as well as Tijuana, Ensenada, Rosarito and Tecate in Mexico.

11.1.2 Central California Valley

Location: Occurring in the central part of California, this area differs from adjacent ecoregions that are hilly or mountainous, forest or shrub-covered, and generally nonagricultural.

Climate: The ecoregion has a mild, mid-latitude, Mediteranean climate, bordering on a mid-latitude desert climate in the south. The region has long, hot dry summers and mild, slightly wet winters. The mean annual temperature is approximately 15°C to 19°C. The frost-free period ranges from 240 to 350 days. The mean annual precipitation ranges 125 mm in the south to 760 in the northern margins.

Vegetation: Once had extensive grasslands and prairies with a variety of bunchgrasses, perennial and annual grasses, and forbs. Most natural vegetation has been greatly altered. Today, some valley oak

savanna, riparian woods of oak, willow, western sycamore, cottonwood, and tule marsh still occur. Saltbush, iodinebush, and saltgrass occur in the Upper San Joaquin Valley.
Hydrology: Low gradient perennial and intermittent streams. Two large rivers are the San Joaquin and Sacramento that are fed by rivers flowing west from the Sierra Nevada (6.2.12); an extensive delta occurs in the middle of the valley where the two rivers converge. Streams flowing eastward through this region from the coastal mountain ranges in Ecoregion 11.1.1 are mostly intermittent and dry during summer months. Some vernal pools, marshes, and wetlands exist. The region has an extensive network of water diversions, channelization, and drainage.
Terrain: Mostly, the terrain consists of flat fluvial plains and terraces, with a few low or rolling hills. There are deep marine and non-marine sedimentary deposits of clays, sands, silts, and gravels. Elevations range from sea level to about 210 masl. A wide variety of soil orders occur, including Alfisols, Aridisols, Entisols, Mollisols, and Vertisols. They have thermic soil temperature regime and aridic and xeric soil moisture regimes. Soils are generally deep, well drained, and loamy or clayey.
Wildlife: The valley's wildlife includes pronghorn, Tule elk, mule deer, coyote, San Joaquin Valley kit fox, cottontail rabbit, jackrabbit, California ground squirrels, kangaroo rat, wintering waterfowl, yellow-billed magpie, Nuttall's woodpecker, giant garter snake, chinook salmon, and delta smelt.
Land Use/Human Activities: In this ecoregion agriculture is extensive, with nearly half of the surface in cropland; three-fourths of which is irrigated. Major crops include rice, almonds, apricots, olives, grapes, cotton, citrus, and vegetables. Some dairy and cattle feedlots are found. Oil and gas production is also important. Environmental concerns in the region include salinity due to evaporation of irrigation water, groundwater contamination from heavy use of agricultural chemicals, wildlife habitat loss, and urban sprawl. Larger cities include Redding, Chico, Davis, Sacramento, Stockton, Modesto, Merced, Fresno, and Bakersfield.

****11.1.3 Southern and Baja California Pine-Oak Mountains (*Montañas con bosques de pino y encino de Baja California y sur de California*)**
Location: Highland areas of southern California and northern Baja California, this region includes numerous mountains of the Transverse Range, such as the Santa Ynez, San Gabriel, and San Bernardino, as well as the Peninsular Range, such as the San Jacinto Mountains, Laguna Mountains, Sierra Juárez, and Sierra San Pedro Martír.
Climate: The ecoregion has a mild, mid-latitude, Mediteranean climate, bordering on a mid-latitude, desert climate in some lower areas. The region has long, hot dry summers and mild, slightly wet winters. The mean annual temperature varies from approximately 6°C at higher elevations to 17°C in lower areas. The frost-free period ranges from 125 to 360 days. The mean annual precipitation is 525 mm, and ranges from 220 to more than 1,250 mm.
Vegetation: Complex mountain topography creates conditions for a variety of natural communities from chaparral, to oak woods, to mixed conifer forests, and alpine habitats. There are chamise and oak scrub chaparral, ceanothus, manzanita, pinyon-juniper woodland, mixed conifer forests of sugar pine, white fir, Jeffrey pine, ponderosa pine, and mountain juniper, ranging to limber pine and lodgepole pine at high elevations. Forest fires are common in the area.
Hydrology: Mostly, intermittent and ephemeral streams occur, with a few perennial watercourses. The region mostly lacks lakes, although a few reservoirs are found.
Terrain: High, sloping, narrow mountain ranges, with plateaus, unstable slopes and sharp crests make up the highly irregular terrain of the region. Narrow valleys are generally filled with colluvium and alluvium. Elevations range widely from sea level, to 3,505 m at Mt. San Gorgonio. Sandy colluvium is present on poorly consolidated rocks of sandstone or granite. In Mexico, outcrops are intrusive and the metamorphic rocks date from the Mesozoic. Alfisols, Entisols, Inceptisols, and Mollisols soils occur, typically with mesic or thermic soil temperature regimes and a xeric soil moisture regime.
Wildlife: Black-tailed deer, coyote, bobcat, cougar, quail, mourning dove, mockingbird, California condor, roadrunner, least Bell's vireo, arroyo southwestern toad, and rattlesnake are dominant species.

Land Use/Human Activities: Principal land uses include recreation, tourism, rural residential, some agriculture, some forestry, and woodland grazing. Large areas are public national forest lands. Larger settlements and cities include Santa Barbara, Wrightwood, Crestline, Running Springs, Lake Arrowhead, Big Bear, and Idyllwild in the United States; and La Rumorosa in Mexico.

12.0 Southern Semi-Arid Highlands

12.1 Western Sierra Madre Piedmont

**12.1.1 Madrean Archipielago (*Archipiélago madrense*)

Location: Straddling the national border in southeast Arizona, southwest New Mexico, and northern Sonora, this region has ecological significance as both a barrier and bridge between two major cordilleras of North America, the Rocky Mountains and the Sierra Madre Occidental.
Climate: The ecoregion has a dry, subtropical to mid-latitude steppe climate. It is marked by hot summers and mild winters. The mean annual temperature ranges from approximately 7°C to 19°C. The frost-free period ranges from 170 to 280 days. The mean annual precipitation is 421 mm and ranges from 260 at low elevations to over 950 mm on the highest peaks. Much of the precipitation falls during July to September thunderstorms.
Vegetation: In the basins, semi-desert grasslands and shrub steppe, with black grama, tobosa, sideoats grama, blue grama, plains lovegrass, sand dropseed, vine mesquite, curly mesquite, ephedra, sotol, yucca, ocotillo, cacti, and agave. On mountain slopes, Madrean oak-juniper woodlands include Emory oak, silverleaf oak, netleaf oak, Tourney oak, Arizona white oak, border pinyon, Mexican pinyon, alligator juniper, one-seed juniper, and chaparral species. At higher elevations, ponderosa pine is predominant, along with areas of southwestern white pine, Apache pine, Chuhuahuan pine, and some Douglas fir.
Hydrology: Surface water is scarce, if any; streams are mostly ephemeral and intermittent. Some perennial streams can occur at higher elevations and some springs. Groundwater levels are dropping.
Terrain: Basins and ranges, or “sky islands,” with medium to high local relief, typically 1,000 to 1,500 meters on ranges. Elevations range from 800 to more than 3,000 m. Tertiary volcanics, Paleozoic and Mesozoic sedimentary rocks, and Precambrian granites are found on the ranges, while basins are deeply filled with Quaternary sediments. Aridisols, Inceptisols, Mollisols and Alfisols are found, with thermic temperature regimes and aridic and ustic soil moisture regimes.
Wildlife: Mule deer, cougar, jaguar, coyote, bobcat, antelope, jackrabbit, Mexican fox squirrel, Cooper’s hawk, red-tailed hawk, raven, turkey vulture, ash-throated flycatcher, canyon wren, greater roadrunner, elf owl, acorn woodpecker, western diamondback rattlesnake, western whiptail lizard, and gila monster are found.
Land Use/Human Activities: Principal land uses include ranching and livestock grazing, some agriculture, wildlife habitat, tourism and recreation, and copper mining. Public range and national forest land, as well as some military lands are present. Larger settlements include Safford, Willcox, Sierra Vista, Bisbee, and Douglas in the United States; as well as Nogales, Agua Prieta, Cananea, Magdalena de Kino, and Nacozari in Mexico.

12.1.2 Piedmonts and Plains with Grasslands, Xeric Shrub, and Oak and Conifer Forests

Location: This region extends from northern Chihuahua to the border with region 12.2.1 in the Bajío region of central Mexico, and includes large portions of the states of Durango, Zacatecas, Aguascalientes, San Luis Potosí and Jalisco.

Climate: Predominant climates are very dry, dry and semi-dry, with mild temperatures. Rainfall is fairly abundant in summer, and minimal in winter. In most of the territory, the mean annual temperature fluctuates between 12 and 18°C.

Vegetation: Large areas of natural grasslands, including grasslands induced by forest clearing and some halophytic grasslands are found, together covering approximately 49 percent of the vegetative cover. Other types of natural vegetation found less frequently include microphyllus, crasicaul and rosette desert shrub; pine, oak and mixed forests; low thorn mesquite forest; and in some areas, tropical deciduous forest introduced through the Bolaños canyon and the basin of the Verde and San Pedro Rivers in the Lerma-Santiago System.

Hydrology: There are no major perennial surface watercourses, but there are many other watercourses, both small and intermittent in nature, that contribute a considerable flow of water into numerous basins, such as those corresponding to the Casas Grandes, Santa María, Conchos, San Pedro, Florido, Aguanaval, Nazas, San Pedro, Jalpa, Bolaños, Huazamota, Mezquital and Grande de Santiago Rivers.

Terrain: The predominant physiography consists of plains and hills extending to the west of the Mexican central highlands from the base of the interior slopes of the Western Sierra Madre and Southern Sierra Madre of Jalisco and Michoacán. There are small mountainous areas and isolated plateaus, generally of sedimentary and volcanic origin to the north, and predominantly volcanic to the south. Average elevation is 1,900 masl, varying from 1,200 to 2,500 masl.

Wildlife: The region's wildlife is of Neartic origin, with numerous mammals and birds characteristic of the area, as well as others found in many places. Some examples are the American black bear (*Ursus americanus*), American badger (*Taxidea taxus*), wildcat (*Lynx spp.*), Mexican wolf (*Canis lupus baileyi*), coyote (*Canis latrans*), mule deer (*Odocoileus hemionus*), pronghorn antelope (*Antilocapra americana*), kangaroo rat (*Dipodomys spp*.), Mexican prairie dog (*Cynomys mexicanus*), collared peccary (*Pecari tajacu*), wild turkey (*Meleagris gallopavo*), Canada goose (*Branta canadensis*), dabbling ducks (*Anas spp*.) and roadrunners (*Geococcys spp*.). There are also reptiles such as the Mexican west coast rattlesnake (*Crotalus basiliscus*) and horned lizards (*Phrynosoma spp*.).

Land Use/Human Activities: Land has been used traditionally for livestock grazing, combined with some irrigation agriculture, although primarily seasonal agriculture in the valleys with the most fertile soil. Large grassland areas are dedicated to extensive livestock ranging (49 percent), mostly cattle. Next in order of importance is agricultural activity (27 percent), with primarily annual seasonal crops. Less than 1 percent is urbanized. There are many small, dispersed towns, isolated villages and tiny rural hamlets. However, the numbers of inhabitants have been diminishing over recent decades, because of migration to the United States and to the region's urban areas. Despite this phenomenon, the overall population of this subregion is quite large and is concentrated in the major cities, especially Chihuahua, Aguascalientes, Zacatecas, Hidalgo del Parral, Fresnillo, Guadalupe and Cuauhtémoc. In contrast, rural population density is low.

12.2 Mexican High Plateau (*Altiplanicie Mexicana*)

12.2.1 Hills and Interior Plains with Xeric Shrub and Mesquite Low Forest (*Lomeríos y planicies interiores con matorral y mezquital xerófilos*)

Location: This region covers an area of 66,921 km^2 and is traditionally known as the Bajío region. Includes the states of Guanajuato, Michoacán and Querétaro, and the southwestern part of Hidalgo, plus some parts of the state of Mexico and the central and eastern parts of Jalisco.

Climate: Predominant climates are temperate and sub-humid with summer rains. Variable temperatures in mountainous areas and semi-warm in the Bajío region. To the north and northeast, as well as in the

extreme southwestern part of the subregion, there are dry, temperate, steppe climates; semi-dry with warm summers and summer rains; as well as cool winters in some parts of the central area.

Vegetation: Current plant communities have been seriously altered, shaped by more than four centuries of agricultural activities and livestock grazing. Predominant vegetation appears to have been grassland, particularly in the Jalisco Highlands and the Lajas River basin. Tropical deciduous forests continue to be dominant in the rest of the subregion, combined with what remains of mesquite forests in the low areas and oak and mixed oak-pine forests in the dispersed mountainous areas.

Hydrology: This subregion is formed by three of the most important hydrological basins in Mexico. The largest is the Lerma River basin, which drains the Bajío region and northern Guanajuato to Chapala Lake, the latter of which sends part of its water to the Pacific Ocean through the Grande de Santiago River. Second in importance is the Moctezuma high basin system, which drains toward the Gulf of Mexico through the Panuco system. And third is the Verde River high basin, which is fed by waters from the Jalisco highlands region, crossing subregion 13.2.1, to then join the Grande de Santiago River. These basins are very important ecologically, covering 2.6 percent of subregion and corresponding to both lakes and lagoons (Chapala, Cuitzeo, Yuriria, Sayula, Zacoalco, Atotonilco, San Marcos and Cajititlan). Unfortunately, these water bodies have been diminished in size in recent decades, due to the intensive use of subterranean aquifers and the use of rivers for irrigation purposes.

Terrain: Characterized by valleys and plains composed of fluvial deposits and lacustrine systems, the region's terrain is the remains of a vast number of lakes that once occupied the bottoms of the Chapala-Zamora, Zayula-Zapotlán, Teocaltiche-Mexticacan and San Miguel Allende rift valleys (from the Miocene and Pleistocene epochs). There are also massive tuff deposits resulting from volcanic activity in the western region and more recently in the Transverse Neovolcanic Belt. There is also evidence of eruptions in the form of pyroclastic cones, and basaltic and andesitic lava overflows and plateaus, as well as the remains of ancient volcanoes in the form of promontories and mountainous formations of considerable size dispersed throughout the area or forming mountainous areas such as the Sierra de Guanajuato and Sierra de Pénjamo.

Wildlife: Despite intensive agricultural activity and livestock grazing, the typical wildlife of central Mexico has been partially conserved to date. In the mountainous areas with oak and oak-pine forests, as well as in diverse areas with the remains of tropical deciduous forests, it is still possible to find white-tailed deer (*Odocoileus virginianus*), collared peccary (*Pecari tajacu*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), gray fox (*Urocyon cinereoargenteus*), nine-banded armadillo (*Dasypus novemcinctus*), skunks (*Mephitis spp., Conepatus spp.*), cottontail rabbits (*Sylvilagus spp.*), hares and jackrabbits (*Lepus spp.*), as well as singing and ornamental birds like the northern mockingbird (*Mimus polyglottos*), solitaire (*Myadestes spp.*), house finch (*Carpodacus mexicanus*), blue grosbeak (*Guiraca caerulea*), Mexican jay (*Aphelocoma ultramarina*), Scott's oriole (*Icterus parisorum*), and golden eagle (*Aquila chrysaetos*). The main migratory aquatic birds that spend the winter in the region's wetlands include the northern pintail (*Anas acuta*), American wigeon (*A. americana*), northern shoveler (*A. clypeata*), common teal (*A. crecca*), blue-winged teal (*A. discors*), lesser scaup (*Aythya affinis*) and American coot (*Fulica americana*).

This is an ecological setting in which cropland, natural forests, and grasslands are combined. It is a unique setting with wildlife adapted to rural and sub-urban environments, including the great-tailed grackle (*Quiscalus mexicanus*), mourning dove (*Zenaida macroura*), Virginia opossum *(Didelphis virginiana*), rock squirrel (*Spermophilus variegatus*), stygian owl (*Asio stygius*), red-tailed hawk (*Buteo jamaicensis*),

northern harrier (*Circus cyaneus*), Mexican falcon (*Falco mexicanus*), Harris's hawk (*Parabuteo unicinctus*), barn owl (*Tyto alba*), hooded oriole (*Icterus cucullatus*), and common raven (*Corvus corax*).

In the major water bodies, like Chapala Lake, there are fish from the genus *Chirostoma*, with their characteristic abundance, and also from families such as the *Atherinidae* (whitefish and charals), *Catostomidae* (*boquinetes* or *hocicona* carp), *Cyprinidae* (native carp, such as *acúmara* and *popocha*), *Goodeidae* (*cheguas* and *pintolillas*) and Petromyzontidae (*lampreas*), together with species like the spottail chub (*Algansea tincella*), bulldog goodeid (*Alloophorus robustus*), scowling silverside (*Chirostoma aculeatum*), largetooth silverside (*C. arge*), smallmouth silverside (*C. chapalae*), pike silverside (*C. estor*), shortfin silverside (*C. humboldtianum*), sharpnose silverside (*C. labarcae*), longjaw silverside (*C. lucius*), *C. ocotlanae*, blacknose silverside (*C. promelas*), bigmouth silverside (*C. sphyraena*), Mexican redhorse (*Moxostoma austrinum*), spotted sawfin (*Skiffia multipunctata*), jeweled goodeid (*Xenotoca variata*), swordtail (*Xiphophorus helleri*), Jalisco chub (*Yuriria alta*), and picotee goodeid (*Zoogonecticus quitzeoensis*).

Endemic species include crustaceans such as *Procambarus chapalanus* and *P. prolixus* (crayfish), and *Pseudothelphusa spp.* (freshwater crab). Also found are fish such as *Algansea avia*, popoche chub (*A. popoche*), barred splitfin (*Chapalichthys encaustus*), ranch silverside (*Chirostoma consocium*), charal (*C. jordani*), blackfin goodea (*Goodea atripinnis*), dusky splitfin (*G. gracilis*), Lerma catfish (*Ictalurus dugesi*), Mexican brook lamprey (*Lampetra geminis*), lamprey (*L. spadicea*), Lerma livebearer (*Poeciliopsis infans*), Sinaola livebearer (*P. presidionis*), and twoline skiffia (*Skiffia bilineata*); amphibians and reptiles like the big-footed leopard frog (*Rana megapoda*), Montezuma leopard frog (*R. montezumae*) and Transverse Volcanic leopard frog (*R. Neovolcanica*); and birds such as the rufous-capped and green-stripe brush-finch (*Atlapetes pileatus, A. virenticeps*), long-tailed wood-partridge (*Dendrortyx macroura*), white-striped woodcreeper (*Lepidocolaptes leucogaster*) and collared towhee (*Pipilo ocai*).

Land Use/Human Activities: Of the total land area, 50 percent has been converted to agricultural and livestock use, particularly for annual seasonal and irrigation crops (31 and 19 percent, respectively). Over 1.6 percent of the land (99,703 hectares) has been urbanized.

The large urban population is concentrated in León, Morelia, Querétaro, Irapuato, Celaya, the Tonalá-Guadalajara metropolitan area, Salamanca and Zamora de Hidalgo. These cities are important as industrial, commercial, petrochemical and agroindustrial centers. There are 83 other urban centers that are smaller but economically and historically important, including Guanajuato, Lagos de Moreno, La Piedad, San Juan del Río, Valle de Santiago, Acámbaro, Silao, Sahuayo, Ocotlán, San Francisco del Rincón and San Miguel Allende. Density of the rural population is very high.

13.0 Temperate Sierras

13.1 Upper Gila Mountains

13.1.1 Arizona/New Mexico Mountains

Location: This is a disjunct region of mountains that extends from northwestern Arizona into central and southern New Mexico, with a small section in west Texas.
Climate: The ecoregion has a variety of climates, depending on latitude and elevation, ranging from severe alpine climates to mid-latitude steppe and desert climates. In general, the region is marked by warm to hot summers and mild winters. The mean annual temperature ranges from approximately 3°C at higher elevations to 19°C in lower southern valleys. The frost-free period ranges from 60 to 280 days. More than half of the precipitation occurs during July, August, and September thunderstorms. Pacific

frontal storms December through March accounts for much of the other seasonal moisture. The mean annual precipitation is 477 mm and ranges from 270 to over 1,000 mm on the highest peaks.
Vegetation: Vegetation in the region is indicative of drier, warmer environments compared to the nearby mountainous ecoregions to the north. Chaparral is common on the lower elevations, pinyon-juniper and oak woodlands are found on lower and middle elevations, and the higher elevations are mostly covered with open to dense ponderosa pine forests along with some Douglas fir, southwestern white pine, white fir, and aspen. The region marks the southernmost extent of spruce-fir forest at higher elevations. Southern areas have some Madrean evergreen oak species.
Hydrology: Many ephemeral, intermittent streams are found, some perennial, with moderate to high gradient. The region contains few lakes relative to their density in other western mountainous ecoregions, although there are some small ponds or reservoirs. The ecoregion provides water resources to settlements in adjacent, lower elevation ecoregions.
Terrain: The terrain here includes both Colorado Plateau and Basin and Range physiography. Steep foothills and mountains are found, and some deeply dissected high plateaus. Elevations range from 1,300 to over 3,800 masl. The region is geologically diverse, with Paleozoic sedimentary rocks of sandstone, shale, and limestone, Tertiary volcanic rocks, and Precambrian igneous and metamorphic rocks. Mollisols, Alfisols, Aridisols, and Inceptisols are typical. Soil temperature regimes are mostly mesic and frigid, with some cryic at high elevations. Ustic to aridic soil moisture regimes occur.
Wildlife: Typical wildlife in the region include mule deer, bighorn sheep, cougar, Mexican gray wolf, coyote, bobcat, ring-tail cat, kit fox, black-tail jackrabbit, tassel-eared squirrel, Cooper's hawk, red-tailed hawk, turkey vulture, canyon wren, Gila trout. The northern extent of some Mexican wildlife species occurs in this region.
Land Use/Human Activities: Activities include some ranching, rangeland and woodland grazing, recreation, forestry, and mining. Large areas are in public forestland, along with some tribal lands, national monuments, and national park lands. Larger settlements include Flagstaff, Prescott, Sedona, Camp Verde, Payson, Show Low, and Ruidoso.

13.2 Western Sierra Madre (*Sierra Madre Occidental*)

13.2.1 Sierra Madre Occidental with Conifer, Oak, and Mixed Forests (*Sierra Madre Occidental con bosques de coníferas, encinos y mixtos*)

Location: This region is located in the states of Chihuahua and Durango, and on the Pacific slopes in Sinaloa and Nayarit, plus southwest Zacatecas and the western half of Aguascalientes. The Western Sierra Madre is a system of sierras and plateaus that runs 1,300 kilometers from northern Sonora to central Jalisco. It includes the Durango, Tepehuana, Huichol, Tarahumara, Fría, Laurel, Nochistlán and Fresnillo sierras.

