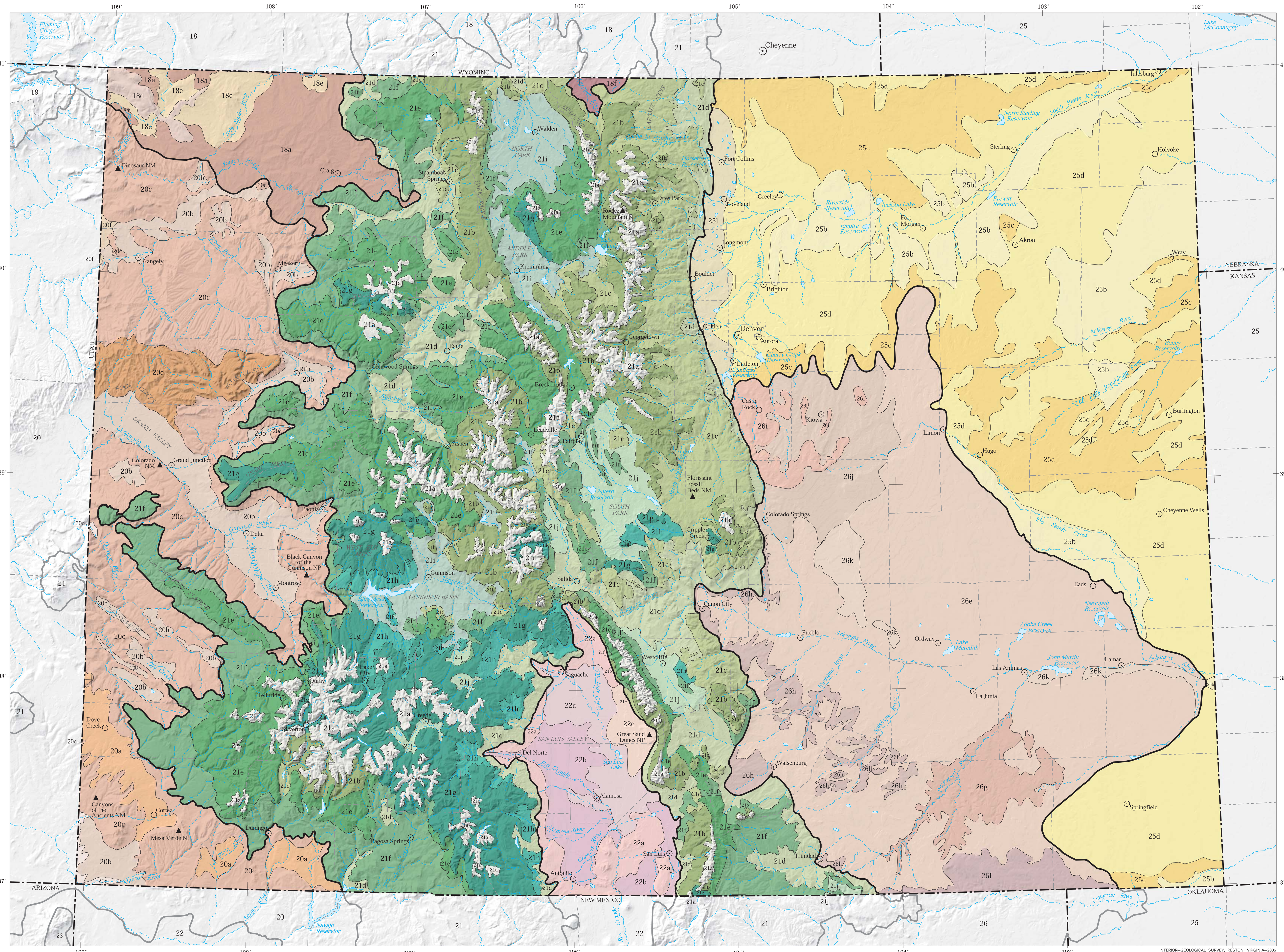
Ecoregions of Colorado



Ecoregions denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources; they are designed to serve as a spatial framework for the research, assessment, management, and monitoring of ecosystems and ecosystem components. By recognizing the spatial differences in the capacities and potentials of ecosystems, ecoregions stratify the environment by its probable response to disturbance (Bryce and others, 1999). These general-purpose regions are critical for structuring and implementing ecosystem management strategies across federal agencies, state agencies, and nongovernment organizations that are responsible for different types of resources within the same geographical areas (Omernik and others, 2000).

The approach used to compile this map is based on the premise that ecological regions can be identified through the analysis of the spatial patterns and the composition of biotic and abiotic phenomena that affect or reflect differences in ecosystem quality and integrity (Wiken, 1986; Omernik, 1987, 1995). These phenomena include geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology.

The relative importance of each characteristic varies from one ecological region to another, regardless of the hierarchical level. A Roman numeral hierarchical scheme has been adopted for different levels of ecological regions. Level I is the coarsest level, dividing North America into 15 ecological regions. Level II divides the continent into 52 regions (Commission for Environmental Cooperation Working Group, 1997). At level III, the continental United States contains 104 ecoregions and the conterminous United States has 84 ecoregions (United States Environmental Protection Agency [USEPA], 2003). Level IV is a further subdivision of level III ecoregions. Explanations of the methods used to define the USEPA's ecoregions are given in Omernik (1995), Omernik and others (2000), Griffith and others (1994), and Gallant and others (1989, 1995).

Colorado contains arid canyons, semiarid shrub- and grass-covered plains, alluvial valleys, lava fields and volcanic plateaus, woodland- and shrubland-covered hills, forested mountains, glaciated peaks, wetlands, and a variety of aquatic habitats. Ecological diversity is enormous. There are 6 level III ecoregions and 35 level IV ecoregions in Colorado, and many continue into ecologically similar parts of adjacent states.

The level III and IV ecoregion map on this poster was compiled at a scale of 1:250,000 and depicts revisions and subdivisions of earlier level III ecoregions that were originally compiled at a smaller scale (USEPA, 2003; Gallant and others, 1989; Omernik, 1987). This poster is part of a collaborative project primarily between USEPA Region VIII, USEPA National Health and Environmental Effects Research Laboratory (Corvallis, Oregon), Colorado Department of Public Health and Environment (CDPHE), Colorado Division of Wildlife (CDOW), United States Department of Agriculture–Forest Service (USFS), United States Department of Agriculture–Natural Resources Conservation Service (NRCS), United States Department of the Interior–Bureau of Land Management (BLM), and United States Department of the Interior–Geological Survey (USGS)–National Center for Earth Resources Observation and Science (EROS).

The project is associated with an interagency effort to develop a common framework of ecological regions. Reaching that objective requires recognition of the differences in the conceptual approaches and mapping methodologies applied to develop the most common ecoregion-type frameworks, including those developed by the USFS (Bailey and others, 1994), the USEPA (Omernik, 1987, 1995), and the NRCS (U.S. Department of Agriculture–Soil Conservation Service, 1981). As each of these frameworks is further refined, their differences are becoming less discernible. Regional collaborative projects, such as this one in Colorado, where agreement has been reached among multiple resource management agencies, are a step toward attaining consensus and consistency in ecoregion frameworks for the entire nation.

Literature Cited:

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 Bailey, R.G.): Washington, D.C., USFS, scale 1:7,500,000.

Bryce, S.A., Omernik, J.M., and Larsen, D.P., 1999, Ecoregions – a geographic framework to guide risk characterization and ecosystem management: Environmental Practice, v. 1, no. 3, p. 141-155.

Commission for Environmental Cooperation Working Group, 1997, Ecological regions of North America – toward a common perspective: Montreal, Commission for Environmental Cooperation, 71 p.

Gallant, A.L., Binnian, E.F., Omernik, J.M., and Shasby, M.B., 1995, Ecoregions of Alaska: U.S. Geological Survey Professional Paper 1567, Washington D.C., 73 p.

Gallant, A.L., Whittier, T.R., Larsen, D.P., Omernik, J.M., and Hughes, R.M., 1989, Regionalization as a tool for managing environmental resources: Corvallis, Oregon, U.S. Environmental Protection Agency, EPA/600/3-89/060, 152 p.

Griffith, G.E., Omernik, J.M., Wilton, T.F., and Pierson, S.M., 1994, Ecoregions and subregions of Iowa – a framework for water quality assessment and management: Journal of the Iowa Academy of Science, v. 101, no. 1, p. 5-13.

