



Base from U. S. Geological Survey, 1957



**Discussion**

The Ward quadrangle is an economically important area because it is a part of a major watershed that serves the towns and farms of the foothills and plains below. The water is used predominantly for agricultural purposes; however, industry and urban areas are making increasingly greater demands on this most critical resource. The area, except for the eastern edge of the Ward quadrangle, where stands of aspen and lodgepole pine prevail, still represents the undisturbed natural succession of plant life from the upper montane to the alpine region.

Because of the development of private lands along the eastern edge of the quadrangle, more people are living in the area and it can be assumed there will be additional development in the area.

politan areas, which are experiencing rapid growth. Access to the Indian Peaks recreation area from the east is principally through the Ward quadrangle, and the back country is becoming more accessible with the paving of roads. Consequently, the Ward area will see more development in years to come as it is more heavily used for recreational purposes. The flora of the upper montane and alpine ecological regions are fragile, and when damaged, hundreds of years are necessary for natural processes to repair it since weather conditions are so adverse and plant growth so slow. People must learn to recognize their impact on the environment because the damage could be irreversible.

**References**

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**EXPLANATION OF MAP UNITS**

[Symbol]	Meadow
[Symbol]	Tundra
[Symbol]	Tundra forest--Area of 50 percent tundra and 50 percent forest
[Symbol]	Scrub
[Symbol]	Scrub-forest--Area of approximately 50 percent scrub and 50 percent forest
[Symbol]	Forest
[Symbol]	Forest-aspen--Area of 25-50 percent aspen
[Symbol]	Aspen-forest--Area of 50-75 percent aspen
[Symbol]	Aspen

**EXPLANATION**

Plant and animal life in Colorado are diverse because of a range in altitude from 4,000 to over 14,000 ft. Because of the range in altitude, a temperature change is encountered in the area along the 35° latitude. With an increase in altitude, climatic conditions change and this brings about a change in plants and animals, and as a consequence, different life zones or ecological regions (Marr, 1967) develop. The distribution of ecological regions is dependent on available moisture, prevailing winds, and exposure as well as the altitude.

The following ecological regions are recognized in Colorado: plains, 4,000-6,000 ft; foothills or lower montane, 6,000-8,000 ft; montane or upper montane, 8,000-9,500 ft; subalpine, 9,500 ft to timberline and alpine (the area above timberline), approximately 11,150 ft and above. Ecological regions do overlap one another considerably and may even form transition zones over short distances, but each region has a characteristic vegetation and animal life.

Three ecological regions which occur in the Ward quadrangle that from east to west are as follows: upper montane, subalpine, and alpine. On the map it is possible to recognize the progression from stands of aspen in the upper montane region, through the evergreen forest of the subalpine region to the tundra of the highest alpine areas. Vegetation units that occur within these ecological regions were mapped, (using knowledge gained of the vegetation while geologic mapping in the area) by using a Kern PG-2 stereoplotter and aerial photos from 1956 and 1967; the photo scales are 1:20,000 and 1:15,940 respectively.

**Upper montane ecological region (8,000-9,500 ft)**--Of the three ecological regions represented in the quadrangle, man has disturbed the vegetation of the upper montane the most. This region has the most varied vegetation of the three regions in the quadrangle, principally due to its milder climate. Vegetation is in many ways transitional between the foothills and the subalpine regions in this region. At lower elevations, quaking aspen and lodgepole pines dominate but ponderosa pine and Douglas-fir are also present, as are a few Colorado blue spruce along the stream beds. At higher elevations, in the upper montane region, Engelmann spruce and limber pine replace the aspen and lodgepole but both the aspen and lodgepole are present locally.

There are many mountain lakes and ponds in the upper montane and subalpine regions. Surrounding the lakes and ponds there may be as many as five distinct vegetation stages ranging from plants submerged in the lakes to trees in the higher and drier surrounding area. Red Rock Lake is one example where this vegetative succession can be seen. The water of the lake is moderately deep, muddy, and not too cold. Aquatic plants, especially the yellow pond-lily or spatterdock, pondweed, bur-reed, and algae occur in the submerged zone. In shallow water, sedges and marsh grass grow and along the shore, shrubs consisting of willow and birch, replace the sedges and grasses. On higher ground there is a progression out from the lake ranging from flowering shrubs to the Engelmann spruce forest. As the lakes and ponds fill with sediments, the vegetation changes so that all stages may not be present around any one lake or pond.