Climate: The predominant climate is temperate and semi-humid, with dry winters. To a lesser extent, there are also semi-dry and warm semi-humid climates. It is common during the winter to find temperatures below zero (ªC) with drizzle or sleet and frost, as well as frequent snowfall at the higher elevations. There is also an especially dry period during the spring months, while summers are mild, with abundant rainfall that often extends into autumn as a result of the hurricane season.

Vegetation: With a total land area of 175,352 km^2, this subregion has 25 general types of vegetation. Its primary, most characteristic component consists of temperate pine, oak and mixed forests, which account for 81 percent of the vegetative cover, while induced grasslands derived primarily from the clearing of those forests account for 4.9 percent (8,647 km^2). Thus, forests represent the distinctive ecological characteristic of this subregion. There are also 6,619 km^2 (3.7 percent) of natural grasslands that extend

ecologically and geographically into bordering subregions 12.1.1 and 12.1.2, as well as 6,353.7 km^2 (3.6 percent) of tropical deciduous forest in the canyons shared with subregion 14.3.2.

Hydrology: Toward the interior of the subregion, the elevation and size of mountains diminish, and there are also plateaus and hills that lead to the fluvial systems and endorheic basins of the Chihuahua desert, and to the Nazas and Conchos Rivers. The Mayo, Yaqui and Fuerte Rivers originate on the Pacific slopes, and bring water to the coastal plain stretching from Sonora to Nayarit.

Terrain: The average elevation is 2,400 masl, with a maximum elevation of 3,300 masl at Cerro de Mohinora in the Guadalupe y Calvo municipality in Chihuahua. The sierras and plateaus are almost completely of volcanic origin. Deep canyons, the result of long periods of erosion on the Pacific and Gulf of California slopes of the mountains, are a characteristic feature shared to some degree with subregion 14.3.2. Well-known examples of these canyons are the Copper, Urique, Batopilas and Candameña Canyons, with their Basaseachic and Piedra Volada waterfalls, located in Chihuahua. In the interior and toward the southern part of the subregion, mountain systems are interspersed with the tectonic valleys and canyons of subregion 14.3.2, creating biological corridors in north-south and southwest-northeast directions. These corridors permit warm-climate biological communities to be introduced into the Chihuahuan highland and desert areas, and Sierra Madrean biota to descend to lower elevations, as far as the Grande de Santiago River basin to the south.

Wildlife: The subregion has a great deal of biodiversity, surpassed only by subregions in southeastern Mexico. It has an extensive variety of flora and fauna, primarily of Neartic origin. There are at least 517 wildlife species, some of which are endemic, including 24 bird species, 22 reptile species and 12 amphibian species, as well as some mammal and fish species. Of special importance are the Townsend's big-eared bat (*Corynorhinus townsendii*), coyote (*Canis latrans*), white-tailed deer (*Odocoileus virginianus*), mountain lion (*Felis concolor*), jaguar (*Panthera onca*), American black bear (*Ursus americanus*), military macaw (*Ara militaris*) and golden eagle (*Aquila chrysaetos*).

Land Use/Human Activities: Economic activities are focused primarily on extraction of forest products, although mining activities also continue to be significant. Approximately 900,000 hectares (5 percent) are dedicated to agriculture, specifically annual seasonal crops. Urban areas account for only 0.1 percent of the total land area, and are widely dispersed, with the exception of the towns surrounding the city of Durango and to the northeast of Guadalajara. Other major cities are Victoria, El Salto and Madera in Durango; Tepatitlán and Yahualica in Jalisco, and Jalpa in Zacatecas. Rural population density is low.

Important natural protected areas in this subregion include Campo Verde and Tutuaca in the state of Chihuahua, Michilia in Durango, the Cacaxtla plateau in Sinaloa, La Primavera in Jalisco, and the ornithological sanctuary for migratory birds at the Laguna de Bavícora in Chihuahua. The subregion is also characterized by some of Mexico's emblematic ethnic groups, including the Huicholes, Tepehuanes, Coras and Tarahumaras.

13.3 Eastern Sierra Madre (*Sierra Madre Oriental*)

13.3.1 Sierra Madre Oriental with Conifer, Oak, and Mixed Forests (*Sierra Madre Oriental con bosques de coníferas, encinos y mixtos*)

Location: This region runs north-south and includes the southern parts of the states of Nuevo León and Tamaulipas, as well as Coahuila, San Luis Potosí, Querétaro and Hidalgo, and the northern parts of Veracruz and Puebla. There are four major areas within this subregion, with distinctive physiographic and ecological characteristics. The northern area has the highest elevation; the central area is known as the Huastec-Potosino-Tamaulipan-Queretaran region. Another area consists of the interior highlands, and finally, the southern region includes the Huastec region in Hidalgo and the Sierra Norte of Puebla.

Climate: Predominant climates in the northern area are semi-dry, semi-warm; sub-humid temperate; and sub-humid, semi-warm with summer rains. In the central area the climate is semi-dry and semi-warm with summer rains, and in the southern area there is a humid, semi-warm temperate climate with rainfall year-around, and a semi-dry, semi-warm climate with summer rains. The mountains in the region form barriers that create a climatic shadow effect and dryness on their interior slopes.

Vegetation: There is natural vegetation with varying levels of conservation in 84 percent (43,580 km^2) of this subregion. At higher elevations this vegetation is characterized by conifer forests, including oak, oyamel, juniper and ayarin, as well as mixed pine-oak forests, accompanied by rosette desert shrub and natural grasslands. There are also tropical deciduous forests and humid, temperate and tropical forests, both medium and tall in height, and rich in epiphytes and sub-mountain and crasicaul shrub. There is a great deal of biodiversity, due to a combination of temperate Neartic species, Madrean biota and organisms from the dry tropics of the Gulf of Mexico. There are numerous species with restricted distribution, including conifers such as Douglas fir (*Pseudotsuga menziesii*), vejar fir (*Abies vejarii*), Mexican fir (*Abies mexicana*), mountain juniper (*Juniperus monticola*), Mexican white pine (*Pinus strobiformis*), *Pinus teocote macrocarpa*, Mexican red pine (*Pinus rudis*), Mexican mountain pine (*Pinus hartwegii*), evergreen mosquito (*Podocarpus reichei*), and Mexican yew (*Taxus globosa*); endemic conifers such as Potosi piñon (*Pinus culminicola*), Johann's piñon (*Pinus johannis*), weeping piñon (*Pinus pinceana*), and Nelson piñon (*Pinus nelsonii*); and relictual species such as Mexican spruce (*Picea mexicana*) and Martinez spruce (*Picea martinezii*). Nevertheless, the characteristic element of this ecoregion is the cloud forest typically composed of American sweetgum (*Liquidambar styraciflua*), Mexican weeping pine (*Pinus patula*), American hornbeam (*Carpinus carolina*), Bentham's cypress (*Cupressus benthamii*), *Dendropanax*, alders (*Alnus*) and various oak species (*Quercus spp*.).

Hydrology: This subregion serves as an important watershed, with water draining into the coastal plains of the western Gulf of Mexico, contributing a large amount of water to the San Juan-Bravo, Conchos, Soto la Marina, Guayalejo-Tamesí, Pánuco-Moctezuma, Túxpam, Cazones, Santa María, Ayutla, Jalpan, El Salto and Amayac Rivers. These river basins allow for the development of coastal wetlands in Tamaulipas and northern Veracruz, as well as the extensive high tropical evergreen forests and their Neotropical fauna in the central and southern Huastec region. In the highlands the shadow effect is a determining factor in the semi-dry conditions characterizing extensive areas of the interior slopes of the Eastern Sierra Madre.

Terrain: This subregion winds along for nearly 1,000 kilometers, although only measures between 50 and 80 kilometers wide. Consists of an elongated, thin mountainous system covered with folds that increase its land area to a total of 54,896 km^2, signifying an increased impact in terms of biodiversity. The folded sierras alternate with parallel narrow valleys. The orientation of the sierras plays an important role, since it helps create orographic barriers to moisture from the Gulf of Mexico. Especially worth noting are Cerro El Potosí at 3,700 masl and Cerro El Coahuilón at 3,460 masl.

Wildlife: The diversity in wildlife reflects the diversity in vegetation, since Neartic species coexist with Neotropical species. Wildlife species in this subregion include the six Mexican feline species: jaguar (*Panthera onca*), ocelote (*Felis pardalis*), margay (*Felis weidii*), mountain lion (*Felis concolor*), jaguarundi (*Felis yagouaroundi*) and bobcat (*Lynx rufus*). There are also two deer species, the white-tailed deer (*Odocoileus virginianus*) and red brocket (*Mazama americana*), and also the collared peccary (*Tayassu tajacu*). Mammals in this subregion include the American black bear (*Ursus americanus*), ring-tailed cat (*Bassariscus astutus*) and long-tailed weasel (*Mustela frenata*), as well as tropical mammals like the kinkajou (*Potos flavus*), tayra (*Eira barbara*), Mexican porcupine (*Coendu mexicanus*), nine-banded

armadillo (*Dasypus novemcinctus*) and northern tamandua (*Tamandua mexicana*). Over 300 bird species have been recorded, including the military macaw (*Ara militaris*), maroon-fronted parrot (*Rhyncopsitta terrisi*) great curassow (*Crax rubra*), crested guan (*Penelope purpurascens*), white-crowned parrot (*Pionus senilis*), red-tailed hawk (*Buteo jamaicensis*), roadside hawk (*Buteo magnirostris*), and lesser roadrunner (*Geococcyx velox*), as well as Neotropical migratory birds. There is also great diversity in the amphibians and reptiles found in this subregion, including rattlesnakes (*Crotalus spp*.), fer de lance (*Bothrops spp*.), eastern coral snake (*Micrurus fulvius*), and various species of tree frogs, toads and salamanders.

Land Use/Human Activities: Wood extraction has been historically significant for the region, although it varies according to the site. There are areas with forests that have been relatively well preserved, and there are others in which the forests have been depleted. Agricultural activities take place on 15.7 percent of the land area (816,655 hectares), with seasonal crops dominating. Main crops include sugar cane, cultivated grasslands, coffee and apples. Mining activities are also important because of the valuable minerals located in seams exploited since colonial times, as in the Guadalcázar and Cerritos mining areas in San Luis Potosí, and Real de Monte in the state of Hidalgo. Human settlements are numerous and dispersed, although there are only a few large cities such as Tulancingo, Huauchinango, Xilotepec, Zacualtipán, Zacatlán, Mineral del Monte and Santiago.

13.4 Transversal Neo-Volcanic System (*Sistema Neovolcánico Transversal*)

13.4.1 Interior Plains and Piedmonts with Grasslands and Xeric Shrub (*Planicies y piedemontes interiores con pastizal y matorral xerófilo*)

Location: This region encompasses a series of lacustrine valleys, including the regions known as the Bajío region, Lerma Highland and Mexican central highlands. Elevation ranges from 1,400 to 2,600 masl.

Climate: In the Bajío region, the predominant climate is warm, despite the effect from the orographic shadow from the Nevado de Colima/Colima Volcano. In the central highlands, the climate is semi-dry and temperate, influenced by the elevation and the orographic shadow from the high elevations of the Transverse Neovolcanic Belt.

Vegetation: 70 percent of subregion is now agricultural land, used primarily for seasonal crops. In the past the dominant vegetation in the central highlands consisted of natural and halophytic grasslands, with crasicaul shrub and some oak and pine forests covering the interior elevations. Today, natural vegetation has been conserved in only 18 percent (1,695.9 km^2) of the land area, with various levels of degradation, primarily in the form of induced grasslands (5.7 percent). Other forms of vegetation that have persisted include halophytic grasslands (3.4 percent), desert rosette scrub (2 percent), crasicaul scrub (1.9 percent) and oak thickets (0.9 percent) toward the Totolcingo Valley and the northeastern part of the Valley of Mexico. In the Bajío region, the predominant vegetation continues to be tropical deciduous forest, while in the saline valleys, the main vegetation consists of low shrubs and halophytic grasslands, together with aquatic vegetation. There are also small relicts of piñon pine, juniper and mesquite forests. In the saline soils of the Valley of Mexico there are endemic species such as the Orizaba piñon pine (*Pinus cembroides orizabensis* or *Pinus orizabensis*) and *romerito* (*Suadea mexicana*).

Hydrology: This is a lacustrine subregion, however many of the wetlands in the form of permanent or intermittent water bodies have been drained. One example is Lake Texcoco, which has almost completely disappeared, while Zacápu and Maravatío are conserved exclusively as moist agricultural lands.

Terrain: This subregion consists of the lacustrine valleys of volcanic origin in central Mexico, divided into three types: the tectonic lacustrine deposits in the Bajío region from the Sayúla, Zapotlán and Atotonilco lakes, with the exception of Chapala Lake; the lacustrine deposits in the Purépecha plateau and Lerma Highland, from Lake Pátzcuaro and the Zacápu and Maravatío paleolakes; and the great lacustrine

valleys of the Mexican central highlands, including the Toluca valley paleolake, the Valley of Mexico with its ancient Texcoco and Zumpango lake bed, together with the Tula, Otumba and Apizaco plains as well as the endorheic plains of the Totolcingo valley, which include the San Juan and Orizaba plains and the Totolcingo and El Salado lakes.

Wildlife: Despite major transformations, this subregion continues to have great ecological importance due to water bodies that have been conserved and that serve as refuges and nesting sites for migratory and resident birds. Biodiversity in local species in very limited, due to the contamination and destruction of habitats for agricultural and urban purposes. Even so, there are numerous endemic resident species, with considerable distribution, and also migratory species. Some examples of endemic species are the emblematic Mexican axolotl (*Ambystoma mexicanum*); crustaceans like the *Procambarus chapalanus* and *P. prolixus* (crayfish), and *Pseudothelphusa spp.* (freshwater crab); fish like the *Algansea avia*, popoche chub (*A. popoche*), barred splitfin (*Chapalichthys encaustus*), ranch silverside (*Chirostoma consocium*), charal (*C. jordani*), blackfin goodea (*Goodea atripinnis*), dusky splitfin (*G. gracilis*), Lerma catfish (*Ictalurus dugesi*), Mexican brook lamprey (*Lampetra geminis*), lamprey (*L. spadicea*), Lerma livebearer (*Poeciliopsis infans*), Sinaola livebearer (*P. presidionis*), and twoline skiffia (*Skiffia bilineata*); amphibians and reptiles like the big-footed leopard frog (*Rana megapoda*), Montezuma leopard frog (*R. montezumae*), and Transverse Volcanic leopard frog (*R. Neovolcanica*); and birds like the rufous-capped and green-stripe brush-finch (*Atlapetes pileatus, A. virenticeps*), bumblebee hummingbird (*Atthis heloisa*), long-tailed wood-partridge (*Dendrortyx macroura*), white-striped woodcreeper (*Lepidocolaptes leucogaster*) and collared towhee (*Pipilo ocai*).

Other important species, not endemic and more well-known, are the stygian owl (*Asio stygius*), red-tailed hawk (*Buteo jamaicensis*), marsh hawk (*Circus cyaneus*), Mexican falcan (*Falco mexicanus*), hooded oriole (*Icterus cucullatus*), Townsend's solitaire (*Myadestes townsendi*), North American dark bluish-gray gallinule (*Gallinula chloropus cachinnans*), black-polled yellowthroat (*Geothlypis speciosa*), least bittern (*Ixobrychus exilis*) and *rascón real*, a King Rail subspecies (*Rallus elegans tenuirostris*).

Land Use/Human Activities: A relatively small ecoregion (9,400 km^2), but densely inhabited and progressively transformed over a period of several thousand years. In economic terms, this subregion is the most important in Mexico since it is the site of the country's political center and its principal business, industrial and commercial nucleus, as well as an area of major agricultural and livestock production. The urbanized portion covers 10.3 percent (971 km^2) of the total land area, and this is where most of Mexico City is situated. Urban and rural population density is the highest in the country. The second largest city is Pachuca.

13.4.2 Hills and Sierras with Conifer, Oak, and Mixed Forests (*Sierras y lomeríos con bosques de coníferas, encino y mixtos*)

Location: This subregion winds somewhat irregularly across 1,200 kilometers, crossing 12 Mexican states from Nayarit and Jalisco to Veracruz, and forming an immense mountainous arc.

Climate: Predominant climates are sub-humid temperate and sub-humid, semi-warm with summer rains. Other less common climates include sub-humid warm; dry or semi-dry and very warm; dry or semi-dry and semi-warm; dry or semi-dry and temperate with summer rains; as well as humid or sub-humid and semi-cold; and cold with summer rains.

Vegetation: The characteristic vegetation consists of temperate-humid forests that, unlike Madrean forests, have highly diverse undergrowth. It is common for forests in the Transverse Neovolcanic Belt to develop to considerable heights, with trees from 30 to 40 meters tall, including both conifers and

broadleaf trees. Natural vegetation has been conserved to varying degrees. It is important to note that this is a subregion with considerable demographic pressure and it has been intensively exploited since pre-Hispanic times. Temperate forests cover 39.5 percent (29,033 km^2) of the subregion, but could have potentially covered 85 percent of the land area. Predominant forests are pine, oak and mixed forests, with a great variety of species, especially Mexican white pine (*Pinus ayacahuite*), Mexican mountain pine (*P. hartwegii*), Chihuahua pine (*P. leiophylla*), ocote pine (*P. montezuma*), smooth-bark Mexican pine (*P. pseudostrobus*), teocote pine (*P. teocote*), castanea oak (*Quercus castanea*), red oak (*Q. crassipes*), *Q. laurina*, *Q. magnoliifolia*, *Q. obtusata*, resinous oak (*Q. resinosa*) and netleaf oak (*Q. rugosa*). Oyamel forests with nearly pure populations of sacred fir (*Abies religiosa*) and in some parts, Guatemalan fir (*Abies guatemalensis*), are characteristic of the peaks in the Transverse Neovolcanic Belt, although they currently cover only 1.7 percent of the subregion. There are also cloud forests, composed primarily of temperate species such as smooth-bark Mexican pine (*Pinus pseudostrobus*) and species from the *Alnus* (alders), *Prunus* and *Cornus* (dogwoods) genuses, although there is more diversity toward the coastal areas. The mountain cloud forests in Veracruz and Puebla form part of the cloud belt of the southwestern Gulf of Mexico, with characteristic species including American sweetgum (*Liquidambar styraciflua*), red oak (*Quercus affinis*), Q. *sartorii*, Mexican weeping pine (*Pinus patula*), Bentham's cypress (*Cupressus benthamii*) and magnolia (*Magnolia* spp). The composition changes toward the Pacific, with characteristic vegetation including thinleaf pine (*Pinus maximinoi*), *P. devoniana*, Mexican yellow pine (*P. oocarpa*), Mexican clethra (*Clethra mexicana*) and *Quercus scytophylla.* There is some limited tropical deciduous and semi-deciduous forest. And other types of vegetation such as mesquites, halophytic vegetation, xerophytic shrub, chaparrals and meadows are found only minimally.

Hydrology: Main natural water bodies include the La Vega lagoon and the Pátzcuaro and Zirahuén lakes. There are many artificial reservoirs and hydraulic works like the El Bosque, Villa Victoria, Valle de Bravo, Tepetitlán, Ignacio Ramírez, Antonio Alzate, Atlangatepec, Huapango and Manuel Ávila Camacho dams. There is an immense amount of rainfall, which drains into the various river basins that feed into the Gulf of Mexico and Pacific Ocean. Especially worth noting in the Gulf basin are the Texolo, Naolinco, Apulco and Zempoala Rivers. The major rivers leading into the Pacific Ocean are the Balsas and Lerma Rivers. The Totolcingo, Texcoco and Chalco endorheic basins also contribute water.

Terrain: This subregion encompasses the volcanic area known as the Transverse Neovolcanic Belt. It is a volcanic belt with lava plateaus and inter-mountain valleys crossing central Mexico from east to west, separating the northern Madrean mountains and highlands from the Balsas depression and the mountainous massifs of the Southern Sierra Madre. The zone is characterized by volcanism evident in the many thermal springs, sulphurated waters, active volcanoes such as the Nevado de Colima (4,240 masl) and Popocatépetl (5,465 masl), and historic eruptions such as from the El Seboruco and Paricutín volcanoes, plus various basaltic overflows in northwest Michoacán. Average elevation varies in the different parts of this subregion, and measures 2,700 masl in the Orizaba area.

Wildlife: The most common wildlife include the Monarch butterfly (*Danaus plexippus*), the endemic volcano rabbit (*Romerolagus diazi)*, white-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans*), long-tailed weasel (*Mustela frenata*), gray fox (*Urocyon cinereoargenteus*), Mexican cottontail (*Sylvilagus cunicularis*), common raven (*Corvus corax*), turkey vulture (*Cathartes aura*), great horned owl (*Bubo virginianus*), Mexican volcano mouse (*Neotomodon alstoni*), mountain lion (*Felis concolor*), golden eagle (*Aquila chrysaetos*), ring-tailed cat (*Bassariscus astutus*), raccoon (*Procyon lotor*), nine-banded armadillo (*Dasypus novemcinctus*), southern spotted skunk (*Spilogale angustifrons*), the *Sciurus poliopus memoralis* squirrel, and a large variety of small rodents, birds, reptiles and amphibians.

Land Use/Human Activities: This subregion is very important for the national economy in all areas, including agriculture and forestry, as well as industry and commerce. The natural environment has changed dramatically, especially the forests, which have suffered intensive extraction of forest products.

Currently, many forests in this subregion are under controlled management, although clandestine extraction continues at many sites. Nearly 41 percent (30,015 km^2) of the land area is used for agriculture, with seasonal agriculture the most common. Important seasonal crops include corn, wheat, oats and sorghum, as well as potatoes and tomatoes. There are also permanent crops such as avocados, peaches and tequila agave. Although human settlements are concentrated in agricultural valleys and hillsides, this is a very populated subregion in both rural and urban settings, since three of Mexico's largest cities and part of Mexico City are located within its borders. A fifth of the country's total population inhabits this subregion. Important cities include Guadalajara, Puebla, Toluca, Xalapa, Tepic and Uruapan. The subregion also has many natural protected areas such as La Primavera, Volcán Nevado de Colima, Mariposa Monarca, Nevado de Toluca, Corredor Biológico Chichinautzin, Iztaccíhuatl-Popocatépetl, Barranca de Metztitlán and Pico de Orizaba.