Omernik, J.M., 1987, Ecoregions of the conterminous United States (map supplement): Annals of the Association of American Geographers, v. 77, no. 1, p. 118-125, scale 1:7,500,000.

Omernik, J.M., 1995, Ecoregions – a framework for environmental management, *in* Davis, W.S., and Simon, T.P., eds., Biological assessment and criteria-tools for water resource planning and decision making: Boca Raton, Florida, Lewis Publishers, p. 49-62.

Omernik, J.M., Chapman, S.S., Lillie, R.A., and Dumke, R.T., 2000, Ecoregions of Wisconsin: Transactions of the Wisconsin Academy of Sciences, Arts, and Letters, v. 88, p. 77-103.

U.S. Department of Agriculture–Soil Conservation Service, 1981, Land resource regions and major land resource areas of the United States: Agriculture Handbook 296, 156 p.

U.S. Environmental Protection Agency, 2003, Level III ecoregions of the continental United States (revision of Omernik, 1987): Corvallis, Oregon, USEPA – National Health and Environmental Effects Research Laboratory, Map M-1, various scales.

Wiken, E., 1986, Terrestrial ecozones of Canada: Ottawa, Environment Canada, Ecological Land Classification Series no. 19, 26 p.

18 Wyoming Basin
- 18a Rolling Sagebrush Steppe
- 18d Foothill Shrublands and Low Mountains
- 18e Salt Desert Shrub Basins
- 18f Laramie Basin

20 Colorado Plateaus
- 20a Monticello-Cortez Uplands and Sagebrush Valleys
- 20b Shale Deserts and Sedimentary Basins
- 20c Semiarid Benchlands and Canyonlands
- 20d Arid Canyonlands
- 20e Escarpments
- 20f Uinta Basin Floor

21 Southern Rockies
- 21a Alpine Zone
- 21b Crystalline Subalpine Forests
- 21c Crystalline Mid-Elevation Forests
- 21d Foothill Shrublands
- 21e Sedimentary Subalpine Forests
- 21f Sedimentary Mid-Elevation Forests
- 21g Volcanic Subalpine Forests
- 21h Volcanic Mid-Elevation Forests
- 21i Sagebrush Parks
- 21j Grassland Parks

22 Arizona/New Mexico Plateau
- 22a San Luis Shrublands and Hills
- 22b San Luis Alluvial Flats and Wetlands
- 22c Salt Flats
- 22e Sand Dunes and Sand Sheets

25 High Plains
- 25b Rolling Sand Plains
- 25c Moderate Relief Plains
- 25d Flat to Rolling Plains
- 25l Front Range Fans

26 Southwestern Tablelands
- 26e Piedmont Plains and Tablelands
- 26f Mesa de Maya/Black Mesa
- 26g Purgatoire Hills and Canyons
- 26h Pinyon-Juniper Woodlands and Savannas
- 26i Pine-Oak Woodlands
- 26j Foothill Grasslands
- 26k Sand Sheets

Level III ecoregion
Level IV ecoregion
County boundary
State boundary

PRINCIPAL AUTHORS: Shannen S. Chapman (Dynamac Corporation), Glenn E. Griffith (Dynamac Corporation), James M. Omernik (USGS), Alan B. Price (NRCS), Jerry Freeouf (USFS), and Donald L. Schrupp (CO Department of Wildlife [CODOW]).

COLLABORATORS AND CONTRIBUTORS: Tony Selle (USEPA), Shannon Albeke (CODOW), Sandy Bryce (Dynamac Corporation), Ed Rumbold (BLM), Tom Weber (NRCS), Carol Dawson, (BLM), Eric Waller (CODOW), Christy Pickens (CDPHE), Brian Moran (Indus Corporation), John Hutchinson (Science Applications International Corporation), and Jack Wittmann (USGS).

REVIEWERS: Patrick Comer (NatureServe), Alisa Gallant (USGS), Tom Huber (University of Colorado, Colorado Springs), and Ron West (CO State Parks).

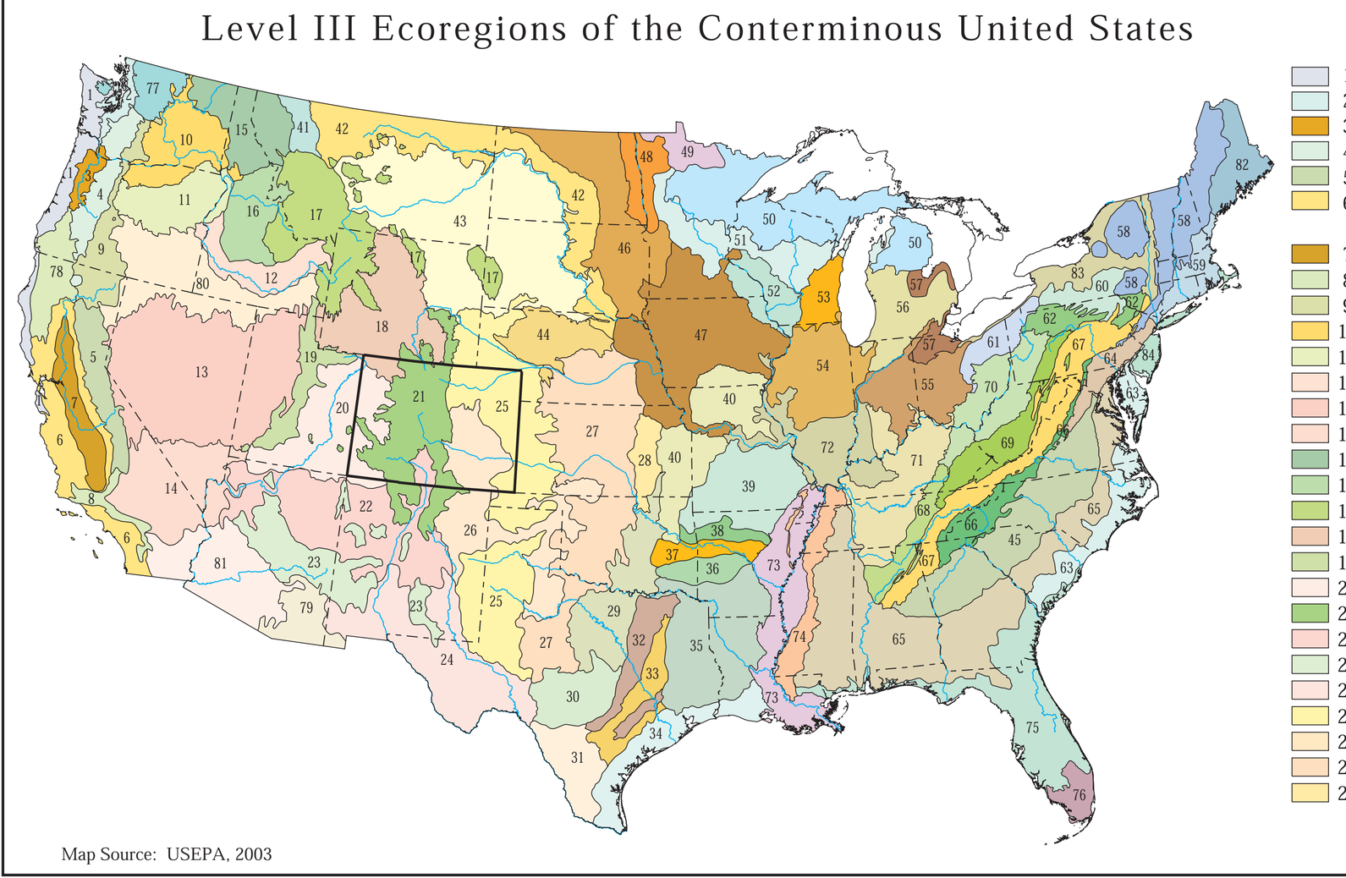
CITING THIS POSTER: Chapman, S.S., Griffith, G.E., Omernik, J.M., Price, A.B., Freeouf, J., and Schrupp, D.L., 2006, Ecoregions of Colorado (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,200,000).