**Subalpine ecological region (9,500 ft to timberline)**--Just below timberline, adjacent to clear streams and in water-soaked soil, a profusion of wildflowers occurs followed upslope typically by alpine shrubs and on higher ground by spruce, sub-alpine fir, and pine. Lichens and moss occur on open ground and bare rock.

In the subalpine region, shrubs are dwarfed and often form tongues that, along with dwarfed trees, extend upward into the tundra areas of the alpine region. In this region, dwarfed, locally prostrate spruce and fir trees may form wind-sculpted krummholz (tree islands) that are nearly impossible to penetrate except along open, windwept areas that parallel the krummholz. This shrub-forest cover gives way downslope to the tall, dense forest trees of Engelmann spruce, subalpine fir, and limber pine.

**Alpine ecological region (above timberline)** Grasslands, meadows, and rockfields containing a profusion of alpine flowers, grasses, sedges, and dwarfed shrubs make up the alpine region. At least three easily recognizable habitats occur in this alpine region: (1) ridges and rock ledges that are dry and windy, (2) moist depressions of valleys that are more protected, and (3) alpine meadows and "fall fields"; the latter is recognized by cushion plants and a gravelly dry surface.

**Kobresia**, in the autumn, colors a rich bronze-yellow-brown as it dries and alpine avens (*Acomastylis*) turn a deep red, giving the alpine-tundra its typical autumn color.

\*Use of a specific brand name does not necessarily constitute endorsements of the product by the U.S. Geological Survey.

TABLE OF THE VEGETATION MAP OF THE WARD QUADRANGLE, BOULDER COUNTY, COLORADO  
(Plant names from Weber, 1976. Bare rock areas in quadrangle not mapped, but may be moss or lichen covered. Scientific name only listed first time plant appears in an ecological region)