13.5 Southern Sierra Madre (Sierra Madre del Sur)

13.5.1 Sierras of Jalisco and Michoacán with Conifer, Oak, and Mixed Forests (Sierras de Jalisco y Michoacán con bosques de coníferas, encino y mixtos)

Location: This region covers the extreme western-southwestern portions of the states of Jalisco and Michoacán and forms part of a fragmented mountain system that runs along the Pacific coast from Jalisco to Chiapas. The section of the Sierra Madre in Jalisco is composed of the Tuito-Tapalpa, Mascotas, Cacoma and Manantlán sierras; and the section of the Sierra Madre in Michoacán is composed of the Coalcomán, Tecalitlán and Tumbiscatío sierras.

Climate: Different types of climates include sub-humid warm, sub-humid semi-warm, and sub-humid temperate with summer rains. The greatest amount of moisture comes from the Pacific Ocean. The rainy season begins in May and June, and can continue until the end of the year due to the hurricane seasons that frequently affect the area.

Vegetation: Natural vegetation is maintained with varying degrees of alteration in nearly 92 percent of the subregion. The best-conserved communities are the forest stands of medium height in canyons with very limited access, and in temperate pine and oak forests at the highest elevations. Pine forests cover 16.4 percent (3,322.4 km^2) of the subregion, oak forests cover 21.1 percent (4,287 km^2), and mixed forests, 33.2 percent (6,736 km^2). Tropical deciduous forests cover 2,146 km^2, while medium-height forests cover 795.5 km^2. Oyamel forests, characterized by *Abies guatemalensis var. jaliscana*, are found in only 7.4 km^2 (0.04 percent). Mountain cloud forests are also found only in very limited land area (370 km^2), distributed primarily in the Sierras de Manantlán and Cocoma, but they have a great amount of biodiversity in terms of both flora and fauna.

Geographic isolation has favored endemic species, such as Rzedowski's pine (*Pinus rzedowskii*) in the Sierra de Coalcoman, and teocintle, or ancient maize (*Zea diploperennis*), in the Sierra de Manantlán.

Because the southern slopes of this subregion's mountains descend gradually to the coastal plains of Jalisco, Colima and Michoacán, there is a significant ecological gradient from tropical deciduous forests to temperate pine, oak and oyamel forests. The effect of the coastal barrier produces some high-moisture areas, allowing the development of a limited and discontinuous but significant belt of cloud forests, medium-height forests, and oyamel forests.

The mountainous topography, minimal roads and relative distance from major urban-industrial centers have made it possible for the original vegetation to be conserved to a certain extent. Nevertheless, extraction of forest products, extensive livestock grazing and accidental fires have affected a significant part of this subregion.

Hydrology: The subregion is partially isolated by the Grande de Santiago River basin to the north and the Balsas River basin to the east. Other important rivers are the Coalcomán and Aguililla Rivers.

Terrain: This subregion consists of two mountainous massifs of igneous and sedimentary rock from the Cretaceous period. The two sections are separated by the Colima-Sayula rift valley and the volcanic shield of the Volcán de Fuego de Colima. The elevation of the sierras is below 2,500 masl on the average; however, in some areas it reaches 2,700 and 2,800 masl.

Wildlife: Some of Mexico's endemic mammal and reptile species can be found in this subregion, as well as various migratory birds and species such as the wild turkey (*Meleagris gallopavo*), Autlán rattlesnake (*Crotalus lannomi*), jaguar (*Panthera onca*), coati (*Nasua nasua*), margay (*Leopardus wiedii*) and nine-banded armadillo (*Dasypus novemcinctus*). Examples of wildlife in danger of extinction are reptiles like the green iguana (*Iguana iguana*) and boa constrictor (*Boa constrictor*); and mammals like the jaguar (*Panthera anca*), margay (*Leopardus wiedii*), jaguarundi (*Felis yagouaroundi*), ocelote (*L. pardalis*), mountain lion (*Felis concolor*), bobcat (*Lynx rufus*) and neotropical otter (*Lontra longicaudis*).

Land Use/Human Activities: Main activities are wood exploitation, livestock and agriculture focused on seasonal crops (corn, beans and sorghum) as well as cultivated grasslands with gramineous species introduced to establish grazing land and forage production in approximately 93,700 hectares (937 km^2). There are also permanent sugar cane and tequila agave fields.

Human populations are numerous, highly dispersed and rural. The population is concentrated in five important towns: Mascota and Talpa to the north, and Coalcomán, Aguililla and Pihuamo to the south. Population density is low.

13.5.2 Sierras of Guerrero and Oaxaca with Conifer, Oak, and Mixed Forests (*Sierras de Guerrero y Oaxaca con bosques templados de coníferas, encino y mixtos*)

Location: This region is an extensive mountainous area of 73,330 km^2, covering 700 kilometers on the Pacific side and just over 350 kilometers on the Gulf of Mexico side. It is composed of four major sections: Northern (extreme southern part of the Eastern Sierra Madre and the Sierra de Juárez), Central (Mixteca Sierra), Western (Southern Sierra Madre of Guerrero) and Southern (Southern Sierra Madre of Oaxaca).

Climate: A subtropical climate predominates on the Pacific slopes, and a humid temperate climate at high elevations. This is one of the two regions in Mexico with the highest rainfall, with between 2,000 mm and 4,000 mm annually. It is a mountainous area with a great amount of moisture in the form of fog and rain during the entire year. The rainy season begins in May and June, and sometimes continues until the end of the year. The area is also affected by hurricanes originating in both the Pacific Ocean and the Caribbean Sea. There is a dramatic effect from the orographic barrier in the Sierras of Guerrero, creating a contrast in climates between the Pacific slopes and the interior slopes of the Balsas-Mezcala basin, ranging from sub-humid warm and temperate, to semi-dry and dry warm. In Oaxaca there are also winter rains, an indirect effect of the north winds that blow in vigorously from the southern Gulf of Mexico coasts.

Vegetation: Large areas of natural vegetation have been conserved to varying degrees. This subregion is characterized by mixed pine-oak forests, as well as oak forests, cloud forests and pine forests. To a lesser degree there are also communities of tropical deciduous forests, medium-height tropical semi-evergreen forests and high tropical evergreen forests. In particular, the northern portion of this subregion contains half of the Gulf of Mexico cloud forests and a significant amount of humid-temperate conifer and mixed pine-oak forests. The combination of Neotropical and Neartic elements and the fact that this is one of the areas in Mexico with the most rainfall signify that there is a great deal of biodiversity and plant

endemisms in the area's forests. In the Mixtec region, characteristic vegetation consists of oak, pine and mixed oak-pine forests that continue to have forestry potential.

Nevertheless, the soil reveals high degrees of plant degradation and erosion due to strong demographic pressure and changes in land use. The Sierra Madre of Guerrero is composed of two major sections, one toward the east and the other toward the west, where the highest elevations can be found. The two sections are very similar in their plant composition, even though they are partially separated by the Chilpancingo Valley and the Zopilote-Mezcala canyon and basins, extending to the Balsas River and Papagayo River basin, and then to the Pacific coast. It is common to find pine, oak and mixed pine-oak, cloud, tropical deciduous, and medium-height tropical semi-evergreen forests with species typical of humid, sub-tropical climates. There is greater orographic isolation in the Sierra Madre of Oaxaca, which has a significant belt of temperate, cloud, mixed and medium-height tropical semi-evergreen forests.

Some of the many tree species in this subregion are: Guatemalan fir (*Abies guatemalensis*), Hickel's fir (*A. hickelii*), achiotillo (*Alchornea latifolia*), alder (*Alnus spp.*), cabbage tree/partridge wood (*Andira inermis*), breadnut (*Brosimum alicastrum*), *copales* (*Bursea spp.*), *Byrsonima americana*, *Carpinus califórnica*, American hornbeam (*C. caroliniana*), devil's hand tree (*Chiranthodendron pentadactylon*), Mexican clethra (*Clethra mexicana*), *Coccoloba schiedeana*, *Cornus disciflora*, Bentham's cypress (*Cupressus benthamii*), angelica tree (*Dendropanax arboreous*), spurius walnut tree (*Engelhardtia Mexicana*), *Ficus spp*., bastard cedar (Guazuma ulmifolia), *Helicteres baruensis*, Brazilian gum-copal tree (*Hymenaea courbaril*), ingas (*Inga spp*.), American sweetgum (*Liquidambar styraciflua*), magnolias (*Magnolia spp*.), *Oreopanax spp.*, hophornbeam (*Ostrya virginiana*), Mexican white pine (*Pinus ayacahuite*), Chiapas pine (*Pinus chiapensis*), Mexican weeping pine (*P. patula*), Lawson's pine (*P. lawsoni*), Chihuahua pine (*P. leiophylla*), thinleaf pine (*P. maximinoi*), Michoacan pine (*P. michoacana*), ocote pine (*P. Montezuma*), Oaxacan pine (*P. oaxacana*), Mexican yellow pine (*P. oocarpa*), Pringle's pine (*P. pringlei*), smooth-bark Mexican pine (*P. pseudostrobus*), teocote (*P. teocote*), sycamore (*Platanus spp.*), Oaxacan Douglas fir (*Pseudotsuga mensiezii var. oaxacana*), *Quercus aristata, Q. conspersa, Q. glaucescens, Q. glaucoides, Q. laurina, Q. magnolifolia, Q. oleoides, Q. salicifolia, Q. scytophylla, Q. acutifolia*, castanea oak (*Q. castanea*), *Q. crassifolia, Q. elliptica, Q. magnoliifolia, Q. obtusata, Q. peduncularis*, netleaf oak (*Q. rugosa*), *Q. sartorii, Q. lawsoni*, shrub live oak (*Q. turbinella*), linden (*Tilia spp.*), and Mexican elm (*Ulmus Mexicana*), among many others.

Hydrology: Especially important are the Balsas, Mezcala, Atempa, Tlapaneco, Papagayo, Mixteco, Juxtlahuaca, Verde, Grande and Copala Rivers.

Terrain: This subregion is geologically very complex, formed by marine and continental rocks from the Paleozoic and Mesozoic eras. There are also patterns of uplifts, faults, igneous intrusions and complex folding, contributing to the isolation of mountain plant communities. Highest elevations are Cerro Quie Yelaag and Cerro Quiexobee (3,700 masl).

Wildlife: The Sierra de Juárez is the part of this subregion in which the most interest has been focused on conserving species, explaining the abundant wildlife found there. Wild birds include the bluebird, white heron, black eagle, cactus wren, vulture, woodpecker, crow, hummingbird, roadrunner, calandria, *jilguero*, owl and chachalaca. The mammals especially worth mentioning include the ring-tailed cat (*Bassariscus astutus*), coyote (*Canis latrans*), Mexican tree porcupine (*Sphiggurus mexicanus*), ocelote (*Leopardus pardalis*), margay (*Leopardus wiedii*), bobcat (*Lynx rufus*), deer (*Odocoileus virginianus*), jaguar (*Panthera onca*), raccoon (*Procyon lotor***)**, gray fox (*Urocyon cinereoargenteus*), red brocket (*Mazama americana*) and northern tamandua (*Tamandua mexicana*). In terms of aquatic species, there are neotropical otters (*Lontra longicaudis*), trout and threadfin. Reptiles include rattlesnakes (*Crotalus spp*.),

beaded lizard (*Heloderma horridum*), coral snakes (*Micrurus spp*.), chameleon (*Anolis spp.*), boa constrictor (*Boa constrictor*), and lizards from different genuses.

Land Use/Human Activities: Of the total land area, 9.9 percent (7,236 km^2) has been converted for livestock grazing, and another 12.6 percent (9,251 km^2) for agriculture, primarily for seasonal crops. Only 0.1 percent is urbanized.

Although a significant portion of the land has been converted to agricultural and livestock use, the type of agriculture continues to be subsistence farming. The important source of income is the extraction of forest products. There are no major cities, and rather, the population is distributed in small cities and rural towns dispersed throughout the subregion. There are numerous indigenous groups and also a rural mestizo population living in conditions of extreme marginalization. Although further study is needed, it is clear this subregion has a high level of biodiversity and great cultural wealth as well.

13.6 Central American Sierra Madre and Chiapas Highlands (*Sierra Madre Centroamericana y Altos de Chiapas*)

13.6.1 Central American Sierra Madre with Conifer, Oak, and Mixed Forests (*Sierra Madre Centroamericana con bosques de coníferas, encino y mixtos*)

Location: This subregion runs parallel to the Soconusco plain and hills, from the extreme southern part of the Isthmus of Tehuantec, through Oaxaca and Chiapas, to the Guatemalan border.

Climate: Predominant climate is semi-warm with uniform distribution and a mean annual temperature between 18 and 22°C. A temperate climate is found at higher elevations in the southern-eastern part of the subregion, with 12 to 18°C. And in the lower parts, the climate is warm, with temperatures above 22°C. The moisture gradient is high, with abundant rainfall in summer and annual precipitation above 3,000 mm.

Vegetation: The landscape is dominated by natural vegetation covering over 9,500 km^2. The most representative vegetation is temperate forest, covering over 70 percent (7,835 km^2). Pine-oak forest covers nearly 3,000 km^2, followed by mountain cloud forest, with one of the largest areas of this type of forest in Mexico (2,400 km^2). Pine forest ranks third, with over 1,900 km^2. The most representative species include Mexican yellow pine (*Pinus oocarpa*), oak species including *Quercus peduncularis, Q. elliptica,* and *Q. skinneri*, and American sweetgum (*Liquidambar styraciflua*). Humid and dry tropical forests cover over 800 km^2 and are found at lower and mid-level elevations on both sides of the mountains, with species such as *Licania arborea, Ipomoea murucoides,* persimmon (*Diospyros spp.*), Spanish cedar (*Cedrela odorata*), gumbo-limbo (*Bursera simaruba),* copal (*B. excelsa*) and trumpet trees (*Tabebuia spp.*).

Hydrology: This area is an important watershed. The monsoon winds come up against the sierras and produce large amounts of rainfall that flow through numerous fluvial basins and micro-basins feeding into the lagoon systems in the Pacific and Atlantic drainage areas, and the tributaries of the Grijalva River.

Terrain: This subregion is a narrow, steep, volcanic mountain system that is particularly scenic, as exemplified by the Tres Picos, Boquerón, La Cumbre, Ovando, El Loro-Paxtal, Bola and La Ventana mountains. Physiographically, the subregion is part of the Central American mountain range and consists basically of the Southern Sierras of Chiapas. The elevation gradient ranges from 200 to 4,000 masl, including valleys with hills, plateaus and high sierras. The highest elevations are Cerro El Male (3,000 masl) and Volcán de Tacaná (4,092 masl). The latter is one of the highest summits in Central America. The dominant type of rock is a granite-type intrusive igneous rock from the Paleozoic era. In the extreme eastern part of the subregion, there is an important massif of limonite-sandstone sedimentary rock from

the Mesozoic era, and to a lesser degree, limestone-sandstone and limestone rock. There are metamorphic rocks in isolated locations, and in the south, there is a massif of andesite-type extrusive igneous rock from the Cenozoic era. In terms of the soil found in this subregion, it is a mosaic of different types, including particularly Acrisols, Regosols, Litosols and Cambisols, all susceptible to erosion.

Wildlife: There are five protected areas in this subregion: Sepultura, Triunfo, Frailescana, Pico el Loro Paxtal and Concordia Zaragoza. These reserves are biological corridors and habitats for species such as the ocelote, mountain lion/cougar and some species in danger of extinction like the quetzal (*Pharomachrus mocinno*) and horned guan (*Oreophasis derbianus*). There are also endemic plant species, such as joe-pye weed (*Eupatorium spp*.).

Land Use/Human Activities: Agriculture is the most common use of land in this area, with seasonal and irrigated crops, and cultivated grasslands. Seasonal agriculture is predominant, covering the largest land area, at 78 percent (1,133 km^2). Crops include corn, coffee (*bourbon* and *caturra* varieties), beans and potatoes, in addition to Jaragua and Pangola grasses.

The population is concentrated in rural localities and small towns. The most important city is the municipal seat of Motozintal in the state of Chiapas. Other important urban areas include Siltepec, Montecristo, Mazapa, Bella Vista, Amatenango, Bejucal and La Grandeza. The main ethnic groups in this subregion include the Mam and Mocho groups inhabiting the eastern part of the Sierra Madre.

13.6.2 Chiapas Highlands with Conifer, Oak, and Mixed Forests (*Bosques de coníferas, encino y mixtos de los Altos de Chiapas*)

Location: This subregion encompasses primarily the Chiapas Highlands, as well as the Sierra Lacandona and Northern Sierras of Chiapas. Locally, some consider this area to be a continuation of the Guatemalan Cuchumatans.

Climate: Climate is mostly semi-warm, with an average temperature of 18ºC. It is warmer in the lowlands, with an average temperature above 22ºC, and milder at higher elevations, where the average temperature fluctuates between 12 and 18ºC. The moisture gradient varies from sub-humid in the south and in some northern parts, to humid in the rest of the subregion. Rains occur during the summer.

Vegetation: The predominant vegetation is mountain cloud forest, with 98,050 hectares in a virgin state and 272,991 hectares in second-growth forests. The species found include majagua (*Belotia mexicana*), American sweetgum (*Liquidambar styraciflua*) and alder (*Alnus* sp). Next in importance is pine-oak forest with 58,728 hectares in a virgin state, and 226,699 in second growth, including Mexican yellow pine (*Pinus oocarpa*), smooth-bark Mexican pine (*P. pseudostrobus*), *Quercus peduncularis* and other oak species (*Quercus spp*.); and then pine forest, with 49,714 hectares in a virgin state and 102,567 hectares in second growth. High tropical evergreen forest in the extreme southern part covers 47,892 hectares that have been well conserved, and 61,205 hectares in second growth. The species found include big-leaf mahogany (*Swietenia macrophylla*), Spanish cedar (*Cedrela odorata*) and Santa Maria hardwood (*Calophyllum brasiliense*). Finally, there is deciduous forest at the low elevations where there is less moisture, with 21,125 hectares in second-growth forest.

Hydrology: Due to the karstic nature of the land in the southern and western parts of this subregion, most watercourses form complex underground systems. In the eastern part, in contrast, there are perennial rivers that feed into the Usumacinta.

Terrain: This subregion includes low regions such as the Chiapas Depression, the Northern Sierras of Chiapas and the Lacandon. It also encompasses a significant portion of sierras, including what is known as the Comiteca plateau, some hills close to the Guatemalan border and transitional areas toward the low parts of the Lacandon Forest, plus some isolated inter-mountain valleys. Elevation ranges from 600 to 2,700 masl. In terms of its geological characteristics, limestone sedimentary rocks predominate, from both the Mesozoic era and the more recent Cenozoic era. Shale and sandstone also predominate. Toward the eastern portion, there are andesitic igneous rocks, and an accumulation of ash forming intermediary tuffs. Soils are varied, and the soil types that can be identified are primarily Phaeozems, Regosols, Acrisols, Rendzinas, Vertisols, Luvisols and Gleysols.

Wildlife: Especially worth noting are the Stuart's burrowing snake (*Adelphicos veraepacis*) and Godman's pit viper (*Bothrops godmani*), as well as the coyote (*Canis latrans*) and white-tailed deer (*Odocoileus virginianus*) found in mountains and canyons. Typical birds include the mountain trogon (*Trogon mexicanus*) and Steller's jay (*Cyanocitta stelleri*).

Land Use/Human Activities: Primary human activities are subsistence agriculture and livestock grazing, with notorious impact on local ecosystems. Ancient agricultural techniques are used, obtaining very low yields.

There are over 5,000 communities, most of which can be classified as small urban areas. The main urban areas are Bochil, Teopisca, Yajalón, Las Margaritas, Las Rosas, Ocosingo, Comitán and San Cristóbal de las Casas. The major ethnic groups in this subregion are the Tzeltal, Tzotzil and Tojalabal.

14.0 Tropical Dry Forests

14.1. Gulf of Mexico Dry Coastal Plains and Hills (*Planicies costeras y lomeríos secos del golfo de México*)

14.1.1 Coastal Plain with Low Tropical Deciduous and Thorn Forest (*Planicie costera con selva baja caducifolia y espinosa*)

Location: This subregion is located in the northeastern part of the country, practically within the limits of the state of Tamaulipas, but also covering small portions of the states of San Luis Potosí and Veracruz. It covers an area of approximately 24,940 km^2.

Climate: There are three different types of climates: semi-dry in the north, sub-humid and semi-warm in the central part, and sub-humid and warm in the south. The temperature fluctuates between 20 and 24°C, and the mean annual precipitation is between 700 and 1,200 mm.

Vegetation: Original vegetation has diminished considerably over the years, giving way to livestock and agricultural activities. Types of vegetation found in the dry part of this subregion include: Tamaulipan thornscrub, with Mexican olive (*Cordia boissieri*), mimosa bush (*Havardia pallens) (P. brevifolium)* and purple sage (*Leucophyllum frutescens*); sub-mountain shrub, with baretta (*Helietta parvifolia*), shrubby bullseye (*Gochnatia hypoleuca*), mountain ash (*Fraxinus spp.*) and brittlebush (*Encelia spp.*); mesquite vegetation, with mesquite (*Prosopis spp.*) and mimosa bush (*Havardia pallens*); and tropical thorn forest, with Texas ebony (*Ebenopsis ebano*), smooth mesquite (*Prosopis laevigata*) and desert hackberry (*Celtis pallida*). In the semi-warm part of the subregion, there is tropical deciduous forest, with elements of *Bursera spp*., bastard cedar *(Guazuma ulmifolia),* laurel (*Phoebe tampicensis*), *Pithecellobium spp.* and Mexican ponytail palm (*Beaucarnea gracilis*). In the alluvial flood plains and low hills in the southern part of the subregion, there is tular, mangrove and halophytic vegetation, with elements of red mangrove (*Rhizophora mangle*), saltgrass (*Distichlis spicata*) and relicts of secondary vegetation of medium-height

semi-evergreen and tropical deciduous forests, with doveweeds (*Croton spp*.,) *Croton ciliato-glanduliferus,* nance (*Byrsonima crassifolia*) and *Randia spp*.

Hydrology: Numerous fluvial systems cross this subregion, especially the Soto la Marina River and its tributaries, the Pilón River, and Arroyo Grande y Purificación, which all flow into the Salobriga and Morales lagoons. Located in the central-eastern part of the subregion are the Barberena and Tigre Rivers. To the south is the basin that leads to the Pánuco alluvial plain, where the Pánuco-Tamesi River fluvial system flows into the Gulf of Mexico, with tributaries characterized by a large flow of water such as the Guayalejo, Tantoán, Santa Clara, Tempoal, Chicayán, Tamacuil and Moctezuma Rivers. The confluence of many rivers, presenting exceptional conditions in the lower part of the plain and on the coast, creates a complex set of salt and fresh water bodies, especially the Montecillos, Chajil, Champayán, Chila and Pueble Viejo Lakes and the Chairel lagoon, as well as an extensive system of saltwater lagoons including the Tamiahua, Marismas and San Andrés lagoons.