SCALE 1:1 200 000

15 10 5 0 30 60 mi
30 20 10 0 60 120 km

Albers equal area projection
Standard parallels 38°N and 40°N

Level III Ecoregions of the Conterminous United States

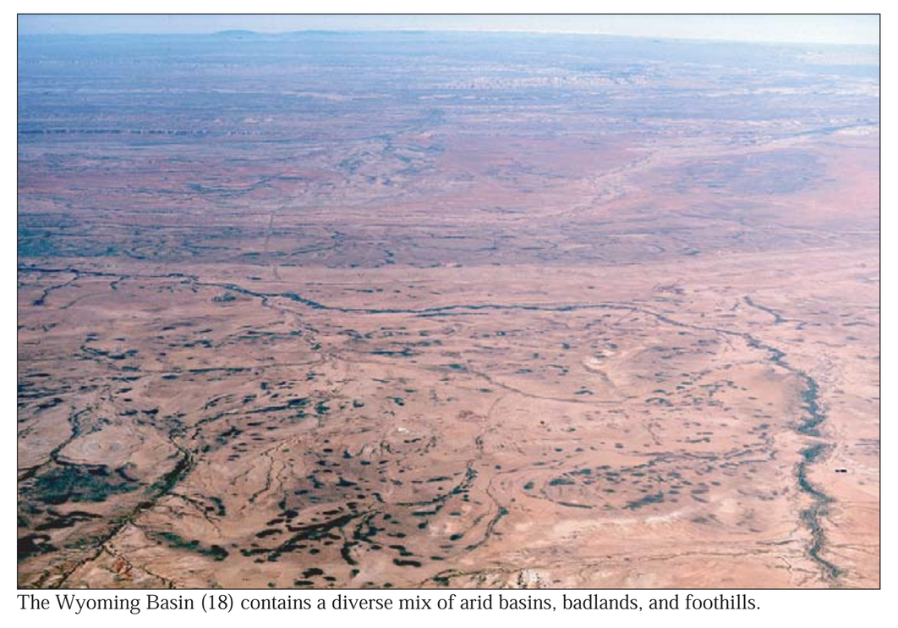


- 1 Coast Range
- 2 Puget Lowland
- 3 Willamette Valley
- 4 Cascades
- 5 Sierra Nevada
- 6 Southern and Central California Chaparral and Oak Woodlands
- 7 Central California Valley
- 8 Southern California Mountains
- 9 Eastern Cascades Slopes and Foothills
- 10 Columbia Plateau
- 11 Blue Mountains
- 12 Snake River Plain
- 13 Central Basin and Range
- 14 Mojave Basin and Range
- 15 Northern Rockies
- 16 Idaho Batholith
- 17 Middle Rockies
- 18 Wyoming Basin
- 19 Wasatch and Uinta Mountains
- 20 Colorado Plateaus
- 21 Southern Rockies
- 22 Arizona/New Mexico Plateau
- 23 Arizona/New Mexico Mountains
- 24 Chihuahuan Deserts
- 25 High Plains
- 26 Southwestern Tablelands
- 27 Central Great Plains
- 28 Flint Hills
- 29 Central Oklahoma/Texas Plains
- 30 Edwards Plateau
- 31 Southern Texas Plains
- 32 Texas Blackland Prairies
- 33 East Central Texas Plains
- 34 Western Gulf Coastal Plain
- 35 South Central Plains
- 36 Ouachita Mountains
- 37 Arkansas Valley
- 38 Boston Mountains
- 39 Ozark Highlands
- 40 Central Irregular Plains
- 41 Canadian Rockies
- 42 Northwestern Glaciated Plains
- 43 Northwestern Great Plains
- 44 Nebraska Sand Hills
- 45 Piedmont
- 46 Northern Glaciated Plains
- 47 Western Corn Belt Plains
- 48 Lake Agassiz Plain
- 49 Northern Minnesota Wetlands
- 50 Northern Lakes and Forests
- 51 North Central Hardwood Forests
- 52 Driftless Area
- 53 Southeastern Wisconsin Till Plains
- 54 Central Corn Belt Plains
- 55 Eastern Corn Belt Plains
- 56 Southern Michigan/Northern Indiana Drift Plains
- 57 Huron/Erie Lake Plains
- 58 Northeastern Highlands
- 59 Northeastern Coastal Zone
- 60 Northern Appalachian Plateau and Uplands
- 61 Erie Drift Plain
- 62 North Central Appalachians
- 63 Middle Atlantic Coastal Plain
- 64 Northern Piedmont
- 65 Southeastern Plains
- 66 Blue Ridge
- 67 Ridge and Valley
- 68 Southwestern Appalachians
- 69 Central Appalachians
- 70 Western Allegheny Plateau
- 71 Interior Plateau
- 72 Interior River Valleys and Hills
- 73 Mississippi Alluvial Plain
- 74 Mississippi Valley Loess Plains
- 75 Southern Coastal Plain
- 76 Southern Florida Coastal Plain
- 77 North Cascades
- 78 Klamath Mountains
- 79 Madrean Archipelago
- 80 Northern Basin and Range
- 81 Sonoran Basin and Range
- 82 Laurentian Plains and Hills
- 83 Eastern Great Lakes and Hudson Lowlands
- 84 Atlantic Coastal Pine Barrens

Map Source: USEPA, 2003

Colorado Department of Public Health and Environment

18. Wyoming Basin


The Wyoming Basin (18) contains a diverse mix of arid basins, badlands, and foothills.

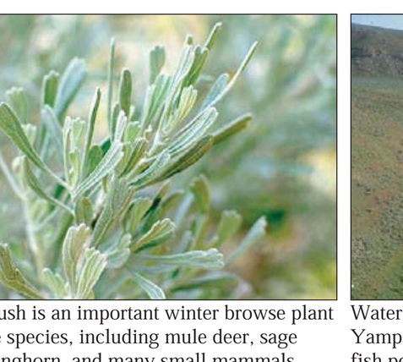
This ecoregion is a broad intermontane basin, interrupted by high hills and low mountains, and dominated by relatively arid grasslands and shrublands. Nearly surrounded by forest-covered mountains, the region is somewhat drier than the Northwestern Great Plains (43) to the northeast and lacks the extensive cover of pinyon-juniper woodland found in the Colorado Plateaus (20) to the south. Much of the region is used for livestock grazing, although many areas lack sufficient forage to adequately support this activity. The region contains major natural gas and petroleum producing fields. The Wyoming Basin also has extensive coal deposits along with areas of trona, bentonite, clay, and uranium mining.

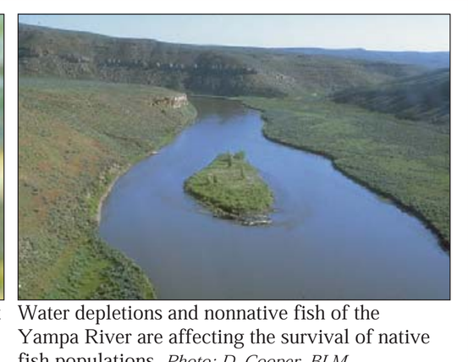
18a The semiarid **Rolling Sagebrush Steppe** is a vast region of rolling plains, alluvial and outwash fans, hills, cuestas, mesas, and terraces. This region is less hilly than the Foothill Shrublands and Low Mountains (18d) ecoregion. Annual precipitation of 10 to 20 inches varies with elevation and proximity to mountains. The sagebrush steppe natural vegetation includes western wheatgrass, needle-and-thread, blue grama, Sandberg bluegrass, Junegrass, rabbitbrush, fringed sage, Wyoming big sagebrush, silver and black sagebrush in lowlands, and mountain big sagebrush in the higher elevations. Land use is mainly rangeland, with some areas of cropland along the Yampa River in hay, wheat, barley, or oats. Oil, gas, and coal deposits are scattered throughout the region.

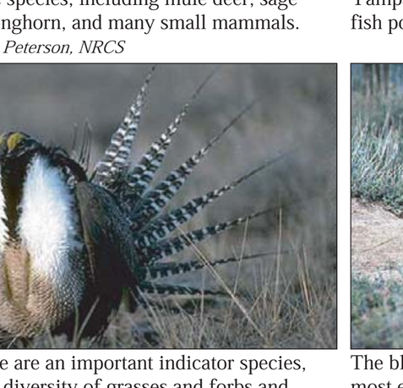
18d The **Foothill Shrublands and Low Mountains** ecoregion includes isolated dry mountain ranges and foothill slopes, and in Colorado includes Cold Spring Mountain, Bishop Peak, Diamond Peak, and Lookout Mountain. The topography of this region is more rugged than the Rolling Sagebrush Steppe (18a). Tertiary sedimentary rocks of sandstone and conglomerate are extensive, but shale, siltstone, and limestone also occur. Big sagebrush, rabbitbrush, pricklypear, bluebunch wheatgrass, and Idaho fescue dominate on fine-textured soils; Rocky Mountain juniper, Utah juniper, and mountain mahogany woodlands occur on rock outcrops. Land use is mostly rangeland and wildlife habitat.

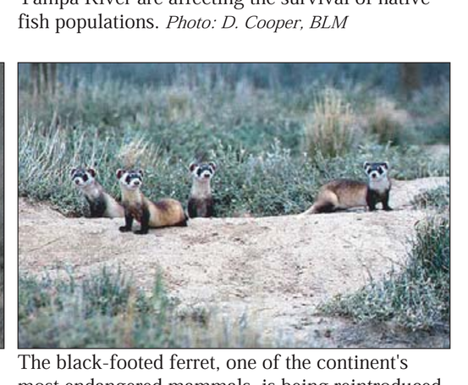
18e The arid **Salt Desert Shrub Basins** ecoregion includes disjunct playas and isolated sand dunes. The plains, terraces, and rolling alluvial fans of Ecoregion 18e have soils that tend to be more alkaline and less permeable than soils in the Rolling Sagebrush Steppe (18a). Vegetation is a sparse cover of arid land shrubs such as shadscale, greasewood, and Gardner's saltbush, with some areas of big sagebrush. Areas with stabilized sand dunes are dominated by alkali cordgrass, Indian ricegrass, blowout grass, alkali wildrye, and needle-and-thread. Land use is rangeland and wildlife habitat. This arid region is sensitive to grazing pressure, which may promote the invasion of weeds such as Russian thistle, cheatgrass, and the toxic halogeton.

18f The **Laramie Basin** ecoregion is a wide intermontane valley of Wyoming that extends slightly into northern Colorado. Elevations in the Colorado portion are generally 7800 to 9100 feet, with annual precipitation of 15 to 20 inches. For the region as a whole, natural vegetation is mainly grassland compared to the sagebrush steppe in other regions of Ecoregion 18. Needle-and-thread, western wheatgrass, blue grama, Indian ricegrass, and other mixed grass species are typical, along with rabbitbrush, fringed sage, and various forb and shrub species. The rolling, high elevation valley of grass and shrubland is used primarily for seasonal livestock grazing. Some hay is produced along the Laramie River.

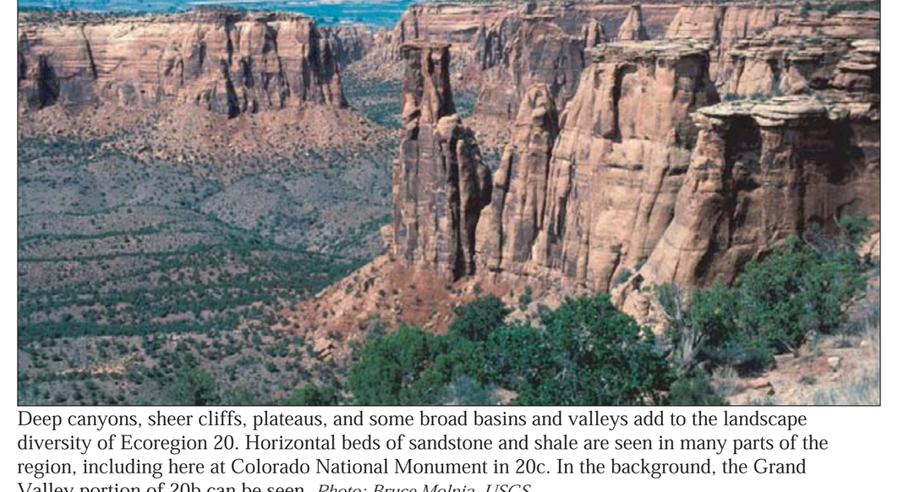

Big sagebrush is an important winter browse plant for wildlife species, including mule deer, sage grouse, pronghorn, and many small mammals. *Photo: Scott Peterson, NRCS*

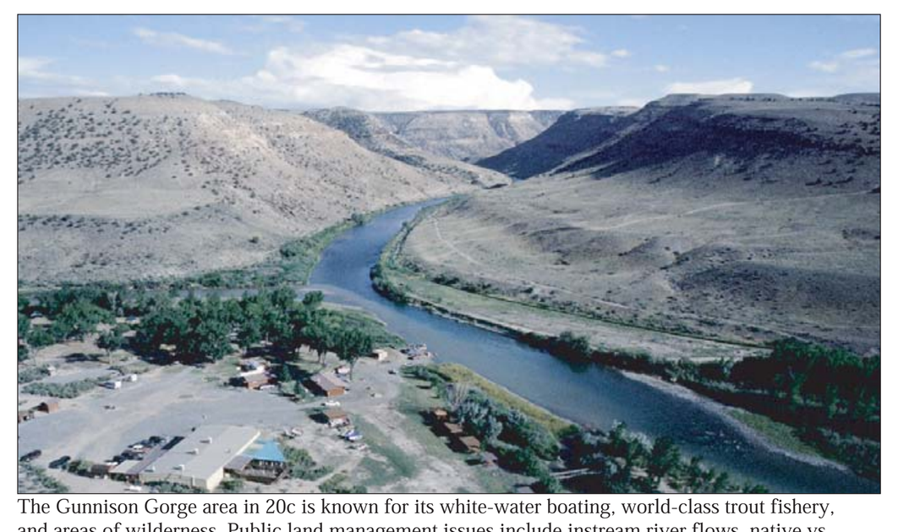

Water depletions and nonnative fish of the Yampa River are affecting the survival of native fish populations. *Photo: D. Cooper, BLM*


Sage grouse are an important indicator species, requiring a diversity of grasses and forbs and healthy riparian areas. *Photo: USFWS*


The black-footed ferret, one of the continent's most endangered mammals, is being reintroduced in parts of Ecoregions 18 and 20. *Photo: BLM*

20. Colorado Plateaus


Deep canyons, sheer cliffs, plateaus, and some broad basins and valleys add to the landscape diversity of Ecoregion 20. Horizontal beds of sandstone and shale are seen in many parts of the region, including here at Colorado National Monument in 20c. In the background, the Grand Valley portion of 20b can be seen. *Photo: Bruce Molnia, USGS*


The Gunnison Gorge area in 20c is known for its white-water boating, world-class trout fishery, and areas of wilderness. Public land management issues include instream river flows, native vs. sports fisheries, grazing and mining impacts, control of invasive plants such as tamarisk, and balancing resource protection with increasing human use. *Photo: Art Ferraro, BLM*

Canyons, mesas, plateaus, and mountains of the Colorado Plateaus expose a long geologic history of rock formations in Colorado. Rugged tableland topography is typical of the ecoregion. Precipitous side-walls mark abrupt changes in local relief, often of 1000 to 2000 feet or more. The region contains more pinyon-juniper and Gambel oak woodlands than the Wyoming Basin (18) to the north. However, the Colorado Plateaus ecoregion also has large low-lying areas containing saltbrush and greasewood (typical of hotter, drier areas) which are generally not found in the Arizona/New Mexico Plateau (22) to the south where grasslands are more common.

20a Parts of the gently sloping **Monticello-Cortez Uplands and Sagebrush Valleys** ecoregion are covered by eolian material. Deep, silty soils are typical and retain enough available moisture to naturally support Wyoming big sagebrush and associated grasses. These soils now sustain dryland farming, with more irrigated agriculture to the east. Crops include pinto beans, Anasazi beans, winter wheat, oats, and alfalfa. Shallow or stony soils occur along the rims of benches and minor escarpments and support pinyon-juniper woodland.

20b The arid **Shale Deserts and Sedimentary Basins** ecoregion consists of nearly level basins and valleys, benches, low rounded hills, and badlands. Rock outcrops occur. It is sparsely vegetated with mat saltbush, bud sagebrush, galleta grass, and desert trumpet. Floodplains have alkaline soils that support greasewood, alkali sacaton, seepweed, and shadscale. Scattered, gravel-capped benches occur and protrude from the present denudational surface because they are more resistant to erosion than the surrounding shales. Soils are shallow and types range from clayey to silty. Soils that formed primarily on Mancos shale are found in the areas northwest of Rangley, east of Meeker, in the Grand Valley, in Dry Creek Basin and Disappointment Valley southwest of the Uncompahgre Plateau, and in southwest Colorado near the Mancos River. The Mancos shale basins have the potential for high selenium levels, a particular problem in areas with irrigated agriculture. Soils formed from sandstone, limestone, shale, and gypsum are found in Paradox and Big Gypsum valleys southwest of the Uncompahgre Plateau. Soils formed from claystone, shale, sandstone, and mudstone are found west of Meeker, and in the Colorado River valley near Rifle. Land use includes rangeland, pastureland, and dryland and irrigated cropland, with winter wheat, small grains, forage crops, and pinto beans as major crops. The valleys of the Gunnison and Colorado rivers have areas favorable for growing apples, peaches, pears, and apricots. Shrublands provide important winter habitat for wildlife.