Terrain: This subregion is physiographically located within the Northern Gulf Coastal Plains. Its elevation varies from 300 masl in Ciudad Victoria, Tamaulipas, to less than 100 masl in the plains and bajadas covering most of the area. With regard to its superficial lithology, there are marine sedimentary rocks from the Cenozoic era and Quaternary period soils, primarily shale, sandstone-shale, limestone, alluvial soils and lacustrine soils. The dominant soils in this zone correspond to superficial soil layers with medium and fine soil textures in the plateaus and hills; and in plains and bajadas there are superficial to deep soil layers with soil that has a high clay content, heavy and sticky when wet, and hard and cracked when dry, and of a dark, reddish brown color.

Wildlife: The subregion is characterized by wildlife that is limited in biodiversity, but including considerable populations of white-tailed deer (*Odocoileus virginianus*), wild boar (*Sus scrofa*), coyote (*Canis latrans*) and various birds partially adapted to a rural environment, such as the white-winged dove (*Zenaida asiatica*). Unfortunately, as land has been converted for agriculture, natural habitats have been progressively reduced. Nevertheless, the subregion's wetlands are very important as nesting and wintering areas for numerous local and migratory birds, and they also serve as refuges and breeding areas for marine life.

Land Use/Human Activities: Agricultural and livestock activities dominate throughout the entire subregion, with more than 70 percent of the total land area used for annual seasonal agriculture, with sorghum, corn and sugar cane; irrigation agriculture with sorghum and corn; and cultivated grasslands, specifically African star, Bermuda and Pangola, used for cattle production with Charolais, Hereford, Angus, Brahman, Brangus, Criollos, Brown Swiss-Zebu, and others.

Fishing activity is also very important economically in this subregion, since Soto La Marina, Tampico and Ciudad Madero provide shrimp, oysters and fish to the states of Mexico, Hidalgo, Nuevo León, Coahuila, Querétaro and San Luis Potosí. The most important localities are Ciudad Victoria, Ciudad Madero and Tampico.

14.1.2 Hills and Sierras with Low Tropical Deciduous Forest and Oak Forest (*Sierras y lomeríos con selva baja caducifolia y bosque de Encino*)

Location: This subregion is located primarily in the Eastern Sierra Madre and Gulf Coastal Plains physiographic regions, and a small portion is in the Transverse Neovolcanic Belt region.

Climate: The climate of this subregion is warm to semi-warm, with summer rains and levels of precipitation that generate a significant amount of moisture.

Vegetation: In terms of vegetation, more than 50 percent of the total land area is used for agriculture, and the type of vegetation covering the largest portion is cultivated grassland. Even so, relicts of forests can still be found and cover approximately 20 percent of the total land area. The type of forest with the largest land area in this subregion is the tropical deciduous forest, with representative species including *Lysiloma spp.*, *Bauhinia spp.*, *Pithecellobium spp.*, *Randia spp.* and *Flourensia laurifolia*.

Hydrology: Most of this subregion is located in the Pánuco River basin, in which major tributaries are found, plus other important rivers such as the Guayalejo River.

Terrain: The most important landforms in the subregion are the sierras and hills, explaining the name it has been given. Although canyons and somewhat steep slopes can be observed in some areas, elevations are all under 2,000 masl, and there are low-lying areas that descend all the way to the Gulf of Mexico coastline. The geology is clearly sedimentary, and mostly from the Mesozoic and Cenozoic eras, with very few igneous rocks. It is especially noteworthy that nearly 20 percent of the soil in this area is Quaternary soil, which is clearly associated with areas that have little elevation gradient, such as valleys and plains.

Wildlife: Representative animal species include macaws and cougars (*Puma concolor*). There are two natural protected areas established in this subregion for purposes of species conservation.

Land Use/Human Activities: Agriculture is the most common activity, especially livestock production and particularly cattle. The most cultivated grasses include African star, Guinea and Privilegio. There are also large extensions of sugar cane fields, and the crop in second place is corn, much of it grown for family consumption. The two most important cities, Ciudad Valles and Ciudad Mante, have the highest concentration of inhabitants. Less than half of the population lives in rural areas.

14.2 Northwestern Plain of the Yucatan Peninsula (*Planicie noroccidental de la península de Yucatán*)

14.2.1 Northwestern Yucatan Plain with Low Tropical Deciduous Forest (*Planicie noroccidental de Yucatán con selva baja caducifolia*)

Location: This subregion is located in the northwestern part of the Yucatán Peninsula. It includes part of Yucatán and Campeche and a minimal portion of Quintana Roo. It takes the form of a large bloc of land that gently extends to the west and to the north, with an extensive continental platform under the Gulf waters.

Climate: Based on the Köppen climatic classification modified by García, the dominant climates in the subregion are semi-arid BS_1 and BS_0, with an annual precipitation of 438 mm reported in Progreso, Yucatán. Although in only a small part of the subregion, a sub-humid warm climate with summer rains is also reported. The main cause of the minimal precipitation in this subregion is a jet stream effect, with wind blowing from land to sea. Climate is a dominant factor directly and indirectly affecting soil formation, and it has an impact on other factors also involved in soil formation, specifically vegetation, topography and human activity. Climate parameters that affect soil development are, first of all, precipitation and temperature, and secondly, radiation and wind.

Vegetation: The predominant type of vegetation in this subregion is low tropical deciduous forest. The main characteristics of this forest type are the low height of its trees, which are between 8 and 15 meters high and organized in only one layer, and the loss of its leaves during the dry season, a period that lasts five or more months. Most of the species are woody and of a small diameter, except at the sites where moisture accumulates in the soil. Among the arboreal species most frequently found are gumbo-limbo

(*Bursera simaruba*), *Coccoloba reflexiflora,* shaving bush tree (*Pseudobombax ellipticum*), *Thevetia gaumeri,* frangipani (*Plumeria rubra*), Florida fish poison tree (*Piscidia piscipula*), ziricote (*Cordia dodecandra*), *Nopalea gaumerí,* buttercup tree (*Cochlospermum vitifolium*), *Dyospyros cuneata, Croton chichenensis, Croton glabellus* and false tamarind (*Lysiloma latisiliquum*). There are also succulent plants such as fishhook cactus (*Mamillaria spp.*) and pitaya (*Stenocereus spp.*).

Hydrology: Drainage in this physiographic subregion is totally subterranean. The minimal topography and permeability of rocks limit the formation of permanent watercourses and favor infiltration.
Terrain: This is a subregion with low relief; it is nearly flat, with elevations under 100 masl. From a geological viewpoint, most of the subregion is composed of layers of carbonated rocks from the Upper Tertiary, and a small strip of the Quaternary coast.

Wildlife: There is a great variety of amphibians in this subregion, including tree frogs (*Phrynohyas venulasa* and *Hyla spp.*) and the Gulf coast toad (*Bufo valliceps*). There is also a wide range of reptiles including the brown basilisk (*Basiliscus vittatus*), neotropical rattlesnake (*Crotalus durissus*), a tree snake (*Leptophys mexicano*) and the boa constrictor (*Boa constrictor*). Among the mammals are bats such as the Jamaican fruit bat (*Artibeus jamaicensis*) and greater sac-winged bat (*Sacropteryx bilineata*). Bird species include the turquoise-browed motmot (*Eumomota superciliosa*), cardenals, pheasants, falcons, quail, chachalacas and American flamingos (*Phoenicopterus ruber*) associated with coastal environments.
In terms of marine wildlife, there are various endemic species such as the lobster, *Octopus maya* and grouper fish. The northern beaches of this subregion are considered to be a sanctuary for sea turtles to lay their eggs, including the Pacific hawksbill turtle (*Eretmochelys imbricata bissa*), Mesoamerican river turtle (*Dermatemys mawii*) and loggerhead sea turtle (*Caretta caretta*) species.

Land Use/Human Activities: There is agricultural activity in 11 percent of the subregion's total land area, including areas where henequen (*Agave fourcroides)* continues to be cultivated. Main economic activities are commerce and tourism in the cities of Merida and Puerto Progreso, Yucatán. These two localities are the largest in the subregion.

14.3 Western Pacific Coastal Plain, Hills and Canyons (*Planicie costera, lomeríos y cañones del Pácifico occidental*)

14.3.1 Sinaloa Coastal Plain with Low Tropical Thorn Forest and Wetlands (*Planicie costera sinaloense con selva baja espinosa y humedales*)

Location: This subregion belongs to the Pacific Coastal Plain physiographic region and a small portion of the Western Sierra Madre. It is characterized by landform systems of plains and hills.

Climate: Climates in this subregion range from one of the driest to somewhat wetter, and including semi-dry, and in only some small areas, warm and dry. The dry climatic conditions are adverse for seasonal agriculture, leading to problems of insufficient water even during the rainy season, with low precipitation, high temperatures and a high degree of evaporation.

Vegetation: Distribution of vegetation is related directly to environmental moisture and soil development. At the highest elevations, where there is more moisture, there are tropical thorn forests with more shrub-like, thorny vegetation, with plant elements such as those characterizing the *Capparis, Bursera, Prosopis, Croton, Hechtia* and *Haematoxylum* genuses. Given the specific environmental characteristics, it is thought that much of the agricultural area is dominated by this plant community. In the relatively high hills in this subregion there is a small amount of sarcocaul and sarcocrasicaul shrubland with crassulaceae, thorny vegetation, such as the *Stenocereus, Fouquieria, Ipomoea, Croton* and *Euphorbia*

genuses. Finally, in the coastline area, there are wetlands with mangrove-type vegetation consisting of plant communities that are relatively low but with an arboreal appearance, belonging to the *Rhizophora, Leguncularia, Conocarpus* and *Avicennia* genuses. Mangrove swamps are ecologically and economically important in this subregion, since they provide a special environment for flora and fauna, and in terms of aquaculture, they serve as natural ponds for developing and exploiting marine species such as shrimp.

Hydrology: Most of the rivers crossing the subregion originate on the western side of the Western Sierra Madre. The most important are the Fuerte, Sinaloa, Culiacán and San Lorenzo Rivers. In the lower basin, the flow of these watercourses is mostly retained, with water stored in artificial reservoirs for later use in irrigating the large agricultural fields in the coastal plains area. Together, these rivers contribute an average of 15,200 million cubic meters of water annually.

Terrain: This subregion consists of basically flat land with low elevations, and a maximum of 300 masl in some isolated hills. The soils are characterized by their depth and productivity, and most are Chromic Vertisols that develop in and are associated with flat areas. Less common are soils containing varying levels of salinity, such as Solonchak soil. And smaller areas are covered by less developed soil, in terms of the depth and fertility required for agricultural crops, characterized by associations of Regosols, Phaeozems and Litosols found on hillsides.

Wildlife: The wildlife in this subregion includes species of land mammals such as the Virginia opossum (*Didelphys virginiana*), hooded skunk (*Mephitis macroura*), desert cottontail (*Silvylalgus audobonii*), nine-banded armadillo *(Dasypus novemcinctus),* antelope jackrabbit *(Lepus allenii*), grayish mouse opossum (*Marmosa canescens*), gray fox (*Urocyon cinerreoargenteus*), ring-tailed cat *(Bassariscus astutus)* and coyote (*Canis latrans)*. Reptiles include the tropical moccasin (*Agkistrodon bilineatus*), ornate wood turtle (*Rhinnoclemmys pulcherrima*), red-eared slider (*Trachemys scripta*), Clark's spiny lizard (*Sceloporus clarkii*), horrible spiny lizard (*Sceloporus horridus*), Nelson's spiny lizard (*S. nelsoni*), tropical tree lizard (*Urosaurus bicarnatus*), lesser earless lizard (*Holbrookia maculate*), boa constrictor (*Boa constrictor*) and Mexican west coast rattlesnake (*Crotalus basiliscus*). Amphibians include the cane toad (*Bufo marinus*), Mexican treefrog (*Smilisca baudina*), Couch's spadefoot toad (*Scaphiopus couchii*), *Eleuterodactylus interobitalis,* marbled toad (*Bufo marmoreus*), red-spotted toad (*Bufo punctatus*), Great Plains narrowmouth toad (*Gastrophyrne olivacea*), fringe-toed foamfrog (*Leptodactylus melanotus*), Mexican leaf frog (*Pachymedusa danicolor),* northern casque-headed frog (*Pternophyla fodiens*), Forrer's grass frog (*Rana forreri*), northwest Mexico leopard frog (*Rana magnaocularis*) and *Smilisca budin.* There are 31 types of birds in the at-risk category. Of these, the most representative species are the great blue heron (*Ardea Herodias*), northern shoveler (*Anas clypeata*), brown pelican (*Pelecanus occidentalis*), northern pintail (*Anas acuta*), greater white-fronted goose (*Anser albifrons*), red-tailed hawk (*Buteo jamaicensis*), great-tailed grackle (*Quiscalus mexicanus*), house sparrow (*Passer domesticus*), common ground dove (*Columbina passerine*), *Pelecanus eritrorynchus,* American kestrel (*Falco sparverius*), neotropic cormorant (*Phalacrocorax olivaceus*), northern mockingbird (*Mimus poliglottos*), roseate spoonbill (*Ajaia ajaja*), great horned owl (*Bubo virginianus*), violet-crowned hummingbird (*Amazilia violiceps*), blue-footed booby (*Sula nebouxii*), brown booby (*Sula leucogaster*), peregrine falcon (*Falco peregrinus*), heermann's gull (*Larus heermanni*) and Virginia rail (*Rallus limicola*).

The Gulf of California also has a great diversity of species that are important as fishing resources. Shrimp is the most important, followed by the warrior swimming crab (*Callinectes bellicosus*), arched swimming crab (*C. arcuatus*), white clam (*Chione californiensis*) and *pata de mula* (*Anadara sp*). In addition, there are 185 registered species of fish that are also important, such as flathead and silver mullet (*Mugil cephalus* and *M. curema*), bullseye puffer fish (*Sphoeroides annulatus*), mojarra (*Diapterus peruvianus*), sierra (*Scomberomorus sierra*), corvina (*Cynoscion reticulatus*), yellow snapper (*Lutjanus argentiventris*), triggerfish (*Pseudobalistes spp.*), Colorado snappers (*Lutjanus colorado, L. guttatus* and

L. griseus) and snook (*Centropomus spp*.). Especially worth noting among the marine mammals is the gray whale (*Eschrichtius robustus*).

Land Use/Human Activities: Agricultural activity in this subregion is important for Mexico, since a significant portion of national grain production takes place in this area. Irrigation is used in nearly all agricultural activity, with drip systems for using water from reservoirs and wells more efficiently. Crops especially worth mentioning are hybrid corn, beans, chilies, potatoes and chickpeas. There are also some seasonal crops, especially sorghum, chickpeas and safflower. Livestock activity, particularly intensive livestock production, is also important in this subregion, as are the poultry and swine industries. This subregion has a well-developed highway system, especially for the transportation required for the US-focused export economy. Major cities include Culiacán, Los Mochis and Guasave.

14.3.2 Sinaloa and Sonora Hills and Canyons with Xeric Shrub and Low Tropical Deciduous Forest (*Lomeríos y cañones de Sinaloa y Sonora con matorral xerófilo y selva baja caducifolia*)

Location: Most of this subregion is located in the Western Sierra Madre, although it is also associated with the Sonora plain, Pacific coastal plain and Transverse Neovolcanic Belt, where there are primarily canyons.

Climate: Predominant climate is sub-humid and warm with summer rains, followed by dry and semi-dry climates. The subregion's climates are influenced orographically by the Western Sierra Madre, and consequently there are areas with a great deal of moisture, as well as dry and semi-dry areas, depending on the position and distance from the ocean.

Vegetation: The most abundant vegetation is tropical deciduous forest, covering over 30 percent of the subregion's land area. The species found in this type of vegetation include *Bursera spp., Fouquieria spp., Leucaena spp., Stenocereus spp., Pachycereus spp.*, bastard cedar (*Guazuma ulmifolia*), and *Ceiba spp.* Some of these species are on the lists of species requiring special protection in Mexico. Approximately 25 percent of the vegetation in this subregion has some degree of anthropogenic disturbance.

Hydrology: This subregion includes the northern part of the Southern Sonora hydrological region and part of the high basins formed by the tributaries of the Sonora, Yaqui and Mayo Rivers. In the central part of the subregion, the Sinaloa region includes the Fuerte, Sinaloa, Mocorito, Culiacán, San Lorenzo, Piaxtla, Elota and Quelite Rivers. In the southern part, the Presidio and San Pedro regions include the tributaries of the Presidio, Acaponeta and Baluarte Rivers. The Lerma-Santiago system includes the Huaynamota, Santiago-Aguamilpa, Santiago-Guadalajara and Juchipila Rivers. All these rivers and tributaries are very importance economically since they provide water to numerous agricultural areas.

Terrain: Sierras and hills cover nearly 70 percent of the subregion's territory, although there are also bajadas, canyons, plains and plateaus (less than 30 percent). Elevations range from sea level to 2,800 masl, with an average of 800 masl. The prevailing type of rock is extrusive igneous from the Tertiary period, signifying there was major volcanic activity. The dominant soil type in this subregion is Litosol-Regosol, found in over 30 percent of the land area. The second-most common soil types are Phaeozem and Vertisol-Luvisol.

Wildlife: There are natural protected areas in the Sierra Álamos-Cuchujaqui River zone, a relatively well-conserved site with great ecological importance. Approximately 500 animal species can be found in this zone, which is considered to be vital for the distribution of species such as the jaguar (*Panthera onca*), cougar (*Puma concolor*), golden eagle (*Aquila chrysaetos*) and peregrine falcon (*Falco peregrinus*). It is

believed there are still some animals from the *Ursidae* family, particularly the grizzly bear (*Ursus arctos horribilis*).

Land Use/Human Activities: Approximately 15 percent of the territory is dedicated to agricultural production, mostly annual seasonal crops, followed by cultivated grasslands and annual irrigation crops. Sonora ranks first nationally in the production of kabocha squash, grapes, hard grain wheat, asparagus, safflower and grain wheat, and in the area of fishing, in industrial anchoveta, sardines, squid, crab and corvina. Sinaloa, for its part, ranks first nationally in the production of dry rye grass, Keitt mango, red tomato, Kent mango, white chickpea (grain), white grain corn, potato, green chili, cucumber and zucchini, and in the area of fishing, in *barrilete*, tuna and shrimp production.

Approximately 45 percent of the population lives in rural areas, and the rest in urban localities. Rural population density remains low, however. There are three important cities in this subregion, with significant economic and tourist activity: Tequila, in Jalisco, and Mazatlán and Escuinapa, in Sinaloa.

14.4 Interior Depressions (*Depresiones intermontanas*)

14.4.1 Balsas Depression with Low Tropical Deciduous Forest and Xerophytic Shrub (*Depresión del Balsas con selva baja caducifolia y matorral xerófilo*)

Location: Located in southern Mexico, in portions of the states of Jalisco, Michoacán, Guerrero, Mexico, Puebla and Morelos. Located to the south of the Transverse Neovolcanic Belt physiographic region and to the north of the Southern Sierra Madre. The following subregions are located in this Depression: the Balsas Depression, Southern Border Slope, Southern Coastal Mountains, Tarasca Neovolcanic, Tepalcatepec Depression, Guerrero Sierras and Valleys, Southern Coasts, Southern Sierras of Puebla, Central Sierras of Oaxaca, and Anáhuac Lakes and Volcanoes.

Climate: Climates vary greatly, and include sub-humid warm; dry; semi-dry, very warm; sub-humid semi-warm; and sub-humid temperate, with summer rains. Temperatures oscillate between 16 and 30°C. In the driest areas, the mean annual precipitation is 500 mm. Precipitation is greater at higher elevations, ranging from 1,000 to 1,200 mm annually.

Vegetation: In general, tropical deciduous forest is found in the low parts of this subregion, and oak and conifer forest at the high elevations. The Balsas Depression has 14 types of vegetation, but primarily tropical deciduous forest, with species including fragrant bursera (*Bursera fagaroides*), *Bursera morelensis, Bursera copallifera, Lysiloma acapulcense,* fernleaf acacia (*Acacia pennatula*), *Acacia cymbispina,* Sonoran palo verde (*Cercidium praecox*), bocote (*Cordia elaeagnoides),* bastard cedar *(Guazuma ulmifolia),* Brazilwood (*Haematoxylum brasiletto*), hopseed bush (*Dodonaea viscose*), smooth mesquite (*Prosopis leavigata*), cuachalalate (*Amphipteryngium adstringens*), *Caesalpinia coririana, Randia spp.,* common yellow elder (*Tecoma stans*), nance *(Byrsonima crassifolia), Pseudosmodingium perniciosum, Pithecellobium acatlense, Mimosa spp.,* sweet brahea palm (*Brahea dulce*), *Ipomoea wolcottiana, Ipomoea murucoides,* and *Ceiba spp.* The predominant vegetation at the high elevations includes pine-oak, oak-pine, oak and táscate juniper forests, with *Quercus magnoliifolia, Q. urbanii, Q. conspersa, Q. scytophylla, Q. crassifolia, Q. glaucoides, Q. elliptica,* Pringle's pine (*Pinus pringlei*), Mexican yellow Pine *(P. oocarpa*), Lawson's pine *(Pinus lawsoni)* and weeping juniper (*Juniperus flaccida*) and other species. Induced grasslands are very important for livestock production, and include species such as *Hilaria cenchroides, Bouteloua spp.,* poverty grass (*Aristida spp.*) and muley grass (*Muhlenbergia spp.*)

Hydrology: The subregion is defined by the Balsas river basin and its many tributaries, such as the Amacuzac, Nexapa, Mixteco, Atoyac, Tuzantla and Grande Rivers. There are numerous water bodies that are important for generating electricity, such as the Infiernillo, El Caracol, Vicente Guerrero and El Gallo reservoirs, and there are others, less important, that are used for agricultural and livestock production.

Terrain: Landforms include basically sierras, hills, valleys, plains and canyons. The rock layer is of extrusive igneous origin, and includes basalts, tuffs, rhyolites and andesites from the Cenozoic era, and to a lesser degree, metamorphic rocks such as schists from the Paleozoic and Mesozoic eras, as well as sedimentary rocks such as shales, limestones, sandstones and conglomerates from the Cenozoic and Mesozoic eras. Soils are Quaternary alluvial soils; the types of soil found in the plains and valleys are Vertisols, Rendzinas and Phaeozems, and the types found in the hills and sierras are Regosols, Litosols, Cambiosols and Luvisols. Elevations range from 200 masl in the low parts, including the Infiernillo Reservoir and Balsas River areas, up to 2,300 masl in the Cerro Quiote and Cerro Nieves areas.

Wildlife: The most important species known in this area are the ring-tailed cat (*Bassariscus astutus*), raccoon (*Procyon lotor*), nine-banded armadillo (*Dasypus novemcinctus*), white-eared hummingbird (*Hylocharris leucostis*), southern spotted skunk (*Spilogale angustifrons*) gray fox (*Urocyon cinereoargenteus*), squirrel (*Sciurus poliopus memoralis*), Mexican cottontail (*Sylvilagus cunicularis*) and white-tailed deer (*Odocoileus virginianus*). Species in danger of extinction include the boa constrictor (*Boa constrictor*), rattlesnake (*Crotalus spp.*), iguana (*Ctenosaura spp.*), vulture (*Sarcorramphus spp.*), golden eagle (*Aquila chrysaetos*), mountain lion (*Felis concolor*), ocelote (*F. pardalis*), margay (*F. wiedii*), jaguarundi (*F. yagouaroundi*), bobcat (*Linyx rufus*), and coyote (*Canis latrans*).

Land Use/Human Activities: More than one-fourth, or 26 percent, of the total land area (16,845 km^2) is used for agriculture. There is both seasonal and irrigation agriculture with the following annual crops: corn, sesame seed, beans, sorghum, jamaica, peanuts, chilies, cantaloupe, onion, sugar cane, papaya, alfalfa, mangos, limes, avocadoes and peaches. Other types of vegetation, water bodies and urban areas cover 3.1 percent of the remaining land area. There are only a few natural protected areas, since vegetation is second growth, and most of the land is used for agriculture or livestock grazing. Some important urban settlements for the region's economy include Tepacaltepec, Apatzingán, Nueva Italia and Huetamo in Michoacán; Ciudad Altamirano, Arcelia, Teloloapan, Iguala, Taxco, Chilpancingo and Chilapa in Guerrero; Cuernavaca and Cuautla in Morelos; Atlixco in Puebla; and Izúcar de Matamoros and Huajuapan de León in Oaxaca.

14.4.2 Chiapas Depression with Low Tropical Deciduous and Medium-high Semi-Deciduous Forest (*Depresión de Chiapas con selvas baja caducifolia y mediana subcaducifolia*)

Location: This subregion crosses central Chiapas, and corresponds physiographically to the Central American Mountains and Sierras of Chiapas and Guatemala regions. The area is also known as the Chiapas Highlands, Central Depression and the Southern Sierras, which run parallel to the Sierra Madre of Chiapas.

Climate: There are two types of climates: warm sub-humid, which is the most common, and semi-warm humid, on the slopes of mountain chains. The "Dog Days" phenomenon is common, and the orographic factor has an impact in this subregion, which has a long dry season (4 to 6 months), and in some areas precipitation is less than 800 mm annually. The mountainous areas in the Sierra Madre and the highlands provide a degree of isolation, affecting temperature and precipitation, with abundant summer rains.

Vegetation: Environmental conditions play a role in the predominance of tropical deciduous forest in this subregion. The trees are not very tall, and their appearance differs significantly between dry and rainy seasons. A very small portion of this plant community is still in its virgin state, and located in plateaus and sierras with steep slopes. However, most of this forest has suffered some type of alteration, due to grazing, conversion to cropland, the building of dams and accidental fires. There are only a few species in the arboreal layer, where the leguminous plant family predominates in both diversity and number of

species. Representative species include: *Lysiloma divaricatum*, Mexican alvaradoa (*Alvaradoa amorphoides*), peacock flower (*Caesalpinia pulcherrima*), kapok (*Ceiba pentandra*), buttercup tree *(Cochlospermum vitifolium*), *Comocladia engleriana*, butterfly orchid tree (*Bauhinia divaricata*) and *Bursera spp*. Also common are cactus and other succulent plants. At the upper part of this subregion, there are conifer, oak and mountain cloud forests. Toward the canyons, where moisture is concentrated, there are semi-deciduous and semi-evergreen forest stands of medium height. There is also tall forest, however not as common. Original vegetation has been converted and sometimes recuperated through induced grasslands and palm groves. The central and northwest parts of the subregion are covered with savannah. It is common to find ahuehuete or Montezuma cypress (*Taxodium mucronatum*), as well as amates (*Ficus*), alongside the area's rivers.

Hydrology: The rivers and streams that cross this subregion originate in the Sierra Madre and central highlands, with Grijalva River as the largest river. Located along this river are two hydroelectric dams: Belisario Domínguez (La Angostura) and Manuel Moreno Torres (Chicoasén).

Terrain: The elevation gradient ranges from 200 to 2,300 masl, and the irregular land surface includes hills, plateaus, canyons, hills and valleys. The Sumidero Canyon is especially worth mentioning, with its steep walls up to 1,000 meters high. Geologically, this subregion is composed of sedimentary rock, although there is also intrusive and extrusive igneous rock. The sedimentary rock consists of predominantly limestone layers from the Cenozoic era. Specifically, there is one bottom marine layer from the Tertiary period, and another upper continental layer from the Quaternary period. There are various soil types, but the dominant ones are Litosols, Regosols, Vertisols and Luvisols.

Wildlife: Although there is some type of human activity occurring in most of this subregion, mammals like the gray fox (*Urocyon cinereoargenteus*) and skunks including the hooded skunk (*Mephitis macroura*) and hog-nosed skunk (*Conepatus mesoleucos*) still survive in isolated sierras and canyons. Also especially worth mentioning in this subregion are snakes like the boa constrictor (*Boa constrictor*) and neotropical rattlesnake (*Crotalus durissus*). The characteristic birds in this subregion include the plain chachalaca (*Ortalis vetula*), mottled owl (*Ciccaba virgata*), lesser roadrunner (*Geococcyx velox*) and white-throated magpie-jay (*Calocitta formosa*).

Land Use/Human Activities: Agricultural activity includes seasonal and irrigated crops and cultivated grasslands. Seasonal crops cover the largest area, with more than 400,000 hectares, followed by cultivated grasslands, with more than 190,000 hectares. The most common annual crops are corn, beans and peanuts. There are also coffee plantations in the foothills of the Sierra Madre. The most common grasses cultivated for livestock grazing are African star, Jaragua and Brizantha grasses. And the crops grown in irrigated areas are primarily corn and sugar cane.
The subregion's population is relatively small and located mostly in rural settlements. The capital and most important city in Chiapas, Tuxtla Gutiérrez, is located in this subregion. This city plays an important role as a center for commerce and services, and it has a certain influence over the entire state. Other important cities are Acala, Berriozábal, Cintalapa, Chiapa de Corzo, Villaflores, Ocozocoautla, Frontera Comalapa, Venustiano Carranza and Suchiapa. The Zoque ethnic group has a significant population in the central-northern part of this subregion.

14.4.3 Valleys and Depressions of Oaxaca and Puebla with Xeric Shrub and Low Tropical Deciduous Forest (*Valles y depresiones de Oaxaca y Puebla con selva baja caducifolia y matorral xerófilo*)

Location: This subregion is located toward the center of the state of Oaxaca, bordered by the Southern Sierra Madre. It covers a total area of 3,798,306 km^2.

Climate: The climate is arid with mean annual precipitation of 600 to 700 mm.

Vegetation: This subregion is considered to have a great wealth of plant species. Especially worth noting are columnar cacti and endemic cacti species such as chende (*Polaskia chende*), *Mammillaria zephyranthoides*, *Oaxacania malvaefolia*, *Tigridia spp.*, *tetetzo* (*Neobuxbaumia tetetzo*), *Lemaireocereus spp., Beaucarnea gracilis, candelilla* (*Euphorbia antisyphilitica*), *Castela spp.*, barrel cacti (*Echinocactus spp.*), *Cephalocereus columna-trajani* and bilberry (*Myrtillocactus geometrizans*). The subregion is also known for its Mexican croton (*Croton ciliatoglandulifer*) and *Agave kerchovei* species, as well as orchids and other species in danger of extinction.

Other types of vegetation include oak forests at lower elevations, dominated by *Quercus glaucoides*, followed by mixed pine-oak forests at higher elevations, where forests are better conserved. All the plant populations are second-growth forests. In the inter-mountain depressions, there are small tropical deciduous forest communities, and in the northeast, there is a small area with smooth mezquite (*Prosopis laevigata*). Twenty percent of land area is covered by induced grasslands, especially hairy grama (*Bouteloua hirsuta*), poverty grass (*Arístida*) and muley grass (*Muhlenbergia*).

Hydrology: The Tlacolula, Etia and Zimatlán Valleys come together in this subregion, and lead into the Atoyac River.

Terrain: Elevation gradient ranges from 1,200 masl in the lowest parts, to hills and low sierras with gradual slopes, up to 3,000 masl at Cerro Tres Cruces.

Wildlife: Despite this subregion's considerable plant biodiversity, a precise record of its wildlife has not been compiled. In general the wildlife in this subregion has been historically decimated as a result of massive human presence. Even so, animals such as rabbits, hares, squirrels, opossums, skunks, beaded lizards and snakes have been observed in forest areas. Among the birds found in this subregion are the northern mockingbird, house finch, calandria, crows and doves, as well as migratory birds that come from the north to winter.

Land Use/Human Activities: Eroded and very arid soil is characteristic of this subregion. At least 20 percent of the land area is covered with induced grasslands. About 30 percent of the land is used for agriculture, which is generally seasonal in nature, with the typical crops of corn and beans for family consumption, and agave for producing mezcal, which is processed manually. In valleys with alluvial soil, irrigation is used to grow alfalfa for feeding to dairy cattle for milk and cheese production. Located in this subregion is the Oaxaca state capital.

14.5 Southern Mexican Pacific Coastal Plain and Hills (*Planicie costera y lomeríos del Pacífico sur mexicano*)

14.5.1 Tehuantepec Canyon and Coastal Plain with Low Tropical Deciduous Forest and Low Thorn Forest (*Bosque tropical caducifolio y bajo espinoso del cañón y planicie de Tehuantepec*)

Location: This subregion is located within the Southern Sierra Madre, Central American Mountains and Southern Gulf Coastal Plain physiographic regions.

Climate: Climates are primarily warm, but there are also a few semi-warm and temperate climates in areas with higher elevation. Most of the rainfall is in the summer, with only a very small amount in the winter.

Vegetation: Tropical deciduous forest predominates and is found mostly in sierras and canyons, represented primarily by trees from the *Lisyloma, Bursera,* and *Ceiba* genuses. Pine and mixed pine-oak forests are also found at the same elevations, although to a lesser degree. Semi-evergreen forest stands of medium height are also found, but in even more limited areas. Vegetation at low elevation consists, first of all, of low thorn forest with elements of *Jacquinia* and *Prosopis* genuses and, secondly, of tropical deciduous forests on hillsides.

Hydrology: This subregion is formed by an extensive fluvial network connected with a coastal lagoon system found all along the coast. The main rivers are the Tehuantepec and Los Perros rivers. The largest lagoons are the Superior, Inferior and Mar Muerto lagoons. Also in this subregion is the Presidente Benito Juárez reservoir, which is fed by water primarily from the Tehuantepec River.

Terrain: This subregion's terrain is rugged, and dominated by a series of canyons, although there are also some important plains in the southern part near the Isthmus Coastal Plain. The soils, which vary according to the different areas, include Regosols, Cambisols, Phaeozems, Luvisols, Vertisols and Gleysols. These soils evolved from rocks from the Cretaceous and Quaternary periods, including granite rocks and tuffs.

Wildlife: Despite the high level of impact from human activities, this subregion is still very important ecologically due to its inaccessible mountain areas and the lagoon system that serves as a feeding site for the black sea turtle (*Chelonia agassizi*). Other important species in this subregion are the Tehuantepec jackrabbit (*Lepus flavigularis*), jaguar (*Panthera onca*), cougar (*Puma concolor*), coyote (*Canis latrans*), white-lipped peccary (*Tayasso pecari*), peregrine falcon (*Falco peregrinus*), great-tailed grackle (*Quiscalus mexicanus*), solitary eagle (*Harpyhaliaetus solitarius*) and wood stork (*Mycteria americana*).

Land Use/Human Activities: Agricultural and livestock activities are the most important activities. Both irrigation and seasonal agriculture are practiced. The main irrigated crops, important in this region, are sugar cane, banana, mango, papaya and coconut, and the main seasonal crops are hybrid and native corn, plus tamarindo, mango and cantaloupe. There is also extensive livestock grazing in established as well as induced grasslands, and to a lesser extent, there are cultivated grasslands for feeding livestock kept in stables.

The subregion's population resides in only a few localities, but these localities are important ones in the Isthmus of Tehuantepec and in the state of Oaxaca. Most of the inhabitants are indigenous, with people from the Huave, Zapotec and Zoque ethnic groups. Highways connecting these localities are limited and, consequently, railroad services are important, since they connect the main cities, including Salina Cruz, Santo Domingo Tehuantepec, Ciudad Ixtepec, Juchitlán, Unión Hidalgo and Matías Romero.

14.5.2 Southern Mexican Pacific Hills and Piedmonts with Low Tropical Deciduous Forest (*Lomeríos y piedemontes del Pacífico sur mexicano con selvas baja y mediana caducifolias*)

Location: This subregion extends across the entire Southern Pacific coastal plains and adjoining hills, from Jalisco to Oaxaca. It is part of the Southern Coasts and Coastal Sierras of Jalisco and Colima physiographic subregions.

Climate: Predominant climates are warm and sub-humid with little or moderate precipitation, and there are also dry climates, although less common. In both cases rainfall occurs in the summer. There is an extremely dry period, both intense and long in duration, due to high temperatures from January to May.

Vegetation: It is typical in this subregion to find forest vegetation dominated by arboreal species (some with thorns and some without) that lose most or all of their foliage during the decisively dry season each year. Because of this, the landscape is markedly different in the dry season than in the rainy season. The

absence of precipitation during the dry season also limits the development of these dominant species, and consequently they typically oscillate between five and 15 meters in height, and are found in virgin tropical deciduous forests, or more frequently, in second growth stands. There are also some semi-deciduous forest stands of medium height, with trees growing taller than 15 meters high. This vegetation is distributed on the lower slopes of hillsides, especially along the banks of rivers and streams, where the layers of soil are very stony and not very deep. Other characteristic types of vegetation are induced grasslands in rolling hills, hydrophytic vegetation all along watercourses and in flooded terrain, and coastal dune vegetation. In some mountainous areas there are also small spots of oak or mixed oak-pine forests.

Hydrology: The most important river that crosses this subregion, between the states of Guerrero and Michoacán, is the Balsas River. It is one of the country's largest rivers, and its waters drain from a land area of 111,122 km^2. Many perennial and semi-perennial rivers cross this subregion from the Southern Sierra Madre to the Pacific Ocean. These rivers maintain the moisture in this subregion, making agricultural activities possible in its alluvial valleys, and at the same time, maintain an extensive system of coastal lagoons. Some of these rivers are the Tomatlán, Purificación, La Unión, Atoyac, Coyuquilla, Nexpa, Sabana and Zimatán Rivers. Also, the Infiernillo Reservoir is located in this subregion.

Terrain: Common landforms include plains, hills, inter-mountain valleys and some low sierras. The lowest elevation is sea level, and the maximum elevations rise sporadically above 1,000 masl. The predominant soils in this subregion are Regosols, and in the plains there are also alluvial soils. The predominant geological substratum consists of intrusive granite igneous rocks.

Wildlife: In the interior of this subregion there is a great variety of wildlife including reptiles like the boa constrictor, rattlesnake, coral snake, beaded lizard and iguana; and birds like the eagle, calandria, quail, hummingbird, chachalaca, gull, house finch, macaw, redpoll, barn owl, parrot, *paloma primavera*, urraca, heron and vulture. Mammals commonly found include various species of squirrels and rabbits, coyote, bobcat, wild boar, raccoon, coati, armadillo, opossum, deer and skunk.

Land Use/Human Activities: There are cultivated grasslands and areas with semi-permanent and permanent irrigated crops. Most common crops are coconut, mango, papaya, limes and various cultivated grasses. There are major tourist-related activities throughout the coastal area, especially in Acapulco, the most important locality in this subregion, together with Colima.

14.6 Sierra and Plain of Los Cabos (*Sierra y planicie de Los Cabos*)

14.6.1 Los Cabos Plain and Hills with Low Tropical Deciduous Forest and Xeric Shrub (*Planicie y lomeríos de Los Cabos con selva baja caducifolia y matorral xerófilo*)

Location: This subregion extends to south of the Tropic of Cancer, and consists of the final part of the state of Baja California Sur. It runs from north to south, and borders with the Pacific Ocean to the southwest, and the Gulf of California to the northeast. It includes part of the La Paz municipality and the entire Los Cabos municipality. Total land area is 7,562.8 km^2.

Climate: Mean annual temperature ranges from 14 to 23°C. Mean annual precipitation fluctuates between 173 and 682 mm, with some torrential rains provoked by hurricanes. Climates vary according to elevation, ranging from very dry and warm in coastal areas, to dry and warm on the eastern slopes of the sierra, plus dry and semi-warm climates covering the area from east of La Paz to Cabo San Lucas and around mountain systems.

Vegetation: Vegetation follows climatic patterns. At the lower elevations, there is xeric sarcocaul and sarcocrasicaul shrubland with species like the Adam's tree (*Fouquieria diguetii*), *Jatropha spp.*, Mexican giant cactus (*Pachycereus pringlei*), *palo blanco* (*Lysiloma candida*), organ pipe cactus (*Stenocereus thurberi*) and sour pitaya (*Macharocereus gummosus*). At mid-level elevations and in the areas surrounding subregion 14.6.2 (La Laguna Mountains), there is tropical deciduous forest with species such as *palo blanco* (*Lysiloma candida*), *Lysiloma divaricada*, *Bursera spp.*, limberbush (*Jatropha cuneata*), Brazilwood (*Haematoxylon brasiletto*), *Cyrtocarpa edulis*, Mexican giant cactus (*Pachycereus pringlei*), *Pachycereus pecten-aboriginum*, and coral tree (*Erythrina spp.*). Tropical deciduous forest is the predominant plant ecosystem, covering approximately 92 percent of the subregion. There are also small amounts of mesquite forest, and riparian, halophytic and coastal dune vegetation.

Hydrology: This subregion has only intermittent streams; the largest is the San José, which originates in the area around the San Lázaro Peak and flows into the San José del Cabo Bay.

Terrain: Landforms are high and low sierras, complex plateaus with canyons, rolling hills with bajadas, steep-sided hills with canyons, bajadas with hillsides, alluvial plains and open, branched valleys. Elevation ranges from sea level to 1,500 masl. The rocks in these areas are primarily intrusive igneous rocks from the Cretaceous period, metamorphic rocks from the Triassic-Jurassic period, and extrusive igneous rocks and volcanic material from the Tertiary period. At the same time, and not in line with the rest of the lithology, there are underlying sedimentary rocks such as sandstones and conglomerates from the Plio-Quaternary period.

Wildlife: Includes the mule deer (*Odocoileus hemionus fuliginatus*), wild cat (*Felis silvestres*), coyote (*Canis latrans*), Baja California rattlesnake (*Crotalus enyo*), prairie rattlesnake (*Crotalus viridus*) and mountain lion (*Felix concolor*).

Land Use/Human Activities: The subregion's population is concentrated in Cabo San Lucas, San José del Cabo and Colonia del Sol. The main activity in these cities is high-end tourism. There are also many rural localities, but rural population density is very low. There is little agricultural activity, with only 0.13 percent of land area dedicated to this activity. The limited agricultural activity is concentrated on growing forage for livestock.

14.6.2 Sierra La Laguna with Oak and Conifer Forests (*Sierra La Laguna con bosques de encino y coníferas*)

Location: This subregion is an isolated mountainous area located on the Baja California peninsula.

Climate: Most common climate is sub-humid and temperate with summer rains, and next in importance are dry climates. In this area the type of climate depends on elevation variations, and on the fact that most of the moisture-carrying winds come from the Pacific Ocean, as opposed to the Gulf. Elevations range from 500 to 2,000 masl, with an average elevation of 1,100 masl.

Vegetation: The most abundant vegetative type is oak forest, covering approximately 44 percent of land area. Species found in this type of forest include *Quercus tuberculata*, *Q. devia*, Arizona white oak (*Q. arizonica*), madrone (*Arbutus spp.*), wild cherry (*Prunus spp.*), *Bumelia peninsularis*, *Buddleia crotonoides*, *Randia megacarpa* and *Nolina beldingii*. Another important type of vegetation is tropical deciduous forest, covering 15 percent of land area and most commonly found on the slopes of low mountains, between 400 and 800 masl. Characteristic species in this type of forest include *Lysiloma divaricata*, coralbean (*Erythrina flabelliformis*), West Indian jasmine (*Plumeria acutifolia*), small-leaf elephant tree (*Bursera microphylla*), Mexican ebony (*Pithecellobium mexicanum*), ashy limberbush (*Jatropha cinerea*), *J. vernicosa*, *Calliandra brandegeei* and sour pitaya (*Machaerocereus gummosus*). The type of vegetation covering the third-largest area is mixed pine-oak forest, including *Pinus*

cembroides var. Lagunae, an emblematic species of this area and an enigmatic case of endemism in the northwestern part of Mexico.

Hydrology: The Sierra La Laguna plays an important role as the area that receives the most rainwater in Baja California Sur.

Terrain: This subregion is a mountainous massif with a very rugged relief. Geomorphologically, this mountainous system is broken up by deep canyons that run east-west, with streams flowing intermittently. The prevailing rock is intrusive igneous (granite) rock from the Cretaceous period (more than 95 percent), although there are also limited amounts of metamorphic rocks from the Mesozoic era (2 percent). The rough-grained rocks are solidly integrated. Late intrusions appear as fine-grained veins in granite rocks. The most abundant type of soil, due to the subregion's physiography, is Litosol (more than 99 percent), while the remaining 1 percent is Regosol.

Wildlife: The Sierra La Laguna biosphere reserve is located in this subregion. It protects areas that have been well-conserved and are very important ecologically, with enormous wealth and diversity of species. Species identified include 108 arthropods, 4 amphibians, 38 reptiles, 65 birds and 30 mammals. The most representative species include the cougar (*Puma concolor*), red diamondback rattlesnake (*Crotalus ruber*), northern/mountain pygmy owl (*Glaucidium gnoma*), American badger (*Taxidea taxus*), Mexican mole lizard (*Bipes biporus*), Xantus's hummingbird (*Hylocharis xantusii*) and Peninsula mule deer (*Odocoileus hemionus peninsulae*).

Land Use/Human Activities: Most important economic activity is tourism, although there is also a considerable amount of extensive livestock grazing. Extraction of forest products is a complementary activity, and includes basically firewood, posts, charcoal and palm beams. Approximately 27 percent of the vegetation has some degree of disturbance. There are no areas formally designated for agriculture, although induced grasslands, such as poverty grasses (*Aristida spp.*) and muley grasses (*Muhlenbergia spp.*), are reported. The entire population lives in rural areas, and this is one of the areas in Mexico with the lowest population density.