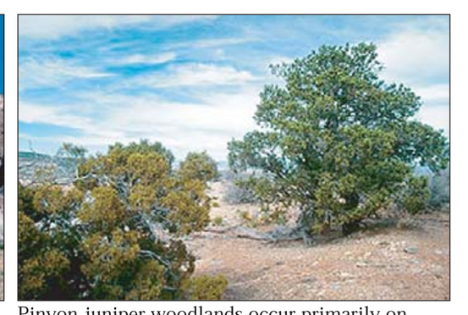
20c Broad, grass-, shrub-, and woodland-covered benches and mesas characterize the **Semiarid Benchlands and Canyonlands** ecoregion. Areas of high relief alternate with areas of low relief. Low escarpments separate remnant mesa tops and narrow canyons from surrounding benches. Bedrock exposures (e.g., slickrock and fins) are common along rims, escarpments, and on steep dip slopes. Deep eolian soils are composed of fine sand and support warm season grasses, winterfat, Mormon tea, fourwing saltbush, and sagebrush. Two-needle pinyon and Utah juniper occur on shallow, stony soils. Scattered areas of Gambel oak occur at higher elevations. Fire suppression and erosion have allowed this woodland to expand beyond its original range. Overall, the vegetation is not as sparse as in drier areas such as Ecoregions 20b and 20d. Average annual precipitation in the Colorado portion of the region varies from 10 to 18 inches in lower areas; on the highest sites, such as Mesa Verde, 20 to 25 inches can occur. Livestock grazing is a dominant land use, although stock carrying capacity is limited. On floodplains and terraces, some irrigated cropland occurs, primarily hay and grain for livestock. Oil and natural gas wells, oil shale extraction, and coal mining are also present in the region.

20d Occurring primarily in Utah, the **Arid Canyonlands** ecoregion includes the inner gorge of the Colorado River and its major tributaries. Much of this ecoregion is bounded by nearly vertical canyon walls that separate it from the adjacent, higher benchlands of Ecoregion 20c. Soils are shallower and have a drier moisture regime than those of Ecoregions 20a and 20c. Exposed bedrock is common. Blackbrush, shadscale, and drought-tolerant grasses including galleta grass and Indian ricegrass occur. Blackbrush is more common here than in Ecoregion 20c, where pinyon-juniper woodland and sagebrush dominate. Annual precipitation is lowest in the deepest canyons, mostly less than 10 inches. Land use is mostly livestock grazing and recreation.

20e The **Escarpments** ecoregion is characterized by extensive, deeply-dissected, cliff-bench complexes that ascend dramatically from Ecoregions 20b or 20c to the forested mountain rim. Local relief can be as great as 3000 feet, and the region is prone to landslides. Ecoregion 20e includes major scarp slopes of the Book Cliffs and Roan Cliffs. Natural vegetation varies according to aspect and moisture availability, ranging from Douglas-fir forest on steep, north-facing slopes at higher elevations to desert and semidesert grassland or shrubland on lower, drier sites. Pinyon-juniper woodland often dominates escarpments and benches that are covered by shallow soils. This rugged, remote, and varied landscape provides habitat for wildlife.

20f Occurring primarily in Utah, the **Uinta Basin Floor** ecoregion lies in a large synclinal basin enclosed by the Uinta Mountains and Tavaputs Plateau. Precipitation is low and soils are arid. Winters are constantly cold and often foggy due to frigid, dense air draining from the adjacent uplands and resultant air temperature inversions. Saltbush-greasewood is the natural vegetation type. Ecoregion 20f is distinguished from other arid basins by the abundant stream runoff it receives from the mountains in Utah. Streams are often diverted for irrigation. Alfalfa, small grain, and corn are grown for silage on arable, gently-sloping terraces and valley floors. Stonier soils are irrigated for pasture where and when water is available. Non-irrigated areas are used for livestock grazing.


Mancos shale landscapes can be natural sources for toxic elements such as selenium that affect surface and groundwater. *Photo: Tim McCabe, NRCS*


Pinyon-juniper woodlands occur primarily on warm dry sites in the foothills and on mesa tops. *Photo: Jean Smith, The Southern Rockies Ecosystem Project*


Rock art, or petroglyphs, can be found in parts of Ecoregion 20, such as these figures made by people of the Fremont culture more than a thousand years ago. *Photo: BLM*


Agriculture occurs in many parts of Ecoregion 20a, and the red soils tend to have a high iron content. Dove Creek calls itself "the pinto bean capital of the world."


The razorback sucker prefers quiet, muddy backwaters of the Colorado River basin. It is endangered due to loss of floodplain habitat and predation by non-native fish. *Photo: CDOW*


River recreation such as white-water rafting has increased in recent years in Ecoregion 20. *Photo: Rick Athearn, BLM*

21. Southern Rockies


The spruce-fir forest pictured is in the West Elk Mountains wilderness area. Spruce-fir forests can be found in the high elevation, cool, moist sites in any of the subalpine forests ecoregions (21b, 21e, and 21g). Most of the precipitation is in the form of snow and the snowpack can remain well into the summer. These high elevation forests are important snow collection areas where water is stored in the soils and in subalpine reservoirs. *Photo: Doug Shinneman, The Southern Rockies Ecosystem Project*

The Southern Rockies are composed of high elevation, steep, rugged mountains. Although coniferous forests cover much of the region, as in most of the mountainous regions in the western United States, vegetation, as well as soil and land use, follows a pattern of elevational banding. The lowest elevations are generally grass or shrub covered and heavily grazed. Low to middle elevations are also grazed and covered by a variety of vegetation types including Douglas-fir, ponderosa pine, aspen, and juniper-oak woodlands. Middle to high elevations are largely covered by coniferous forests and have little grazing activity. The highest elevations have alpine characteristics. The region includes the Colorado Mineral Belt, a broad area stretching northeast from the San Juan Mountains in southwestern Colorado to the Colorado Front Range near Boulder. Most of the historic mining camps of Colorado lie in this area.

21a The **Alpine Zone** occurs on mountain tops above treeline, beginning at about 10500 to 11000 feet. It includes alpine meadows as well as steep, exposed rock and glaciated peaks. Annual precipitation ranges from about 35 to greater than 70 inches, falling mostly as snow. Vegetation includes low shrubs, cushion plants, and wildflowers and sedges in wet meadows. The forest-tundra interface is sparsely colonized by stunted, deformed Englemann spruce, subalpine fir, and limber pine (krummholz vegetation). Rocky Mountain bristlecone pines are also found here, some of the oldest recorded trees in North America. Land use, limited by difficult access, is mostly wildlife habitat and recreation. Ecoregion 21a is snow-free only 8 to 10 weeks annually. Snow cover is a major source of water for lower, more arid ecoregions.

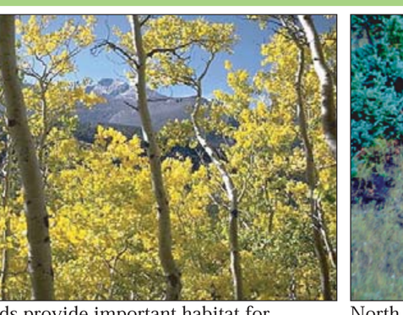
21b The **Crystalline Subalpine Forests** ecoregion occupies a narrow elevational band on the steep, forested slopes of the mountains, becoming more extensive on the north-facing slopes. The elevation range of the region is 8500 to 12000 feet, just below the Alpine Zone (21a). The lower elevation limit is higher in the south, starting at 9000 to 9500 feet. The dense forests are dominated by Englemann spruce and subalpine fir; aspen and pockets of lodgepole pine locally dominate some areas. Subalpine meadows also occur. Forest blowdown, insect outbreaks, fire, and avalanches affect the vegetation mosaic. Soils are weathered from a variety of crystalline and metamorphic materials, such as gneiss, schist, and granite, as well as some areas of igneous intrusive rocks. Recreation, logging, mining, and wildlife habitat are the major land uses. Grazing is limited by climatic conditions, lack of forage, and lingering snowpack.