15.0 Tropical Humid Forests

15.1 Gulf of Mexico Humid Coastal Plains and Hills (*Planicies costeras y lomeríos húmedos del golfo de México*)

15.1.1 Gulf of Mexico Coastal Plain with Wetlands and Tropical EvergreenForest (*Planicie costera del golfo de México con humedales y selva alta perennifolia)*

Location: This subregion is located in the states of Veracruz and Tabasco, and part of Campeche, plus small portions of Oaxaca and Chiapas. It is located within the Veracruz Coastal Plains and Tabasco Plains and Marshes physiographic subregions.

Climate: Predominant climates are warm and semi-warm. In general this is a region in which it rains throughout the year, but in some areas it is most common to find only summer rains.

Vegetation: Plant communities consist primarily of cultivated grasslands, which cover approximately 80 percent of the subregion. Other components are tulars and popals found in marshy areas. In addition important mangrove swamps are found in this subregion, including the Alvarado wetlands, the Centla region in Tabasco, and Laguna de Términos in Campeche. High tropical evergreen forest is another important type of vegetation in this subregion, although it has been greatly endangered by the extensive grasslands and croplands established. Currently, this type of vegetation is found only in small spots

located in isolated areas. Another important type of vegetation is low tropical evergreen forest that currently is also seriously threatened. In addition there are also areas of savannah, primarily in the Huimanguillo and Balancán region in the state of Tabasco, and in Palenque, Chiapas; and finally, there are also tropical oak forests located in the Balancán area of Tabasco.

Hydrology: This subregion has abundant water, in the form of rivers, lagoons and marshes. Especially worth mentioning are the Papaloapan river basin, Laguna de Términos (lagoon) and the Pantanos de Centla (marsh).

Terrain: The characteristic topography consists of extensive plains with gentle hills and in some cases, beaches and sandbars. In terms of its geological formation, this subregion is composed primarily of sedimentary sandstones from the Cenozoic era of the Miocene epoch, and also alluvial, marsh and lacustrine formations from the Cenozoic era of the Quaternary period. Limestone formations from the Cenozoic era of the Miocene epoch have also been found. The edaphology of this ecological subregion is comprised primarily of Gleysol soils that cover approximately 70 percent of the territory, followed by Cambiosols, Vertisols, Acrisols, and to a lesser extent, Luvisols. Gleysol soils are found in the marshy areas of the Papaloapan, Alvarado basin, as well as in the Pantanos de Centla area, the region known as the Chontalpa in Tabasco, and in the area around the Laguna de Términos in the state of Campeche.

Wildlife: Wildlife is highly varied due to the presence of both forest and wetland ecosystems. The latter constitute important sites for the protection, nesting, feeding and breeding of fish and birds. Both forests and wetlands have, however, been severely disturbed by human activities. Some characteristic animals in this subregion are on the list of species in danger of extinction, including the margay (*Leopardus wiedii*), jaguar (*Panthera onca*), West Indian manatee (*Trichechus manatus*), peregrine falcon (*Falco peregrinus*), jabiru (*Jabiru mycteria*), Morelet's crocodile (*Crocodylus moreletii*) and hawksbill turtle (*Eretmochelys imbricata*).

Land Use/Human Activities: The most important economic activity is the petroleum industry, with major installations in the Coatzacoalcos-Minatitlan area, in much of the state of Tabasco and in Ciudad del Carmen, Campeche. Agriculture is also very important among the region's economic activities. The most important crop is sugar cane, followed by rice, cacao, bananas and coconut palm (for coconut oil) in the state of Tabasco. In addition, it is important to mention the cultivated forests of eucalyptus, melina, teak and cedar in the Choapas and Agua Dulce area of Veracruz and in Huimanguillo and Tenosique, Tabasco. In the Isla y Juan Rodríguez Clara region of Veracruz, as well as in Loma Bonita, Oaxaca, there are large pineapple plantations and, in fact, this is the most important area of pineapple production in Mexico. Other crops are citrus fruits, chilies, plantain and watermelon.
The most important cities in this subregion are Puerto de Veracruz, Coatzacoalcos and Minatitlán in the state of Veracruz, Tuxtepec in the state of Oaxaca, Villahermosa and Cárdenas in Tabasco, and Ciudad del Carmen in Campeche.

15.1.2 Hills with High and Medium-high Tropical Evergreen Forest (*Lomeríos con selvas alta y mediana perennifolias*)

Location: This region covers parts of the states of San Luis Potosí, Veracruz, Hidalgo, and Puebla to the north, continuing through Oaxaca in the center, and then to the south with Tabasco and Chiapas. Because of its extended form, it includes parts of seven physiographic regions: Eastern Sierra Madre, Northern and Southern Gulf Coastal Plains; Transverse Neovolcanic Belt, Southern Sierra Madre, Central American Mountains and the Sierras of Chiapas and Guatemala. It is divided into eleven subregions: Huastec Karst, Chiconquiaco, Plains (Veracruz Coastal and Tabasco Marshes and Hills), Sierras (Eastern, Southern and Northern of Chiapas, Lacandon, Low Sierras in Petén) and the Chiapas Highlands.

Climate: The climate is mostly warm, with an average temperature above 22°C, as well as a semi-warm climate that averages 18°C. The moisture gradient is much more pronounced in the extreme northern portion of the subregion. Rains occur in the summer, and annual precipitation exceeds 2,000 mm in some areas.

Vegetation: Even though there is more land used for agricultural-livestock activity than the presence of plant communities, forests can be identified as the most representative of the remaining virgin vegetation (over 3 million hectares). First, virgin high tropical evergreen forests cover the largest land area of more than 1.2 million hectares, while the forests in this group that have suffered some type of alteration cover 1.8 million hectares. Common species include jutahy (*Dialium guianense*), *Vatairea lundelli*, white olive (*Terminalia amazonia*), big-leaf mahogany (*Swietenia macrophylla*), breadnut (*Brosimum aliscatrum*), sapodilla (*Manilkara zapota*) and *Vochysia hondurensis*. The group of forests including mountain cloud, pine, oak and mixed pine-oak forests covers more than 135,000 hectares, of which 56,000 hectares correspond to conserved areas, and the remaining are second-growth forests. Species include American sweetgum (*Liquidambar styraciflua)* and American hornbeam (*Carpinus caroliniana)*. There are also halophytic and savannah grasslands, covering more than 27,000 hectares.

Hydrology: There are two important rivers, the Lacantum and Usumacinta Rivers, both of which are in Chiapas. The latter marks part of the border between Mexico and Guatemala. There are also two important hydroelectrical dams in this subregion: the Miguel Alemán dam built over the Tonto River (a tributary of the Papaloapan River), and the Netzahualcóyotl dam, built over the Grijalva River basin, at the border between Veracruz and Chiapas.

Terrain: Elevation ranges from 100 to 2,200 masl, with varying relief created by the beaches, plains, hills, valleys, canyons, plateaus and sierras that define the various landscapes in this subregion. The main types of rock are sedimentary sandstone, shale and limestone. In the east central section, there are also igneous rocks, especially granite, but also basalt, gabbro, tuff, volcanic ash and andesite. The soil types in this subregion are very clay-like and have significant organic material content. The primary types are Acrisols, Regosols, Vertisols, Rendzinas, Litosols and Luvisols.

Wildlife: Important wildlife found in this region is primarily animals characteristic of wet forests. They can be found in restricted areas of natural vegetation that have some type of government-sponsored protection or in areas with difficult access. Examples of mammals include the spider monkey (*Ateles geoffroyi*), Guatemalan black howler monkey (*Alouatta pigra*), jaguar (*Panthera onca*), Baird's tapir (*Tapirus bairdii*), bats, rodents, keel-billed toucan (*Ramphastos sulfuratus*), various species of parrots from the genus *Amazona*, and countless migratory birds. Amphibians and reptiles include tree frogs (*Smilisca baudini*) and snakes, lizards and crocodiles. Insects are also important in this subregion, especially the butterflies from the genus *Morpho* in the Lacandon Forest.

Land Use/Human Activities: The greatest amount of land area is dedicated to agricultural-livestock activities, with a total of over 3.8 million hectares. Within these activities, cultivated grasslands cover the most land area (over 2.3 million hectares), stretching from the northern end to the southern end. The grasses most used for livestock grazing are: African star, Pangola, Guinea, Grama, Brizantha and Jaragua. Seasonal agriculture is the second most important agricultural activity, with both permanent and annual crops, including oranges, tangerines, coffee, mango, corn, beans and coconut.
The most important urban areas in the subregion are Poza Rica, Córdoba, Tuxpan, Papantla, Martínez de la Torre, Tlapacoyan, Cerro Azul, Tantoyuca and Álamo in the state of Veracruz, plus Huejutla de Reyes in the state of Hidalgo.

15.2 Plain and Hills of the Yucatan Peninsula (*Planicie y lomeríos de la península de Yucatán*)

15.2.1 Plain with Low and Medium-high Tropical Deciduous Forest (*Planicie con selvas baja y mediana subcaducifolias*)

Location: This subregion is located on the Yucatán peninsula, and includes parts of the states of Yucatán and Campeche.

Climate: For the most part the climate is sub-humid and warm, and the mean annual temperatures vary between 24 and 26°C. Average precipitation is approximately between 500 and 600 mm, and therefore the climate in this subregion is also considered to be dry.

Vegetation: Especially worth noting are the different types of forests in this subregion: semi-evergreen, semi-deciduous, and deciduous forests of medium and low height. Currently, these forests are largely deteriorated and continue to be threatened by the cultivated grasslands and agricultural areas established.

Hydrology: The absence of perennial surface water is notable. Such watercourses are created only during the rainy season, but water disappears through infiltration or drains into hollows, sinkholes or interior lagoons.

Terrain: Dominant landforms are rocky plains with shallow hollows in bedrock and low hills with hollows. In the central area of the subregion there is a landform described as a small, faulted sierra, but the rest of the relief is relatively flat. The geology in the subregion is quite homogenous, consisting of limestone layers from the Tertiary and Quaternary periods in 90 percent of the land area. Next in importance are alluvial Quaternary elements and residual Paleogenic elements. Soils are generally black or red, rendzic-type limestone soils, however in some parts there are hydromorphic soils of various types. Other types of soil found in the area are Luvisols, Cambiosols, Litosols and Nitosols.

Wildlife: This subregion has numerous bird species, such as the greater flamingo (*Phoenicopterus ruber roseus*), Yucatán wren (*Campylorhynchus yucatanicus*) and Mexican sheartail (*Doricha eliza*). Other bird species found in only limited locations are the Yucatán bobwhite (*Colinus nigrogularis*), Zenaida dove (*Zenaida aurita*), great egret (*Casmerodius albus*), yellow-crowned night heron (*Nycticorax violaceus*) and brown pelican (*Pelecanus occidentalis*). Other animal species include the spider money (*Ateles geoffroyi*), margay (*Leopardus wiedii*), ocelote (*L. pardalis*), jaguar (*Panthera onca*), boa constrictor (*Boa constrictor*), American crocodile (*Crocodylus acutus*), Morelet's crocodile (*C. moreletii*), yellow-lored Amazon (*Amazona xantholora*) and keel-billed toucan (*Ramphastos sulfuratus*).

Land Use/Human Activities: There are large areas of cultivated grassland, as well as fields of corn, tomatoes, beans, oil palm, sugar cane and some citrus fruit plantations, as well as melina, teak and cedar plantations.

The main urban centers are the city of Campeche in the state of Campeche; and Tzimin, Valladolid and Ticul in the state of Yucatán.

15.2.2 Plain with High and Medium-high Tropical Semi-Evergreen Forest (*Planicie con selvas mediana y alta subperennifolias*)

Location: This subregion is located on the Yucatán peninsula and also covers most of the state of Quintana Roo.

Climate: The mean annual temperature in the region is 26ºC, and coolest months are December, January and February, with temperatures under 22ºC. According to the Köppen climatic classification modified by

García, there are warm, sub-humid climates with intermediate rains. A humid warm climate with abundant rainfall in summer is found on Cozumel Island. Since there are no mountainous systems, there is less precipitation in general, although rainfall should be more intense due to the influence from trade winds and the Bermuda-Azores high-pressure cell. Generally it rains from May to October, although more intensely in September, primarily due to the effect from hurricanes and tropical depressions. Precipitation during the winter is caused by "north winds" (cold fronts carrying moisture), and corresponds to more than 10.2 percent of total annual rainfall.
Vegetation: Medium-height tropical semi-evergreen forest is the type of vegetation most extensively distributed throughout Quintana Roo. It can be found in places with a moderate slope and quicker surface drainage, and also in flat but somewhat drier regions with quick drainage. The trees in this plant community, as those in high evergreen forest, have buttresses and generally have many epiphytes and lianas. The trees have an average height of 25 to 35 meters, and reach a diameter at chest height that is less than that of trees in high tropical evergreen forests—even when from the same tree species. Three arboreal strata can be distinguished in this type of forest: 4–12 meters, 12–22 meters and 22–35 meters. Some palms can be found at low and medium heights. Among the dominant species are breadnut (*Brosimum alicastrum*), gumbo-limbo (*Bursera simaruba)*, sapodilla (*Manilkara zapota)*, fiddlewood (*Vitex gaumeri)*, big-leaf mahogany (*Swietenia macrophylla)*, black olive (*Bucida buceras)*, *Alseis yucatanensis*, false tamarind (*Lysiloma latisiliquum*) and *Carpodiptera floribunda*. Along riverbanks, malabar chestnut (*Pachira aquatica*) can be found. The most common epiphytes are some ferns and mosses, and abundant orchids, bromeliads and arums. An unusual situation in Quintana Roo is that pine stands are formed by an association of a particular species of pines, Caribbean pine (*Pinus caribaea*), with elements characteristic of a savannah. The presence of this particular pine species is important, since it is the only place in Mexico where it exists. These pine stands are found in the southeastern part of the Caobas *Ejido* in the Othón P. Blanco municipality.

Hydrology: Drainage in this subregion is totally subterranean. The minimal topography and permeability of the rocks limit the formation of any perennially-flowing watercourses. These same elements favor the infiltration of the abundant rainfall, forming caves, caverns, sinkholes and natural water wells all along the coast. However, the high permeability of rocks and the low water table make aquifers highly to extremely vulnerable.

Terrain: It is an almost flat area with low relief and elevation under 50 masl. Most of the subregion is composed of layers of carbonated rocks from the Upper Tertiary, and on the coast there is a strip of land from the Pliocene epoch. It has hardly any continental plateau in relation to the Caribbean Sea. This bloc emerged slowly in marine waters during the Tertiary and Quaternary periods of the Cenozoic era. The various types of limestone are rather superficial, and give way to marls and other types of sediments in minimal depths of 160 to 325 meters. The high degree of fracturing in superficial rock, and thin, porous and highly permeable soil, as well as high precipitation, lead to the formation of a complex area of subterranean cavities.

Wildlife: Despite pressure on habitats, native wildlife species have managed to survive, although with increasing difficulties. It is still possible to see toucan, (*Ramphastos spp.*), jaguar (*Felis onca*), white-tailed deer (*Odecoileus virginianus*), ocelote *(Leopardus pardalis*), spider money (*Ateles geoffroyi*), Mexican howler monkey (*Alouatta palliata mexicana*), raccoon (*Procyon lotor*), white-nosed coati (*Nasua narica*), Cozumel Island coati (*Nasua nelsoni*), weasels, paca (*Agouti paca*), opossum, white-lipped peccary (*Tayasso pecari*), squirrels, nine-banded armadillo (*Dasypus novemcinctus*), northern tamandua (*Tamandua mexicana*), ocellated turkey (*Meleagris ocellata*), great curassow (*Crax rubra*), jaguarundi (*Felis yagouaroundi*), chachalaca, parrot, quail, owl, vulture, fer de lance (*Bothrops asper*), rattlesnakes (*Crotalus spp.*), boa constrictor (*Boa constrictor*), iguana, green tree snake, horned lizard,

coral snake, Baird's tapir (*Tapirus bairdii*), turtles, heron, pelicans, gulls, ducks, crocodiles (*Crocodylus acutus* and *C. moreletii*), lobster, snails and squid.

Land Use/Human Activities: Of the total land area, 58 percent is covered with dense vegetation that has been fairly well conserved. There is very little agricultural activity, and the principal economic activity is the extraction of precious woods such as mahogany and cedar. The main population center is Cancún, where the primary activity is large-scale tourism.

15.2.3 Hills with High and Medium-high Tropical Semi-Evergreen Forest (*Lomeríos con con selvas alta y mediana subperennifolias*)

Location: This is one of the most conserved subregions in the Yucatán Peninsula, with a total land area of 47,914 km^2.

Climate: From north to south, the climate types found in this subregion are first, warm and driest of the sub-humid, then warm and sub-humid (intermediate), and finally, warm and wettest of the sub-humid. In the north the mean annual precipitation is 1,100 mm, and to the south, it increases to 1,500 mm. The mean annual temperature is 22°C.

Vegetation: Vegetation is dominated by natural forests with different levels of conservation, covering 82 percent of land area (39,380 km^2). Forest type with the largest land area is medium tropical semi-evergreen forest, covering 56 percent (26,874.4 km^2), followed by low semi-evergreen thorn forest, with 16.1 percent (7,736.17 km^2) and medium semi-deciduous forest, with 7.7 percent (3,700.7 km^2). There are also small areas of high tropical evergreen forest and tropical semi-evergreen forest. Some species characteristic of these forests are the Florida fish poison tree (*Piscidia piscipula*), *Lysiloma spp.*, fiddlewood (*Vitex gaumeri*), gumbo-limbo (*Busera simaruba*), black poisonwood (*Metopium brownei*), *Croton spp.*, *Coccoloba spp.*, sapodilla (*Manilkara zapota*), yellow mombin (*Spondias mombin*), and black olive (*Bucida buceras*). Low semi-evergreen thorn forests are characterized by species such as logwood (*Haematoxylum campechianum*), white poison wood (*Cameraria latifolia*) and black olive (*Bucida buseras*).

Hydrology: In the southwestern part of the subregion, there are permanent bodies of water such as the Candelaria River and part of the Usumacinta River, and lagoons such as the Silvituc, Maravillas, Misteriosa and El Toro lagoons.

Terrain: Hills are the dominant landform in this subregion. There are higher hills in the central part of the subregion, although not above 400 masl. Toward the west there are lower hills with hollows and low areas with plains. Also to the west, before reaching the plains characterized by bedrock and lacustrine deposits, there are low hills with plains. The geological origin is sedimentary rock from the Cenozoic era; the hills are of limestone and the plains are alluvial. The dominant soil type in the subregion is Rendzina, followed by Gleysol, Vertisol and Cambisol.

Wildlife: Especially noteworthy are felines like the jaguarundi (*Felis yagouaroundi*), mountain lion (*Felis concolor*), margay (*Leopardus wiedii*), ocelote (*Leopardus pardalis*) and jaguar (*Panthera onca*). Other species commonly found are the Mexican howler monkey (*Alouatta palliata mexicana*), spider monkey (*Ateles geoffroyi*), Baird's tapir (*Tapirus bairdii*), white-lipped peccary (*Tayasso pecari*), northern tamandua (*Tamandua mexicana*), nine-banded armadillo (*Dasypus novemcinctus*), white-tailed deer (*Odocoileus virginianus)* and red brocket (*Mazama americana*). There are also 282 bird species, including the chachalaca, parakeet, various tucan species, ocellated turkey (*Meleagris ocellata*), some parrot species, great curassow (*Crax rubra*), king vulture (*Sarcoramphus papa*), eagle and hawk. And there are approximately 50 reptile species and 400 butterfly species present.

Land Use/Human Activities: The subregion has been converted over time, as new areas have been opened up for livestock production. Approximately 12.5 percent (5,994.4 km^2) of the subregion is covered by cultivated grasslands, and the grass most frequently cultivated is African star, followed by German, Privilegio and Brizantha grasses. Of the much smaller land area dedicated to growing crops, most is dedicated to seasonal agriculture, with 2 percent (999 km^2) used specifically to grow corn. There is also some irrigation and non-irrigation agriculture, with crops including rice, sorghum, beans, habanero chilies and jalapeño chilies.

Human settlements are distributed toward the western part of the subregion, all along the Pan-American Highway leading to the capital of Campeche, and to the east, in the area surrounding the capital of Quintana Roo. There are hardly any human settlements in the central part of the subregion since there are no roads there. Only 0.17 percent (82.4 km^2) of the subregion is urbanized, and urban areas are small. The two largest cities are Escárcega, Campeche and Chetumal, Quintana Roo.

15.3 Sierra Los Tuxtlas (*Sierra de Los Tuxtlas*)

15.3.1 Sierra Los Tuxtlas with High Tropical Evergreen Forest (*Sierra de Los Tuxtlas con selva alta perennifolia*)

Location: This subregion is physiographically located within the Southern Gulf Coastal Plain region, in the southern part of the Mexican state of Veracruz. What distinguishes this area is that it is completely isolated from all other mountainous systems, and is therefore referred to as a "volcanic island" in the great Gulf of Mexico Coastal Plains.

Climate: Predominant climates are warm and semi-warm, generally with abundant rainfall, in summer in some areas, and year-round in others.

Vegetation: The plant communities in the subregion consist of high tropical evergreen forest, primarily on the windward slopes, and some areas of mountain cloud forest in the highest parts of the Santa Marta, San Martín Pajapan, Campanario and San Martín Tuxtla volcanoes. The open areas correspond mainly to cultivated grasslands with forest remnants, and this is the predominating landscape in the subregion. There are also some spots of tropical oak forest in the lowlands on the leeward side, and there is an area of pine groves in the middle part of the Sierra de Santa Marta. There are mangrove swamps and some isolated palm groves in the coastal area, principally in the Sontecomapan area.

Hydrology: The subregion is characterized by an abundance of water resources. This factor, together with the presence of mountain summits, allows for the draining of water along different slopes, creating a radial drainage system that not only leads to the forming of white water rapids and waterfalls, like the Eyipantla waterfall, but also supplies water bodies like the Sontecomapan Lagoon and Catemaco Lake.

Terrain: This sierra is volcanic in origin, and this distinguishes it in edaphological, geomorphological and climatic terms from the coastal plains of the Papaloapan River lower basin and the Coatzacoalacos River that surrounds it to the south and the west.

The region has a pronounced elevation gradient, from sea level to 1,680 masl, the latter corresponding to the San Martín and Santa Marta volcanoes. Nearly the entire region is covered with lava, ash and pyroclasts, with only minimal outcrops of marine sediments from the Tertiary period. Especially worth noting in the cliff areas are the calcareous sandstones and sands from the Filisola Formation, while in places with a gentle topography there are small areas of clays. To the south and west of the city of San Andrés Tuxtla, there are many sedimentary components from the Oligocene epoch of the Tertiary period,

specifically formations from prior to the first period of volcanic activity. In terms of the soil types characterizing this subregion, Luvisols and Acrisols cover approximately 34 percent of the total land area, followed in importance by Andosols, Phaeozems and Vertisols. The most common type of soil is Haplic Phaeozem.

Wildlife: The mammals especially worth mentioning are various species of bats in danger of extinction, as well as rodents and large mammals such as the cougar (*Puma concolor*), white-lipped peccary (*Tayasso pecari*), Baird's tapir (*Tapirus bairdii*), ocelote (*Leopardus pardalis*), jaguar (*Panthera onca*), howler monkey (*Alouatta palliata*) and spider monkey (*Ateles geoffroyi*). There are also many migratory bird species in the area, as well as some endemic bird species like the long-tailed sabrewing (*Campylopterus excellens*) and Tuxtla quail-dove (*Geotrygon carrikeri*). Insects, herpetofauna and ichthyofauna are all equally important due to their diversity and abundance.

Land Use/Human Activities: In higher elevation areas there are coffee fields under the shade of forest canopy or in the transition area between forest and cropland, and there are also seasonal cornfields. Agricultural crops with a high commercial value are planted on land that is flatter, has deeper soil layers and better road access, and these include sugar cane, oil palm, mango, banana and citrus fruit. Tobacco is grown in the San Andrés Tuxtla area. The crop covering the largest land area is corn, and it is grown primarily where the majority of inhabitants are Popoluca or Nahuatl indigenous. The main towns in this subregion are: San Andrés Tuxtla, Acayucan, Catemaco and Santiago Tuxtla.

15.4 Everglades

15.4.1 Southern Florida Coastal Plain

Location: Southern tip of Florida, from Lake Okeechobee in the north to Key West in the south.
Climate: The nearly frost-free climate of the Southern Florida Coastal Plain makes it distinct from other ecoregions in the conterminous United States. The ecoregion has a humid subtropical to tropical savanna climate. It is marked by hot summers and warm winters, with a drier winter season. The mean annual temperature is approximately 22° to 25°C. The frost-free period ranges from 330 to 365 days. The mean annual precipitation is 1,338 mm, ranging from 1,250 to 1,650 mm.
Vegetation: In the Everglades, sawgrass marshes are extensive with some tree-islands of slash pine, gumbo limbo, live oak, strangler fig, and royal palm. To the west in the Big Cypress area, are found cypress in wet areas, and gumbo limbo, pigeon plum, live oak, and laurel oak elsewhere. On the eastern coastal strip are areas of slash pine, sand pine, scrub oak, and saw palmetto. Mangrove swamps are common on the southern coast and the islands.
Hydrology: Drainage patterns are poorly defined. Many drainage canals exist and nearly all streams and rivers have been channelized. Wetlands are abundant.
Terrain: This region is characterized by flat, weakly dissected alluvial plains, with wet soils, marshland, and swampy land cover. Relatively slight differences in elevation and landform have important consequences for vegetation and the diversity of habitat types. Limestone underlies the surficial sands and gravels, and areas of peat, muck and clay.
Wildlife: Alligator, American crocodile, Florida panther, Key deer, white-tailed deer, manatee, brown pelican, woodstork, ibis, and herons.
Land Use/Human Activities: Although portions of this region are in parks, game refuges, and Indian reservations, a large part of the region has undergone extensive hydrological and biological alteration. Some areas of agriculture occur, with sugar cane, rice, sod, and vegetables. Urban areas are extensive along the Atlantic Coast. Population centers include Miami, Fort Lauderdale, West Palm Beach, and other adjacent coastal cities.

15.5 Western Pacific Plains and Hils (Planicies y lomeríos del Pácifico occidental)

15.5.1 Nayarit and Sinaloa Plain with Low Tropical Thorn Forest (*Planicie costera de Nayarit y Sinaloa con selva baja espinosa*)

Location: This subregion is located within the Pacific Coastal Plains physiographic region, part of the coastal plains of Nayarit and Sinaloa.

Climate: The region possesses a warm climate with an intermediate level of precipitation. Because of the topographic, climatic and soil conditions, some areas remain flooded year-round.

Vegetation: Dominant vegetation benefits from from permanent and seasonal moisture. In areas with permanent flooding, the type of vegetation corresponds to saltwater conditions, and includes *Rhizophora, Avicenia* and *Laguncularia* mangrove trees. In some mangrove swamps there are herbaceous plants of the *Batis* genus, and also halophytic vegetation, indicators of degradation. The mangrove swamps in this subregion are important ecologically and economically for the states of Nayarit and Sinaloa due to aquaculture activities. Another important type of vegetation is low thorn tropical forest. Here this type of forest is found in different conditions than in the Pacific drainage area, Species like the red mangrove (*Rhizophora*) can be found, but the most common elements in this forest are the *Pithecellobium*, *Prosopis*, *Pisonia* and *Sporobolus* genuses.

Hydrology: As an area that is very flat and subject to flooding, and with a warm climate, coastal lagoons and coastal saltwater lagoons are common.

Terrain: A very particular characteristic of this subregion is that it is very flat, with elevation ranging only from sea level to a maximum of 50 to 100 masl. In relation to soil conditions, Solonchak soil predominates. There are some areas subject to periodic flooding, and in those cases the soil is a swamp or Gleyic Solonchak. And in other areas where there is less moisture, Solonchak soil is associated with Regosol soil. The geological conditions are characterized by lacustrine-type Quaternary soil, in addition to the coastal strip of land that is also part of the subregion.

Wildlife: The diverse wildlife in this subregion is of Neotropical origin, and includes a considerable number of endemic, migratory, endangered and economically important species. The diversity of wildlife is associated with the environmental heterogeneity in the area. In Sinaloa and Nayarit 543 species of vertebrates are reported, and of these, at least 60 are in danger or extinction, particularly due to the over-use and destruction of habitats, and 51 species are endemic. The important species include the jaguar (*Panthera onca*), American crocodile (*Crocodylus acutus*), lilac-crowned Amazon (*Amazona finchii*), military macaw (*Ara militaris*), river otter (*Lutra canadiensis*), collared peccary (*Tayassu tajacu*), cougar (*Puma concolor*), bobcat (*Linx rufus*), ocelote (*Leopardus pardalis*), margay (*Leopardus wiedii*) and the white-tailed deer (*Odocoileus virginianus*).

Land Use/Human Activities: Irrigation agriculture is very important for local and international markets, and depends on a network of canals that bring water from reservoirs and also remove excess volume. The main crops are watermelon, cantaloupe, red and green tomatoes, chilies, beans and coconut. There is also seasonal agriculture, with primarily sorghum, corn and beans. Livestock, poultry and swine production is limited, however shrimp production is very significant, together with red snapper, salmon, sea bass and striped mullet.
Road and highway infrastructure is limited, and there are only a few population centers in this subregion because of flooding conditions, but there are small settlements and communities distributed throughout the subregion.

15.5.2 Jalisco andNayarit Hills and Coastal Plain with Medium-high Tropical Semi-Evergreen Forest (*Lomeríos y planicie costera de Nayarit y Jalisco* con *selva mediana subperennifolia*)

Location: This subregion is located within the physiographic subregions known as the Southern Foothills, Plateaus and Canyons; Neovolcanic Sierras of Nayarit; and Coastal Sierras of Jalisco and Colima.

Climate: Corresponds generally to the warm, sub-humid category.

Vegetation: The vegetation specified in the name for this subregion is medium-height tropical semi-evergreen forest, which is typical in protected canyons and sierras where environmental conditions allow the development of more exuberant vegetation and facilitate relatively good conservation of plant communities. Despite the importance of this type of vegetation, it is not the dominant one, since in the interior of this subregion, medium-height tropical semi-deciduous forests are more widely found, both in a virgin state and also as second growth. In drier areas there are also tropical deciduous forests, induced grasslands and small relicts of oak forest.

Hydrology: This subregion has two main rivers: Lerma-Santiago and Ameca. The main flow of water is located in the northern part, due to the Santiago River, also called the Lerma-Santiago River, and its tributaries. The Lerma River originates in the Almoloya del Río lagoon in the state of Mexico, where it begins its journey that ends in Chapala Lake. There the Grande Santiago River begins, crosses the entire central part of Jalisco, then enters Nayarit and flows into the Pacific Ocean. The water system in the state of Nayarit has a direct impact on the subregion, which contains the San Pedro, Lerma-Chapala-Santiago, Ameca, Acaponeta and Las Cañas Rivers.

Terrain: Common landforms in this area are high and low sierras, canyons, hills and alluvial plains. Elevation ranges from sea level at the coast to 1,800 masl in the high sierras. Predominant soils are Regosols and Phaeozems. The predominant geological stratum is composed of extrusive igneous rocks of rhyolites, acid tuffs and basalts, as well as intrusive igneous rocks of granite.

Wildlife: Nearly all the representative wildlife in the state of Nayarit can be found in the subregion, with species such as the white-tailed deer (*Odocoileus virginianus*), collared peccary (*Tayassu tajacu*), cougar (*Puma concolor*), ocelote (*Leopardus pardalis*), margay (*Leopardus wiedii*), cottontail rabbit (*Sylvilagus spp.*), nine-banded armadillo (*Dasypus novemcinctus*), coati (*Nasua nasua*), raccoon (*Procyon lotor*), dove, chachalaca, wild turkey, wild duck, quail, zanate, shiny cowbird and rattlesnake (*Crotalus spp.*).

Land Use/Human Activities: Due to the rugged topography, agricultural areas are mostly seasonal, with annual and permanent crops and cultivated grasslands. The only significant portion of the territory where irrigation agriculture is practiced is in the Valley of Banderas, at the border between Jalisco and Nayarit. The main crops are mango, corn, sorghum and coffee.
In the coastal area, tourist activities are important economically, and this is especially true in Puerto Vallarta, the subregion's major city.

15.6 Coastal Plain and Hills of Soconusco (*Planicie costera y lomeríos del Soconusco*)

15.6.1 Coastal Plain and Hills with High and Medium-high Tropical Evergreen Forest and Wetlands (*Planicie costera y lomeríos con humedales y selvas media y alta perennifolias*)

Location: This subregion extends along the coast in the state of Chiapas and includes nearby sierras. It is located within the physiographic subregions known as the Coastal Plains of Chiapas and Guatemala, Southern Sierras of Chiapas, Isthmus Plains and Central American Volcanoes. Also, the Encrucijada Biosphere Reserve is located within this subregion.

Climate: The climate is warm and humid in the mountainous areas, and warm and sub-humid closer to the coast. In the higher mountainous areas there is also a humid, temperate climate.

Vegetation: This subregion favors the development of medium and high tropical evergreen and semi-evergreen forests, although their area of distribution is gradually being reduced. Currently, the second-growth forests are most widely distributed in the area. Vegetation in a major part of this subregion has been altered from its original state in order to establish cultivated grasslands. The significant elevation gradient permits a great diversity of vegetation types, ranging from temperate pine-oak, oak-pine and cloud forests, to evergreen forests, deciduous forests, savannah, induced grasslands, and also hydrophytic vegetation near the coast, where mangrove swamps are especially important due to their prominence.

Hydrology: The Soconusco region is located among the areas in Mexico with the highest precipitation. The water from the many rivers that descend from the Sierra Madre of Chiapas flows into wetlands and marshes that extend all along the coastline, almost continually.

Terrain: Common landforms in this subregion include mostly coastal plains, high and low sierras, and flooded beaches and sandbars. Lowest elevation is at sea level, and highest elevation is just over 2,000 masl. Predominant soils in this subregion are Cambisols, Regosols, Litosols and Acrisols. The geological stratum dominating this subregion consists of intrusive igneous granite rocks. Especially worth noting is a large area with alluvial deposits.

Wildlife: The varied wildlife in this subregion includes the Xolocalca bromeliad salamander (*Dendrotriton xolocalcae*), Matuda's arboreal alligator lizard (*Abronia matudai*), a type of pit viper (*Bothriechis ornatus*), and a common caiman (*Caiman crocodilus chiapasius*). Bird species, also diverse, include the ornate hawk-eagle (*Spizaetus ornatus*), black hawk-eagle (*Spizaetus tyrannus*), black-and-white hawk-eagle (*Spizaetus melanoleucus*), white-necked puffbird (*Notharchus macrorhynchus*), fulvous owl (*Strix fulvescens*), white-bellied chachalaca (*Ortalis leucogastra*), black-throated jay (*Cyanolyca pumilo*), crested guan (*Penelope purpurascens*), wine-throated hummingbird (*Atthis ellioti*), green parakeet (*Aratinga holochlora*), sharp-shinned hawk (*Accipiter striatus*), magnificent frigatebird (*Fregata magnificens*), peregrine falcon (*Falco peregrinus*), great curassow (*Crax rubra*), mealy Amazon (*Amazona farinosa*), yellow-naped Amazon (*Amazona auropalliata*), giant wren (*Campylorhynchus chiapensis*), blue-throated motmot (*Aspatha gularis*), highland guan (*Penelopina nigra*), common duck (*Anas acuta*), horned guan (*Oreophasis derbianus*), lineolated parakeet (*Bolborhynchus lineola*), quetzal (*Pharomachrus mocinno*), yellow-throated brush-finch (*Atlapetes gutturalis*), white-eared ground-sparrow (*M. leucotis*), Prevost's ground-sparrow (*Melozone biarcuatum*), azure-rumped tanager (*Tangara cabanisi*) and king vulture (*Sarcoramphus papa*).

Considerable populations of the following mammal species have been conserved: gray sac-winged bat (*Balantiopteryx plicata*), Mexican mouse opossum (*Marmosa mexicana*), northern tamandua (*Tamandua mexicana*), Mexican agouti (*Dasyprocta mexicana*), spider money (*Ateles geoffroyi*), tayra (*Eira barbara*), greater grison (*Galictis vittata*), ocelote (*Leopardus pardalis*), neotropical otter (*Lontra longicaudis*), jaguar (*Panthera onca*), cougar (*Puma concolor*) and Baird's tapir (*Tapirus bairdii*).

Some marine invertebrates characteristic of this subregion are mollusks such as *Acanthochitona avicula* (coastal area), *Chiton albolineatus* (under rocks) and *Radsiella muscaria*. Among the inhabitants of underground rivers and caves are palaemonid shrimp (*Creaseria morleyi*) and cave shrimp (*Typhlatya pearsei*). The subregion's freshwater and saltwater fish species include *Anableps dowi*, *Brachyrhaphis hartwegi*, *Cichlasoma macracanthum*, three-spot cichlid (*C. trimaculatum*), *Gymnotus spp.*, *Lepisosteus tropicus*, Pacific molly (*Poecilia butleri*), San Jeronimo livebearer (*Poeciliopsis fasciata*), a type of

pimelodid catfish (*Rhamdia guatemalensis*) and tonala catfish (*R. parry*i). The marshes and flooded areas are vital to the tropical gar (*Atractosteus tropicus*), for refuge, feeding and breeding. This species is considered to be a “living fossil,” and maintains large populations in the region.

Land Use/Human Activities: Cultivated grasslands and seasonal permanent croplands characterize the agricultural areas in this subregion. Especially worth mentioning are introduced grasses, mango, coffee, cacao, bananas and coconut palm.
The most important localities are Tapachula, Tonalá and Arriaga, all in the state of Chiapas.

Appendix 1: Map of North America Level III Ecoregions

Appendix 2: Soil Classifications

Soil Classifications from FAO, the United States, and Canada were used in this text but each classification varies. The FAO classification is based on the UNESCO *Soil Map of the World* (1974); it includes 26 soil units. The United States recognizes 12 soil orders and 64 suborders, according to the 1975 US soil taxonomy. The Canadian soil classification has 10 main soil orders that branch into great groups, subgroups, families and series. Mexico relied on the FAO classification, while Canada and the United States each relied on their own soil classification systems. However, the US and Canadian systems were derived from the FAO classification. Thus, soil names can be cross-linked through the FAO system.

	FAO (26 classes)	**United States (12 order system)**	**Canada (10 order system)**
1	Acrisols	Gelisols	Regosolic
2	Andosols	Histosols	Chernozemic
3	Arenosols	Spodosols	Brunisolic
4	Cambiosols	Andisols	Gleysolic
5	Chernozems	Oxisols	Luvisolic
6	Ferralsols	Vertisols	Podzolic
7	Fluvisols	Aridisols	Solonetzic
8	Gleysols	Ultisols	Organic
9	Greyzems	Mollisols	Crysolic
10	Xerosols	Alfisols	Vertisolic
11	Histosols	Inceptisols	
12	Kastanozems	Entisols	
13	Lithosols		
14	Luvisols		
15	Nitosols		
16	Phaeozems		
17	Planosols		
18	Podzols		
19	Podzoluvisols		
20	Rankers		
21	Regosols		
22	Rendzinas		
23	Solonchaks		
24	Solonetz		
25	Vertisols		
26	Yermosols		

REFERENCES

CANADA

Alberta, Environmental Protection. 1995. Alberta's State of the Environment Comprehensive Report. Alberta, Environmental Protection, Edmonton, Alta. ISBN 0-7732-1412-7.

British Columbia Ministry of Environment, Lands and Parks; Government of Canada. 1993. State of the Environment Report for British Columbia. Ministry of Environment - Lands and Parks, Victoria, BC; Environment Canada Communications, Vancouver, BC. ISBN 0-7726-1773-2

Commission for Environmental Cooperation. 1997. Ecological Regions of North America: Toward a Common Perspective, Commission for Environmental Cooperation (CEC) www.cec.org, Montreal, Quebec, Canada. 71 pp.

Demarchi, D., R. Marsh, A. Harcombe, and E. Lea. 1989. The Environment: A Regional Ecosystem Outline of British Columbia. The Birds of British Columbia by R. Campbell, N. Dawe, I. McTaggertCowan, J. Cooper, G Kaiser, and M. McNall. Royal British Columbia Museum and Canadian Wildlife Service, Victoria, BC.

Ecosystem Stratification Working Group (ESWG). 1995. A National Ecological Framework for Canada. Agriculture and Agri-Food Canada/Environment Canada, Ottawa, ON, K1A OH3. ISBN 0-662-24107-X.

Ecosystem Working Group. 1996. An Ecological Framework for North America. (Work document). Commission for Environmental Cooperation, Montreal, Quebec H2Y 1N9

Ecosystem Classification Group. 2007. Ecological Regions of the Northwest Territories: Taiga Plains. Department of Environment and Natural Resources ISBN 0-7708-0161-7, Yellowknife, NT X1A 2L9, 209 pp.

Government of Canada. 1991. The State of Canada's Environment. Ottawa: Minister of Supply and Services Canada. ISBN 0-660-14237-6.

Government of Canada. 1996. The State of Canada's Environment. Environment Canada. Minister of Supply and Services Canada, Ottawa, ON. http://www.199.212.18.12/~soer/.

Manitoba, Manitoba Environment. 1995. State of the Environment Report for Manitoba, 1995: Focus on Agriculture, Winnipeg. ISBN 0-7711-1452-4.

Padbury, G. A. and D. Acton. 1995. Ecoregions of Saskatchewan. Sask. Property Management Cooperation, Regina, Sask. S4P 3V7.

Rowe, J. S. 1972. Forest Regions of Canada. Publication No. 1300. Environment Canada, Canadian Forestry Service, Ottawa, ON.

Saskatchewan Environment and Resource Management. 1995. Saskatchewan's State of the Environment Report. The Boreal Plains Ecozone: A Forest Community. Saskatchewan Environment and Resource Management, Regina, SK.

Saskatchewan Environment and Resource Management. 1995. Saskatchewan's State of the Environment Report, 1995. Government of Saskatchewan, Regina, SK.

Statistics Canada. 2001/2002/2003/2004/2005/2006/2007. Human Activity and the Environment: Annual Statistics. Yearly Report Series, Ottawa, Ontario.

Wickware, G. M. and C. D. A. Rubec. 1989. Ecoregions of Ontario. Ecological Land Classification Series. No. 26. Lands Directorate, Environment Canada, Ottawa, ON, K1A OH3. 37 pp.

Wiken, E. B. 1979. Rationale and Methods of Ecological Land Surveys: An Overview of Canadian Approaches. In: Ecological Land Classification Series No. 11. Lands Directorate, Environment Canada, Ottawa, Ontario. 160 pp

Wiken, E. *et al*. 1981. The Northern Yukon: An Ecological Land Survey. Environment Canada: Ecological Land Classification Series, No. 6, Vancouver, BC.

Wiken, E. 1986. Terrestrial Ecozones of Canada. Ecological Land Classification Series, No. 19. Environment Canada, Ottawa, ON, K1A OH3 ISBN 0-662-14761-8.

Wiken, E. 1993. Terrestrial Ecoregions of Canada. Map MCR 416 AF. Energy, Mines, and Resources/Environment Canada, Ottawa, ON.

Wiken, E. B. 1995. Environmental/ecological monitoring: strategies for transition. In development of the unified environmental monitoring system in the Russian Federation. OECD/UNEP Seminar Series. GA/205024-95/6. GRID, Arendal, Norway.

Wiken, Ed. 1996. Ecosystems: Frameworks for Thought. In *World Conservation*. Volume 27, Number 1. Gland, Switzerland.

Wiken, E. B., Gauthier, D.A., Marshall, I. B., Hirvonen, H. and Lawton, K.: 1997, 'A Perspective on Canadian Ecosystems: Terrestrial and Marine Ecozones,' *Canadian Council on Ecological Areas (CCEA). Report* No. 14, Ottawa, ON, K1H 5Y9. http://www.ccea.org, 95 pp.

Wiken, E. B. and Gauthier, D.A. 1998, Ecological Regions of North America, in N.W.P. Munro and J. H. M Willison (eds.), Linking Protected Areas with Working Landscapes Conserving Biodiversity, *Proceedings of the Third International Conference on Science and Management of Protected Areas,* 12-16 May 1997, Science and Management of Protected Areas Association, Wolfville, Nova Scotia, pp. 114-129.

Wiken, E. B. and D.A. Gauthier. 1999. Experiences in integrating monitoring and SOE activities In Canada and North America. Pp. 233 In: *North American Science Symposium: Toward a Unified Framework for Inventorying and Monitoring Forest Ecosystem Resources*. C.

Wiken, E., Gauthier, D., Lafón, A., Toombs, T. and J. Hoth. 2003. Towards a Conservation Strategy for North American Grasslands. Paper (24 pp.) presented at the Science and Management of Protected Areas (SAMPA) Conference, Victoria, British Columbia, May 13-15, 2003.

Wildlife Habitat Canada. 2001. The Status of Wildlife Habitats in Canada 2001. WHC report, Ottawa, Ontario. K1Y 4P1. www.whc.org ISBN 0-921553-30-7. 97 pp.