21c The **Crystalline Mid-Elevation Forests** are found mostly in the 7000 to 9000 feet elevation range on crystalline and metamorphic substrates. Most of the region occurs in the eastern half of the Southern Rockies (21). Natural vegetation includes aspen, ponderosa pine, Douglas-fir, and areas of lodgepole pine and limber pine. A diverse understory of shrubs, grasses, and wildflowers occurs. The variety of food sources supports a diversity of bird and mammal species. Forest stands have become denser in many areas due to decades of fire suppression. Land use includes wildlife habitat, livestock grazing, logging, mineral extraction, and recreation, with increasing residential subdivisions.

21d The **Foothill Shrublands** ecoregion is a transition from the higher elevation forests to the drier and lower Great Plains (Ecoregions 25, 26) to the east and to the Colorado Plateaus (20) to the west. This semiarid region has rolling to irregular terrain of hills, ridges, and footslopes, with elevations generally 6000 to 8500 feet. Sagebrush and mountain mahogany shrubland, pinyon-juniper woodland, and scattered oak shrublands occur. Other common low shrubs include serviceberry and skunkbush sumac. Interspersed are some grasslands of blue grama, Junegrass, and western wheatgrass. Land use is mainly livestock grazing and some irrigated hayland adjacent to perennial streams.

21e The **Sedimentary Subalpine Forests** ecoregion occupies much of the western half of the Southern Rockies, on sandstone, siltstone, shale, and limestone substrates. The elevation limits of this region are similar to the crystalline (21b) and volcanic (21g) subalpine forests. Stream water quality, water availability, and aquatic biota are affected in places by carbonate substrates that are soluble and nutrient rich. Soils are generally finer-textured than those found on crystalline or metamorphic substrates of Ecoregion 21b, and are also more alkaline where derived from carbonate-rich substrates. Subalpine forests dominated by Englemann spruce and subalpine fir are typical, often interspersed with aspen groves or mountain meadows. Some Douglas-fir forests are at lower elevations.

21f The **Sedimentary Mid-Elevation Forests** ecoregion occurs in the western and southern portions of the Southern Rockies, at elevations generally below Ecoregion 21e. The elevation limits and vegetation of this region are similar to the crystalline (21c) and volcanic (21h) mid-elevation forests; however, a larger area of Gambel oak woodlands and forest is found in this region. Carbonate substrates in some areas affect water quality, hydrology, and biota. Soils are generally finer-textured than those found on crystalline and metamorphic substrates such as those in Ecoregion 21c.


Aspen stands provide important habitat for wildlife. The leaves, twigs, and bark are nutritious for deer, elk, bear, beaver, and other animals. *Photo: NPS*


North American elk, or wapiti, are found in many parts of Ecoregion 21. The bugle calls of bull elk are an autumn hallmark. *Photo: NPS*


The Canada lynx, once near the brink of extinction in Colorado, is being reintroduced into the subalpine forests of the Southern Rockies. Snowshoe hares and red squirrels are its primary prey. *Photo: CDOW*


Historical and current mining operations can affect water quality and habitat.


Flatirons of the Fountain Formation and hogbacks of Dakota Sandstone are found in the Foothill Shrublands (21d) in the transition zone between the Great Plains and Rocky Mountains. *Photo: Jeremy McCreary*

21. Southern Rockies (continued)


The Gunnison Basin of Ecoregion 21i has some unique biogeographic characteristics and several endemic plant species. *Photo: CDOW*

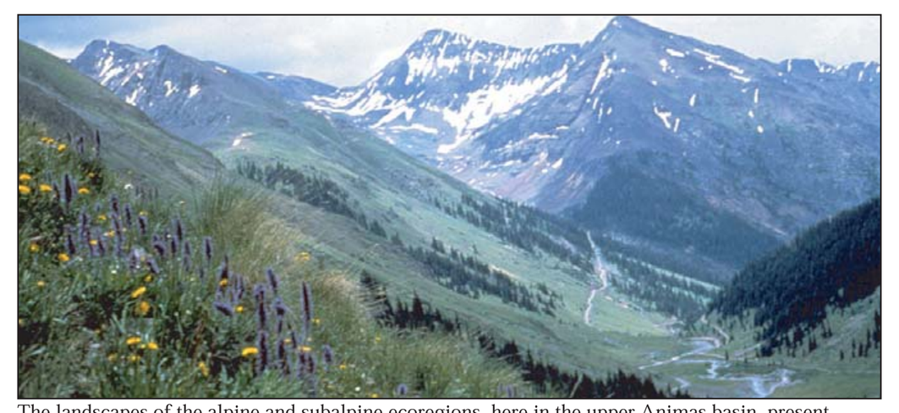

Alberta Falls in Ecoregion 21b, Rocky Mountain NP. *Photo: NPS*

21g The steep, mountainous **Volcanic Subalpine Forests** ecoregion is composed of volcanic and igneous rocks, predominately andesitic with areas of basalt. The region is found mainly in the San Juan Mountains, which have the most rugged terrain and the harshest winters in the Southern Rockies of Colorado. Smaller areas are found in the West Elk Mountains, Grand Mesa, Flat Tops, and in the Front Range. The area is highly mineralized, and gold, silver, lead, and copper have been mined. Relatively young geologically, the mountains are among the highest and most rugged of North America and still contain some large areas of intact habitat. Englemann spruce, subalpine fir, and aspen forests support a variety of wildlife.

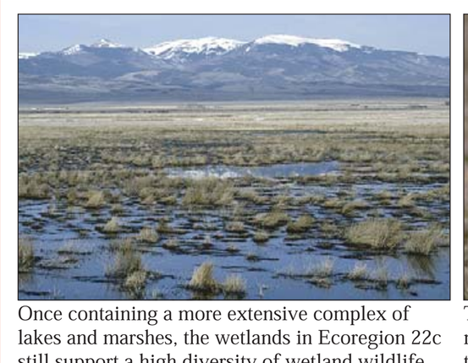
21h The **Volcanic Mid-Elevation Forests** ecoregion occurs at elevations of 7000 to 9000 feet and is composed of igneous rocks of andesite and basalt. The majority of the region is found in the San Juan Mountains, the West Elk Mountains, and in a small area of the Front Range. Forests of ponderosa pine, Douglas-fir, and aspen occur. Land use includes wildlife habitat, livestock grazing, logging, recreation, and mineral extraction of silver and gold.

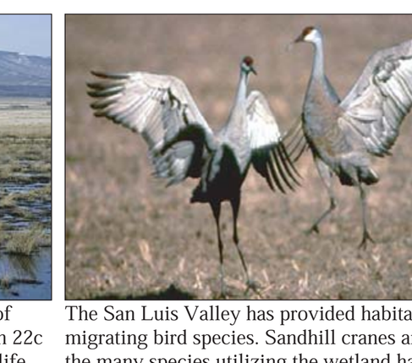
21i The **Sagebrush Parks** ecoregion contains the large, semiarid, high intermontane valleys that support sagebrush shrubland and steppe vegetation. The ecoregion includes North Park, Middle Park and the Gunnison Basin, and is slightly drier than the Grassland Parks (21j). Summers tend to be hot and winters very cold, with annual precipitation of 10-16 inches. Land use is mostly rangeland and wildlife habitat, with some hay production near streams. The sagebrush provides forage and habitat to many animals and birds. Sandy loam soils are typical, formed in residuum from crystalline and sedimentary rocks, glacial outwash, and colluvial or alluvial materials.

21j The **Grassland Parks** ecoregion also consists of high intermontane valleys similar in elevation to the drier Sagebrush Parks (21i); however, water availability is greater in 21j and the region supports grasslands rather than the sagebrush shrubland and steppe found in 21i. Grasslands with bunchgrasses are dominant, and include Arizona fescue, Idaho fescue, mountain muhly, bluebunch wheatgrass, needle-and-thread, Junegrass, and slender wheatgrass. Springs and wetlands may occur. Some subalpine/montane fens are found where groundwater seepage has persistently reached the surface and supported peatland development. There are only a few trees or shrubs, and if present, they are widely scattered and mature.

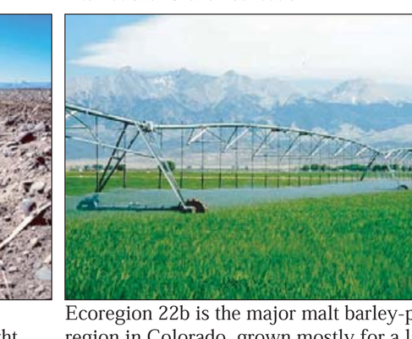

The landscapes of the alpine and subalpine ecoregions, here in the upper Animas basin, present beautiful contrasts, with dense spruce-fir forests, flower-studded alpine meadows, snowfields, and rocky peaks. *Photo: BLM*

22. Arizona/New Mexico Plateau


Once containing a more extensive complex of lakes and marshes, the wetlands in Ecoregion 22c still support a high diversity of wetland wildlife. *Photo: USFWS*


The San Luis Valley has provided habitat for many migrating bird species. Sandhill cranes are one of the many species utilizing the wetland habitats and barley and grain fields of this ecoregion. *Photo: International Crane Foundation*


Potatoes are a major crop in Ecoregion 22b, growing well in the loose, loam soil and bright, warm days and cool nights. More than 20 major potato warehouses in the San Luis Valley pack and ship potatoes for the fresh market. *Photo: Gene Alexander, NRCS*


Ecoregion 22b is the major malt barley-producing region in Colorado, grown mostly for a large in-state brewing company. Center pivot irrigation is common, relying on conjunctive use of shallow groundwater and surface water. Nitrate, sodium, and pesticides in water are a concern in some areas. *Photo: ARS, USDA*

The Arizona/New Mexico Plateau represents a large transitional region between the semiarid grasslands and low relief tablelands of the Southwestern Tablelands (26) ecoregion in the east, the drier shrublands and woodland-covered higher relief tablelands of the Colorado Plateaus (20) in the north, and the lower, hotter, less vegetated Mojave Basin and Range (14) in the west and Chihuahuan Deserts (24) in the south. Higher, forest-covered, mountainous ecoregions border the region on the northeast and southwest. Local relief in the Colorado portion is relatively low, but in other parts of the ecoregion relief can be well over 1000 feet. The region in Colorado known as the San Luis Valley forms part of the upper end of the Rio Grande Valley. It is flanked by the Sangre de Cristo Range on the east and the San Juan Mountains on the west. This ecoregion has the lowest annual precipitation in the state, mostly 6 to 12 inches. However, surface runoff from the surrounding mountains and groundwater migrate toward the low point at San Luis Lake, providing a good water supply to the region. Desert and wetlands exist side by side. A large part of the north San Luis Valley is a closed basin with no surface outlet to the Rio Grande. The high water table has created many ephemeral lakes, wetlands, springs, and flowing wells, and supports considerable irrigation in the valley. At the western edge of the Central Flyway, the valley wetlands historically provided crucial migratory bird habitat. Water-use issues are a continuing concern as the demand for water grows. Excessive use of surface and groundwater has led to waterlogged soils in some parts of the valley, causing alkaline soils and highly mineralized groundwater from the concentration of salts.

22a The **San Luis Shrublands and Hills** ecoregion includes the higher relief foothill edges and low mountain areas within the basin. It includes the San Luis Hills in the southwest, a rugged mass of hills and tilted mesas. The hills are composed of andesitic volcanic rock and are 500 to 1000 feet higher than the adjacent ecoregions of 22. Vegetation communities represent a transition from the grassland and desert communities of the lower basin to the woodland species found in the surrounding foothills of the Southern Rockies (21). Big sagebrush, rabbitbrush, and winterfat occur, as well as grasslands of western wheatgrass, green needlegrass, blue grama, and needle-and-thread. Areas of pinyon-juniper are found on the tops of the San Luis Hills.

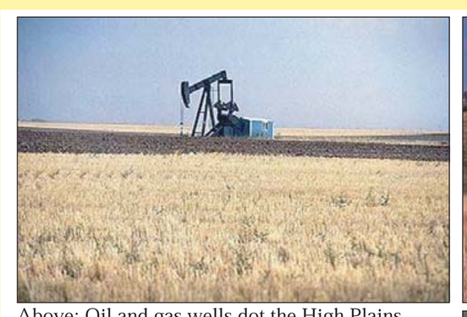
22b Although precipitation in the **San Luis Alluvial Flats and Wetlands** ecoregion is low, less than 8 to 10 inches, water availability from mountain runoff, a high water table, and associated springs and wetlands have made cropland irrigation possible. The ecoregion was once dominated by shadscale, saltbush and greasewood, but most of the native vegetation has been removed for agriculture. Irrigated cropland is common, with barley malt, potatoes, alfalfa, small grains, and hay, and smaller areas of vegetables such as spinach, head lettuce, and carrots. Generally, the soils of this region tend to be less alkaline than the soils of 22c. The increasing demand for water throughout this region is an ongoing issue, exacerbated by recent droughts. Increased salt accumulation in soils and groundwater depletion are problems associated with irrigation and the competing uses of available water.

22c The **Salt Flats** ecoregion includes the alkaline basin that surrounds the San Luis Lakes. The smooth to irregular plains of low to moderate relief have elevations ranging from 7400 to 7700 feet, some of the lowest areas in the San Luis Valley. Vegetation is sparse, with greasewood and shadscale dominating along with scattered areas of horsebrush, spiny hopsage, rabbitbrush, saltgrass, alkali sacaton, and small areas of sagebrush at the eastern edges. Some areas are devoid of vegetation. Land use is limited to low density livestock grazing and wildlife habitat. Unlike 22b, cropland is more limited within this region due to the more alkaline soils. Precipitation ranges from 6 to 8 inches annually.

22e Great Sand Dunes National Park and the outlying sand sheets are included in the **Sand Dunes and Sand Sheets** ecoregion. The sand sheets consist of low parabolic and longitudinal dunes that are largely stabilized by scrubby vegetation. The Great Sand Dunes rise up to 750 feet above the basin and are the tallest dunes in North America. The sand was derived mainly from volcanic rock sediments of the San Juan Mountains that were transported by the Rio Grande, and deposited on the alluvial fan on the west side of the valley. The sand was then blown by the prevailing southwesterly winds, piling up at the base of the mountains. The dunes are mostly bare, with patches of Indian ricegrass, blowout grass, or lemon scurfpea. Sand sheet plants include rabbitbrush, sand dropseed, spiny hopsage, sand verbena, and prairie sunflower. Land use in the region is mostly recreation and wildlife habitat, with some limited rangeland.


The Sand Dunes and Sand Sheets (22e) ecoregion has a surprising diversity of plant and animal life, as well as some unique geological and hydrological features. Elk, pronghorn, bison, coyotes, jackrabbits, and small rodents occur, along with a variety of birds, reptiles, and endemic beetles. Streams with a "pulse" or surge flow occur here and in only a few other places in the world. *Photo: Don Klosterman*

25. High Plains


Above: Oil and gas wells dot the High Plains. *Photo: Paul Starrs*


Top right: Urban and suburban development is spreading across much of the cropland and grasslands of Ecoregion 25l. *Photo: Jeff Vanuga, NRCS*


The swift fox is home in the prairies of the High Plains. It feeds mainly on jackrabbits, prairie dogs, small rodents, birds, and insects. *Photo: Gary Kramer, NRCS*

Higher and drier than the Central Great Plains (27) to the east, and in contrast to the irregular, mostly grassland or grazing land of the Northwestern Great Plains (43) to the north, much of the High Plains comprises smooth to slightly irregular plains having a high percentage of cropland. Grama-buffalo grass is the potential natural vegetation in this region as compared to mostly wheatgrass-needlegrass to the north, Trans-Pecos shrub savanna to the south, and taller grasses to the east. The northern boundary of this ecological region is also the approximate northern limit of winter wheat and sorghum and the southern limit of spring wheat. In Colorado, gas and oil fields are scattered throughout the region, with the greatest concentration found in the Denver Basin area.

25b The grass-stabilized sand plains, sand dunes and sand sheets of the **Rolling Sand Plains** ecoregion are a divergence from the mostly loess-covered plains of adjacent ecoregions. Sandy soils, formed from eolian deposits, supported a sandsage prairie natural vegetation type, different from the shortgrass and midgrass prairie of other neighboring level IV ecoregions in the High Plains (25). Sand sagebrush, rabbitbrush, sand bluestem, prairie sandreed, and Indian ricegrass were typical plants. Land use is primarily rangeland, although a few scattered areas have been developed for irrigated cropland using deep wells.