Yukon Territorial Government and Environment Canada. 1996. Yukon State of the Environment Report. Whitehorse, YT.

MEXICO

Acosta, Salvador, *Afinidades de la flora genérica de algunos bosques mesófilos de montaña del noreste, centro y sur de México*, UNAM, Mexico, 2004.

Atlas de México, "Medio físico," Mexico, <http://www.elbalero.gob.mx/explora/html/atlas/relieve.html>.

CDI, Comisión Nacional para el Desarrollo de los Pueblos Indígenas, Mexico, 2008, <http://www.cdi.gob.mx>.

Ceballos, G. and G. Oliva, *Los mamíferos silvestres de México*, Fondo de Cultura Económica-Conabio, 2005.

Ceballos, G. and V.L. Márquez (coords.), *Las aves de México en peligro de extinción*, Instituto de Ecología, UNAM-Conabio-FCE, Mexico, 2000.

Chalenger, Antony, *Conceptos generales acerca de los ecosistemas templados de la montaña de México. Su estado y conservación*, Semarnat, Mexico, 2003.

Challenger, A., *Utilización y conservación de los ecosistemas terrestres de México. Pasado, presente y futuro*, Conabio-Instituto de Biología-Sierra Madre, Mexico, 1998, 847 pp.

Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (Conabio), 2008, <www.conabio.gob.mx>.

Comisión Nacional Forestal (Conafor), 2008, <http://www.conafor.gob.mx/>.

Comisión Nacional de Áreas Naturales Protegidas (Conanp, Semarnat), <http://www. conanp.gob.mx/>.

Conanp, *Estudio previo justificativo para el establecimiento de la Reserva de la Biosfera Sierra de Tamaulipas*, Comisión Nacional de Áreas Naturales Protegidas (Conanp), Mexico, 2005.

Conanp, "Programa de conservación y manejo. Reserva de la Biosfera Los Tuxtlas" (borrador), 2006.

Diego, P. Nelly, *Listado florístico de la Costa Grande del estado de Guerrero*, UNAM, Mexico, 1997.

Diego, P. Nelly, *Base de datos del municipio General Heliodoro Castillo, Guerrero (sierra Madre del Sur)*, UNAM, Mexico, 2000.

ECAmbiental, *Educación y capacitación ambiental*, 2008, <http://www.ecambiental.org.mx/>.

Gobierno del Estado de Yucatán, *Fauna del estado de Yucatán*, <http://www.yucatan.gob.mx/independientes/buscador/index.jsp>.

García G., Alberto. *El bosque mesófilo de montaña*, Comisión Estatal del Medioambiente, Mexico, 2003.

Gobierno del Estado de Jalisco, *Enciclopedia temática de Jalisco* (tomo Geografía: vegetación y flora), Mexico, 1992.

González, M. Francisco, *Comunidades vegetales de México*, INE-Semarnat, Mexico, 2004.

Guízar. N., Enrique and V.A. Sánchez, *Principales árboles del Alto Balsas*, Universidad de Chapingo, Mexico, 1991.

Historia y geografía del estado de Guerrero, BTU Comunicación, S.A. de C.V., México, 1996, <http://www.acabtu.com.mx/guerrero/hidrologia.html>.

Instituto Mexicano de Recursos Naturales Renovables (IMRNR).

Instituto Nacional de Ecología (INE), México, 2008, <www.ine.gob.mx>.

Instituto Nacional de Estadística y Geografía (INEGI), <www.inegi.gob.mx>.

INEGI, *Anuario estadístico del estado de Aguascalientes 2001. Aspectos geográficos, estado y movimiento de la población, agricultura, ganadería, silvicultura, industria manufacturera*, INEGI, Mexico, 2001.

INEGI, *Anuario estadístico del estado de Chihuahua 2007. Aspectos geográficos, población, agricultura, ganadería, aprovechamiento forestal, industria manufacturera*, INEGI, Mexico, 2007.

INEGI, *Anuario estadístico del estado de Durango 2007. Aspectos geográficos, población, agricultura, ganadería, aprovechamiento forestal, industria manufacturera*, INEGI, Mexico, 2007.

INEGI, *Anuario estadístico del estado de Zacatecas 2007. Aspectos geográficos, población, agricultura, ganadería, aprovechamiento forestal, industria manufacturera*, INEGI, Mexico, 2007.

INEGI, *Continuo Nacional de Climas*, escala 1:1'000,000, INEGI, Mexico, 2000.

INEGI, *Continuo Nacional de Edafología*, serie II, escala 1:250,000, INEGI, Mexico, 2007, <www.inegi.gob.mx>.

INEGI, *Continuo Nacional de Fisiografía*, escala 1:1'000,000; INEGI, Mexico, 2000.

INEGI, *Continuo Nacional Geología*, serie I, escala 1:250,000, INEGI, Mexico, 1998.

INEGI, *Continuo Nacional de Hidrología de Aguas Superficiales*, escalas 1:250,000 y 1:1'000,000, INEGI, Mexico, 2000.

INEGI, *Continuo Nacional de Uso del Suelo y Vegetación*, serie II, escala 1:250,000, INEGI, Mexico, 2001.

INEGI, *Continuo Nacional de Uso del Suelo y Vegetación*, serie III, escala 1:250,000, INEGI, Mexico, 2005.

INEGI, *Datos topográficos 1995*, escala 1:250,000, INEGI, Mexico, 1995.

INEGI, *Marco Geoestadístico Nacional 2005*, escala 1:250,000, INEGI, Mexico, 2005.

INEGI, *Vegetación primaria de México*, escala 1:1'000,000, INEGI, Mexico, 2000.

Instituto Nacional para el Federalismo y el Desarrollo Municipal, *Enciclopedia de los municipios de México*, Secretaría de Gobernación y Gobierno del Estado de Guerrero, 2005, <http://www.e-local.gob.mx/work/templates/enciclo/guerrero/>.

Instituto Nacional para el Federalismo y el Desarrollo Municipal, *Enciclopedia de los municipios de México*, Secretaría de Gobernación y Gobierno del Estado de Jalisco, 2005, <http://www.e-local.gob.mx/work/templates/enciclo/jalisco/>.

Jiménez, J., G. Martínez and S. Valencia, *Estudio florístico del municipio Eduardo Neri, Guerrero*, UNAM, Mexico, 2003.

Laguna de Términos: Área de protección de flora y fauna, Campeche, México, Conanp, <http://lagunadeterminos.conanp.gob.mx/cuerpo%20ramsar.htm>.

Laguna de Términos-Pantanos de Centla, Conabio, Mexico, <http://www.conabio.gob.mx/conocimiento/regionalizacion/doctos/rhp_090.html>.

Leopold, A.S. and Charles W. Schwartz, *Fauna silvestre de México: Aves y mamíferos de caza*, 3a. ed.

López Portillo, J. and E. Ezcurra, "Los manglares de México: Una revisión," *Madera y Bosques*, número especial, Mexico, 2002.

Luna, Isolda and J. Llorente, *Historia natural del parque ecológico estatal Omiltemi, Chilpancingo, Guerrero*, Facultad de Ciencias, UNAM-Conabio, Mexico, 1993.

Mamíferos de América del Norte, Smithsonian Institution, <http://www.mnh.si.edu/mna/main.cfm>.

Martínez, Maximino, *Catálogo de nombres vulgares y científicos de las plantas mexicanas*, Fondo de Cultura Económica, Mexico, 1994.

Meza, Luis and José López, *Vegetación y mesoclima de Guerrero*, Facultad de Ciencias, UNAM, número especial, Mexico, 1997.

Miranda, F., *Estudios sobre la vegetación de México I*, tomo XII, núm, 2, Instituto de Biología, UNAM, Mexico, 1941.

Miranda, F., *La vegetación de Chiapas*, Gobierno del Estado de Chiapas y Coneculta, Mexico, 1998, 576 pp.

Nicolás Triedo, "Sayulita, paraje sin igual en la costa de Nayarit", *México Desconocido, 1999-2007*, <http://www.mexicodesconocido.com.mx/notas/2297-Sayulita,-paraje-sin-igual-en-la-costa-de-Nayarit>.

Peña, V. and C. Bonfil, *Encinos de la montaña de Guerrero*, UNAM, Mexico, 2003.

Pronatura, A.C., <www.pronatura.org.mx>.

Conabio, "Regiones terrestres prioritarias de México," <http://www.conabio.gob.mx/conocimiento/regionalizacion/doctos/terrestres.html>.

Rzedowski, J. and G. Calderón, *Flora fanerogámica del valle de México*, IPN, Mexico, 1991.

Rzedowski, J. *et al*., "Cartografía de los principales tipos de vegetación de la mitad septentrional del valle de México," *An. Esc. Nac. Cienc. Biol*., UNAM, Mexico, 1964.

Rzedowski, J. and R. McVaugh, *La vegetación de Nueva Galicia*, Contributions from the University of Michigan Herbarium, IX (9), 1966. 123 pp.

Rzedowski, J., *Vegetación del Pedregal de San Ángel*, vol. VIII, Escuela Nacional de Ciencias Biológicas, UNAM, Mexico, 1954, pp. 1-2, 59-129.

Rzedowski, J., "Las principales zonas áridas de México y su vegetación," *Bios*, vol. 1, 1968, pp. 4-24.

Rzedowski, J., *Vegetación de México*, Limusa, Mexico, 1994.

Rzedowski, J., *Análisis preliminar de la flora vascular de los bosques mesófilos de montaña de México*, Instituto Nacional de Ecología (INE), Mexico, 1996.

Sánchez, S.O., *La flora del valle de México*, Editorial Herrero, Mexico, 1980.

Selva Lacandona. Centro Geo-Semarnat, 2008, <http://www.centrogeo.org.mx/internet2/lacandona/>.

Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (Sagarpa), 2008, <www.sagarpa.gob.mx>.

Secretaría de Planeación y Presupuesto del Estado de Guerrero (Seplap), *Geografía física del estado de Guerrero*, Gobierno del Estado de Guerrero, Mexico, 1985.

Secretaría de Medio Ambiente y Recursos Naturales (Semarnat), 2008, <http://www.semarnat.gob.mx/Pages/inicio.aspx>.

US Department of Agriculture, *Biodiversity Management of the Madrean Archipelago. The Sky Islands of Southwestern United States and Northwestern Mexico*, General Technical Report RM-GTR-264, USDA, 1995.

Valencia, A. S., M. Gómez and F. Becerra, *Catálogo de encinos del estado de Guerrero*, INIFAP, Mexico, 2002.

Van Devender, T.R., "Climatic cadences and the composition of Chihuahuan desert communities: The Late Pleistocene packrat midden record," in J. Diamond and T.J. Case (eds.), *Community Ecology*, Harper & Row, New York, 1986, pp. 285-299.

Vega, L. Adrián *et al*., "Zonas ecológicas de *Brosimun alicastrum* en la costa del Pacífico mexicano," *Madera y Bosques*, 9(1), Mexico, 2003.

Villa R., B and F.A. Cervantes, *Los mamíferos de México*, Instituto de Biología, UNAM-Grupo Editorial Iberoamérica, Mexico, 2003.

UNITED STATES

Anderson, J.R. 1970. Major land uses. In: *The National Atlas of the United States of America*. Washington, DC, US Geological Survey, pp. 158–159, scale 1:7,500,000.

Bailey, R.G., Avers, P.E., King, T., and McNab, W.H., eds., 1994, Ecoregions and subregions of the United States (map) (supplementary table of map unit descriptions compiled and edited by McNab, W.H., and R.G. Bailey), US Department of Agriculture–Forest Service, Washington, DC, scale 1:7,500,000.

Bryce, S.A., J.M. Omernik, D.E. Pater, M. Ulmer, J. Schaar, J. Freeouf, R. Johnson, P. Kuck, and S.H. Azevedo. 1998. Ecoregions of North Dakota and South Dakota. (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:1,500,000.

Bryce, S.A., A.J. Woods, J.D. Morefield, J.M. Omernik, T.R. McKay, G.K. Brackley, R.K. Hall, D.K. Higgins, D.C. McMorran, K.E. Vargas, E.B. Petersen, D.C. Zamudio, and J.A. Comstock. 2003. Ecoregions of Nevada. (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:1,350,000.

CEC. 1997. Ecological Regions of North America: Towards a Common Perspective. Commission for Environmental Cooperation. Montreal, Quebec, Canada. 71p.

CEC. Ecological Regions of North America, Level 3, Scale 1:4,000,000, second edition, Commission for Environmental Cooperation, Montreal, Quebec, Canada, 2005.

Chapman, S.S., S.A. Bryce, J.M. Omernik, D.G. Despain, J. ZumBerge, and M. Conrad. 2004. Ecoregions of Wyoming. (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:1,400,000.

Chapman, S.S., G.E. Griffith, J.M. Omernik, J.A. Comstock, M.C. Beiser, and D. Johnson. 2004. Ecoregions of Mississippi. (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:1,000,000.

Chapman, S.S., G.E. Griffith, J.M. Omernik, A.B. Price, J. Freeouf, and D.L. Schrupp. 2006. Ecoregions of Colorado. (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:1,200,000.

Chapman, S.S., B.A. Kleiss, J.M. Omernik, T.L. Foti, and E.O. Murray. 2004. Ecoregions of the Mississippi Alluvial Plain. (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:1,150,000.

Chapman, S.S., J.M. Omernik, J.A. Freeouf, D.G. Huggins, J.R. McCauley, C.C. Freeman, G. Steinauer, R.T. Angelo, and R.L. Schlepp. 2001. Ecoregions of Nebraska and Kansas. (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:1,950,000.

Chapman, S.S., J.M. Omernik, G.E. Griffith, W.A. Schroeder, T.A. Nigh, and T.F. Wilton. 2002. Ecoregions of Iowa and Missouri. (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:1,800,000.

Daigle, J.J., G.E. Griffith, J.M. Omernik, P.L. Faulkner, R.P. McCulloh, L.R. Handley, L.M. Smith, and S.S. Chapman. 2006. Ecoregions of Louisiana. (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:1,000,000.

Daly, C., G. Taylor, and W. Gibson. 1997. The PRISM approach to mapping precipitation and temperature. Proceedings, 10th Conference on Applied Climatology, American Meteorology Society, pp. 10-12.

Ecological Stratification Working Group. 1995. A National Ecological Framework for Canada. Agriculture and Agri-Food Canada, Research Branch, Centre for Land and Biological Resources Research; and Environment Canada, State of the Environment Directorate, Ecozone Analysis Branch, Ottawa/Hull, Ontario. Report and national map, scale 1:7,500,000. 125p.

Fenneman, N.M. 1931. *Physiography of Western United States*. McGraw-Hill, New York. 534p.

Fenneman, N.M. 1938. *Physiography of Eastern United States*. McGraw-Hill, New York. 714p.

Gallant, A.L., E.F. Binnian, J.M. Omernik, and M.B. Shasby. 1995. Ecoregions of Alaska. US Geological Survey Professional Paper 1567. US Government Printing Office, Washington, DC, 73p.

Griffith, G.E., S.A. Bryce, J.M. Omernik, J.A. Comstock, A.C. Rogers, B. Harrison, S.L. Hatch, and D. Bezanson. 2004. Ecoregions of Texas. (2-sided color poster with map, descriptive text, and photographs). US Geological Survey, Reston, VA. Scale 1:2,500,000.

Griffith, G. E., J. M. Omernik, and S. H. Azevedo. 1997. Ecoregions of Tennessee. EPA/600/R-97/022. US Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Corvallis, OR. 51p.

Griffith, G.E., J.M. Omernik, and S.H. Azevedo. 1998. Ecoregions of Tennessee. (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:940,000.

Griffith, G.E., J.M. Omernik, J.A. Comstock, S. Lawrence, G. Martin, A. Goddard, V.J. Hulcher, and T. Foster. 2001. Ecoregions of Alabama and Georgia. (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:1,700,000.

Griffith, G.E., J.M. Omernik, J.A. Comstock, M.P. Shafale, W.H. McNab, D.R. Lenat, J.B. Glover, and V.B. Shelburne. 2002. Ecoregions of North Carolina and South Carolina. (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:1,500,000.

Griffith, G.E., J.M. Omernik, M.M. McGraw, G.Z. Jacobi, C.M. Canavan, T.S. Schrader, D. Mercer, R. Hill, and B.C. Moran. 2006. Ecoregions of New Mexico (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:1,400,000.

Griffith, G.E., J.M. Omernik, S.M. Pierson, and C.W. Kiilsgaard. 1994. Massachusetts Ecological Regions Project. EPA/600/A-94/111. US EPA, Environmental Research Laboratory, Corvallis, OR. 58p.

Griffith, G.E., J.M. Omernik, C.M. Rohm, and S.M. Pierson. 1994. Florida Regionalization Project. EPA/600/Q-95/002. US EPA, Environmental Research Laboratory, Corvallis, OR. 83p.

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. *The Journal of the Iowa Academy of Science* 101(1): 5-13.

Hammond, E.H., 1970, Classes of land-surface form, *in The National Atlas of the United States of America*, Washington, DC, US Geological Survey, p. 62-63, scale 1:7,500,000.

King, P.B., and Beikman, H.M., 1974, Geologic map of the United States: US Geological Survey, scale 1:2,500,000.

Kuchler, A.W., 1964, Potential Natural Vegetation of the Conterminous United States: New York, American Geographical Society, Special Publication no. 36, 116 p., scale 1:3,168,000.

Loveland, T.R., J.W. Merchant, D.O. Ohlen, J.F. Brown. 1991. Development of a land-cover characteristics database for the conterminous US Photogrammetric Engineering and Remote Sensing 57(11): 1453-1463.

Loveland, T.R., J.W. Merchant, J.F. Brown, D.O. Ohlen, B.C. Reed, P. Olsen, and J. Hutchinson. 1995. Seasonal land-cover regions of the United States. *Annals of the Association of American Geographers* 85(2): 339-355.

McGrath, C.L., A.J. Woods, J.M. Omernik, S.A. Bryce, M. Edmondson, J.A. Nesser, J. Shelden, R.C. Crawford, J.A. Comstock, and M.D. Plocher. 2002. Ecoregions of Idaho. (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:1,350,000.

McNab, W.H. and P.E. Avers (compilers). 1994. Ecological Subregions of the United States: Section Descriptions. Administrative Publication WO-WSA-5. US Department of Agriculture, Forest Service. Washington, DC, 267p.

Omernik, J.M. 1987. Ecoregions of the Conterminous United States. *Annals of the Association of American Geographers* 77(1): 118-125.

Omernik, J.M. 2004. Perspectives on the Nature and Definition of Ecological Regions. *Environmental Management* 34 (Supplement 1): s27-s38.

Omernik, J.M., S.S. Chapman, R.A. Lillie, and R.T. Dumke. 2000. Ecoregions of Wisconsin. *Transactions of the Wisconsin Academy of Science, Arts and Letters* 88(2000): 77-103.

Pater, D.E., S.A. Bryce, T.D. Thorson, J. Kagan, C. Chappell, J.M. Omernik, S.H. Azevedo, and A. J. Woods. 1998. Ecoregions of Western Washington and Oregon (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:1,350,000.

Peel, M.C., B.L. Finlayson, and T.A. McMahon. 2007. Updated world map of the Koppen-Geiger climate classification. *Hydrology and Earth System Sciences Discussions* 4: 439-473.

Thorson, T.D., S.A. Bryce, D.A. Lammers, A.J. Woods, J.M. Omernik, J. Kagan, D.E. Pater, and J.A. Comstock. 2003. Ecoregions of Oregon. (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:1,350,000.

Woods, A.J., T.L. Foti, S.S. Chapman, J.M. Omernik, J. Wise, E.O. Murray, W.L. Prior, J. Pagan, J.A. Comstock, and M. Radford. 2004. Ecoregions of Arkansas. (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:1,000,000.

Woods, A.J. and J.M. Omernik. 1996. Ecoregions of Pennsylvania. *The Pennsylvania Geographer* 34(2): 2-37.

Woods, A.J., J.M. Omernik, C.S. Brockman, T.D. Gerber, W.D. Hosteter, and S.H. Azevedo. 1998. Ecoregions of Indiana and Ohio (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:500,000.

Woods, A.J., J.M. Omernik, D.D. Brown, and C.W. Kiilsgaard. 1996. Level III and IV ecoregions of Pennsylvania and the Blue Ridge Mountains, the Ridge and Valley, and Central Appalachians of Virginia, West Virginia, and Maryland. EPA/600/R-96/077. US EPA National Health and Environmental Effects Research Laboratory, Corvallis, OR. 50p.

Woods, A.J., D.A. Lammers, S.A. Bryce, J.M. Omernik, R.L. Denton, M. Domeier, and J.A. Comstock. 2001. Ecoregions of Utah. (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:1,175,000.

Woods, A.J., J.M. Omernik, D.R. Butler, J.G. Ford, J.E. Henley, B.W. Hoagland, D.S. Arndt, and B.C. Moran. 2005. Ecoregions of Oklahoma. (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:1,250,000.

Woods, A.J., J.M. Omernik, W.H. Martin, G.J. Pond, W.M. Andrews, S.M. Call, J.A. Comstock, and D.D. Taylor. 2002. Ecoregions of Kentucky. (2-sided color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:1,000,000.

Woods, A.J., J.M. Omernik, J.A. Nesser, J. Shelden, and S.H. Azevedo. 1999. Ecoregions of Montana. (2-sided, 2 sheet color poster with map, descriptive text, summary tables, and photographs). US Geological Survey, Reston, VA. Scale 1:1,500,000.

Woods, A.J., J.M. Omernik, C.L. Pederson, and B.C Moran. 2006. Level III and IV Ecoregions of Illinois. US EPA Report, EPA/600/R-06/104. US Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Western Ecology Division, Corvallis, Oregon. 45p.

US Department of Agriculture, Forest Service, 1997, Forest type groups of the United States, scale 1:7,500,000, *in* Powell, D.S., J.L. Faulkner, D.R. Darr, Z. Zhu, and D.W. MacCleery, Forest Resources of the United States: US Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, General Technical Report RM-234, 132 p.

US Department of Agriculture, National Agricultural Statistics Service, 1999, Census of Agriculture, 1997, v. 2, subject series, part 1, Agricultural Atlas of the United States: US Government Printing Office, Washington, DC, 163 p.

US Department of Agriculture, Natural Resources Conservation Service, STATSGO soils data.

US Department of Agriculture - Natural Resources Conservation Service, 2006, *Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin*: US Government Printing Office, Agriculture Handbook 296, Washington, DC, 669 p. + map.

US Department of Agriculture - Soil Conservation Service, 1981, *Land Resource Regions and Major Land Resource Areas of the United States*: US Government Printing Office, Agriculture Handbook 296, Washington, DC, 156 p. + map.

Many of the ecoregion maps, publications, and GIS files are available at http://www.epa.gov/wed/pages/ecoregions.htm