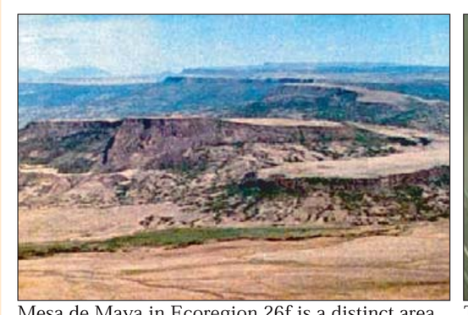
25c The **Moderate Relief Plains** ecoregion is typified by irregular plains with slopes greater than the surrounding at and rolling plains of Ecoregion 25d. Land use is predominantly rangeland, in contrast to the cropland or mosaic of cropland and rangeland of surrounding ecoregions. Soils are silty and clayey loams, formed from eolian sediments, shallower than the thicker loess-capped uplands of 25d. Blue grama-buffalograss was the natural prairie type.

25d The **Flat to Rolling Plains** ecoregion is more level and less dissected than the adjacent Moderate Relief Plains (25c). Soils are generally silty with a veneer of loess. Dryland farming is extensive, with areas of irrigated cropland scattered throughout the ecoregion. Winter wheat is the main cash crop, with a smaller acreage in forage crops.

25l The **Front Range Fans** ecoregion flanks the northern Front Range of the Southern Rockies in Colorado. Streams tend to be cooler than in other High Plains (25) regions and contain many Front Range aquatic species. The soils of the region have more outwash gravels than regions farther east and occupy old terraces, benches, and alluvial fans. The soils are formed from materials weathered from arkosic sedimentary rock, gravelly alluvium, and redbed shales and sandstone. Some soils have a high shrink-swell potential. Land use is changing from mostly cropland and rangeland to more extensive urban development. Development has led to an increase in manmade lakes and gravel pits dotting the region.

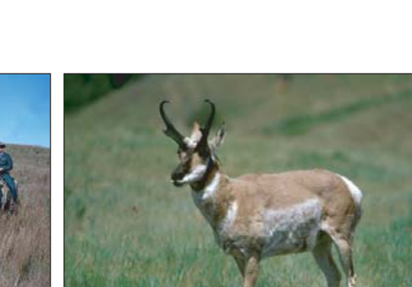
Shortgrass prairie at Pawnee National Grassland in Ecoregion 25c. *Photo: Gary Kramer, NRCS*

26. Southwestern Tablelands


Mesa de Maya in Ecoregion 26f is a distinct area of basalt-capped tablelands with a unique mix of plains and foothill flora. *Photo: R.B. Taylor, USGS*


The lark bunting, Colorado's state bird, breeds in open grasslands of the Great Plains. *Photo: Gary Kramer, NRCS*


Cattle production is common in Ecoregion 26. Effects of different stocking densities and rotation times can often be seen at fence lines. *Photo: Irv Cole, NRCS*


Once nearly extinct, the pronghorn is adapted to the grasslands of Colorado's eastern plains, as well as to the shrublands of the mountain parks and western basins. These fast mammals can reach speeds over 60 miles per hour over short distances. *Photo: USFWS*

The Southwestern Tablelands flank the High Plains (25) with red hued canyons, mesas, badlands, and dissected river breaks. Unlike most adjacent Great Plains ecological regions, little of the Southwestern Tablelands is in cropland. Much of this region is in sub-humid grassland and semiarid rangeland. The boundary to the east in Colorado represents a transition from the more extensive cropland within the High Plains (25) to the generally more rugged and less arable land within the Southwestern Tablelands (26) ecoregion. The natural vegetation in the Colorado portion of this region is mostly grama-buffalograss, with some juniper-scrub oak-grass savanna on escarpment bluffs.

26e The **Piedmont Plains and Tablelands** ecoregion is a vast area of irregular and dissected plains underlain by shale and sandstone. Precipitation varies from 10 to 16 inches, with the lowest amounts found along the Arkansas River between Pueblo and Las Animas. The shortgrass prairie contains buffalograss, blue grama, western wheatgrass, galleta, alkali sacaton, sand dropseed, sideoats grama, and yucca. Land use is mostly rangeland. Irrigated agriculture occurs along the Arkansas River, and dryland farming is found primarily in the north half of the region.

26f The **Mesa de Maya/Black Mesa** ecoregion contains a broad basaltic mesa and dissected plateaus with steep canyons. Juniper and pinyon-juniper woodlands grow along canyons and mesa sides, while grasslands occur on the basalt cap of the mesa. This is the only region in Colorado where small areas of mesquite are found. Soils are formed in materials weathered from basalt, limestone, sandstone, and shale. Rock outcrops are common. Low precipitation, low available water capacity, and erodibility limit agricultural use.

26g The **Purgatoire Hills and Canyons** ecoregion includes dissected hills, canyons, and rock outcrops. Woodland vegetation is dominated by juniper with less grassland vegetation than found in 26f. Unlike Ecoregion 26f, the Purgatoire Hills and Canyons ecoregion is generally more dissected and does not contain the basaltic mesa or soils derived from basalt. Soils are well drained and formed in calcareous eolian sediments and material weathered from sandstone; rock outcrops are common. The Purgatoire River supports a diverse fish assemblage.

26h Scattered, dissected areas with pinyon and juniper on the uplands characterize the **Pinyon-Juniper Woodlands and Savannas** ecoregion. The region is a continuation or an outlier of the pinyon-juniper woodlands found in Ecoregion 21d in the Southern Rocky Mountains to the west. Soils tend to be thin and are formed in materials weathered from limestone, sandstone, and shale. Rock outcrops are common. Annual precipitation varies from 12 to 20 inches, with the highest amounts found in areas closest to the mountains. Land use is mainly wildlife habitat and rangeland.

26i The **Pine-Oak Woodlands** ecoregion is a dissected plain with dense oakbrush and deciduous oak woodlands combined with ponderosa pine woodlands. The southern portion is known locally as the Black Forest. Although woodlands dominate, the region is a mosaic of woodlands and grasslands. It is somewhat more dissected than the surrounding Foothill Grasslands (26j) ecoregion. The Pine-Oak Woodlands may be an outlier of the ponderosa pine woodlands found in the mid-elevation forests of the Southern Rockies (21) to the west. Soils are formed from weathered sandstone and shale with some outwash on uplands. Land use is woodland, wildlife habitat, and some rangeland. Areas of the region are rapidly urbanizing.

26j The **Foothill Grasslands** ecoregion contains a mix of grassland types, with some small areas of isolated tallgrass prairie species that are more common much further east. The proximity to runoff and moisture from the Front Range and the more loamy, gravelly, and deeper soils are able to support more tallgrass and midgrass species than neighboring ecoregions. Big and little bluestem, yellow Indiangrass, and switchgrass occur, along with foothill grassland communities similar to those of Ecoregion 21d. Although grasslands dominate, scattered pine woodlands similar to those found in 26i also occur. The annual precipitation of 14 to 20 inches tends to be greater than in regions farther east. Soils are loamy, gravelly, moderately deep, and mesic. They are formed from weathered arkosic sedimentary rock, gravelly alluvium, and materials weathered from sandstone and shales. Rangeland and pasture are common, with small areas of cropland. Urban and suburban development has increased in recent years, expanding out from Colorado Springs and the greater Denver area.

26k The **Sand Sheets** ecoregion has rolling plains with stabilized sand sheets and areas of low sand dunes. Soils are formed from wind-deposited and alluvial sands. Natural vegetation is primarily sandsage prairie with sand reed grass, blue grama, sand dropseed, needlegrass, and sand sagebrush, and is similar to the Rolling Sand Plains (25b) ecoregion found in the neighboring High Plains (25). Annual precipitation ranges from 10 to 16 inches, less than the Foothill Grasslands to the northwest. Land use in this region is mainly rangeland.


The rolling grasslands of the Piedmont Plains and Tablelands (26e) are punctuated by the juniper-dotted canyons and mesas of the Purgatoire Hills and Canyons (26g) south of La Junta. Extensive dinosaur tracksites are found in some areas along the Purgatoire River. *Photo: Jim Wark, AirPhotoNA*