Ecological region	Common trees (flowers)	Common shrubs	Prominent herbs (flowers)	Common herbs (sedges and grasses)	Remarks
Alpine (meadows not mapped separately, but are lumped under unit t)	None	Willows (Principally, <i>Salix arctica</i> )	Moss campion ( <i>Silene acaulis</i> ) Alpine avens ( <i>Acomastylis rossii</i> ) Parry's clover ( <i>Trifolium parryi</i> ) Buttercup ( <i>Ranunculus adoneus</i> ) Phlox ( <i>Phlox stizoides</i> ) Mountain avens ( <i>Dryas octopetala</i> )	Kobresia ( <i>Kobresia myosuroides</i> ) Tufted hairgrass ( <i>Deschampsia caespitosa</i> )	Willow-sedge hummocks occur in the alpine region; wet meadows of sedge and grass occur in the alpine and subalpine regions and dry meadows in the upper montane and subalpine. Nearly 90 species of grasses have been recognized with timothy the most common. Sedges are represented by more than 40 species of the common genus <i>Carex</i> ; rushes by numerous species of the genus <i>Juncus</i> . Lichen and mosses occur in areas where snow accumulates earlier and melts later. Shrubs and some sedges and many flowers follow water courses through meadows. Subalpine is a transition zone between alpine tundra and the upper montane.
Subalpine	Quaking aspen ( <i>Populus tremuloides</i> ) and Lodgepole pine ( <i>Pinus contorta</i> ) invade meadows	Willow ( <i>Salix</i> several sp. esp. <i>glauca</i> and <i>planifolia</i> ) Bog birch ( <i>Betula glandulosa</i> ) Shrubby cinquefoil ( <i>Pentstemon floribunda</i> ) Myrtle blueberry ( <i>Vaccinium myrtillus</i> )	Shooting star ( <i>Dodecatheon pulchellum</i> ) Elephantella ( <i>Pedicularis groenlandica</i> ) Marsh marigold ( <i>Caltha leptosepala</i> ) Parry's primrose ( <i>Primula parryi</i> ) Chiming bells; blue bells ( <i>Mertensia viridis</i> ) Jacob's ladder ( <i>Polemonium delictatum</i> ) Sky pilot ( <i>Polemonium viscosum</i> )	Slender wheat-grass ( <i>Agropyron trachycalum</i> ) Reed-grass ( <i>Calamagrostis purpurascens</i> ) Alpine timothy ( <i>Phleum commutatum</i> ) Sedge ( <i>Carex</i> ) Rush ( <i>Juncus</i> ) Blue-grass ( <i>Poa nemoralis</i> , <i>Poa nervosa</i> ) Mountain mulch ( <i>Muhlenbergia montana</i> )	
Upper Montane	Quaking aspen Lodgepole pine	Willow ( <i>Salix</i> several sp.) Bog birch Shrubby cinquefoil Myrtle blueberry Woolly cinquefoil ( <i>Potentilla hippiana</i> ) River birch ( <i>Betula fontinalis</i> ) Alder ( <i>Alnus tenuifolia</i> )	Larkspur ( <i>Delphinium ranosum</i> ) Paintbrush ( <i>Castilleja linearifolia</i> ) ( <i>Castilleja minima</i> ) Daisy; Fleabane ( <i>Erigeron</i> , numerous sp.) Lupine ( <i>Lupinus argenteus</i> ) Chiming bells ( <i>Mertensia ciliata</i> ) Golden banner ( <i>Thermopsis divaricata</i> ) Yarrow ( <i>Achillea lanuosa</i> ) Aster ( <i>Aster porteri</i> )	Slender wheat-grass Reed-grass Alpine timothy Sedge ( <i>Carex</i> ) Rush ( <i>Juncus</i> ) Blue-grass Mountain mulch	
Alpine	None	No tall shrubs; in moist areas find Shrubby cinquefoil and Whitlow-wort ( <i>Draba aurea</i> )	Tundra (t)	Kobresia Tufted hairgrass	Alpine tundra dominated by low, perennial sedges, grasses, herbs, and alpine shrubs. Competition (frost churning), solifluction (slumping), depth and duration of snow cover and work of pocket gophers are among the chief controls of vegetation in the alpine tundra. Flora of rock and coarse soil on windswept ridges and mountain summits include foliose ground lichens and Mountain avens. Lichen-moss ( <i>Sibbaldia Sibbaldia procumbens</i> ) occurs on the ground that is the last to be exposed.
Alpine	None	Willows	Moss campion Alpine avens Parry's clover Buttercup Phlox Mountain avens	Kobresia Tufted hairgrass	Tundra forest is a transition area; although an area of trees, strong westerly winds cause profuse open areas in which only tundra is found. Generally only the hardiest of flowers shrubs, grasses, and sedges of the alpine type can grow here.
Subalpine	Subalpine fir ( <i>Abies lasiocarpa</i> ) Engelmann spruce ( <i>Picea engelmannii</i> ) Limber pine ( <i>Pinus flexilis</i> )	Willow Bog birch Shrubby cinquefoil Myrtle blueberry	Columbine ( <i>Aquilegia caerulea</i> ) Aster ( <i>Aster porteri</i> ) Paintbrush ( <i>Castilleja rhexifolia</i> ) Jacob's ladder Stonewort Dry, rock areas: Sedum ( <i>Sedum lanceolatum</i> ) Wet, marshy areas: Kings crown ( <i>Rhodiola integrifolia</i> )	Slender wheat-grass Reed-grass Alpine timothy Sedge ( <i>Carex</i> ) Rush ( <i>Juncus</i> ) Blue-grass Mountain mulch	
Subalpine	Engelmann spruce Limber pine Subalpine fir	Willow Bog birch Shrubby cinquefoil Myrtle blueberry	Paintbrush Daisy; Fleabane ( <i>Erigeron</i> , numerous sp.) Lupine ( <i>Lupinus argenteus</i> ) Chiming bells ( <i>Mertensia ciliata</i> ) Jacob's ladder ( <i>Polemonium foliosissimum</i> )	Slender wheat-grass Reed-grass Alpine timothy Sedge ( <i>Carex</i> ) Rush ( <i>Juncus</i> ) Blue-grass Mountain mulch	Shrubs and krummholz impossible to separate at higher elevations. Shrub at lower elevations may be associated with a few shrubby or dwarfed quaking aspen.
Upper Montane	Quaking aspen	Shrubby cinquefoil Planeleaf willow ( <i>Salix phyllifolia</i> ) Wild rose ( <i>Rosa woodsii</i> ) Wax currant ( <i>Ribes cereum</i> )	Aster Golden banner Paintbrush Fireweed ( <i>Chamerion angustifolium</i> ) Larkspur Lupine	Slender wheat-grass Alpine timothy ( <i>Phleum pratense</i> ) Sedge ( <i>Carex</i> ) Rush ( <i>Juncus</i> ) Blue-grass Mountain mulch	
Subalpine	Subalpine fir Engelmann spruce Limber pine	Willow Bog birch Shrubby cinquefoil	Scrub-forest (sp)	Where scrub and trees are less dense, same vegetation as in subalpine of unit m is found in disturbed areas as along roads, in burned, mined, and logged open areas and along streams in upper montane region.	The flowers and grasses are limited to open areas in subalpine region. Flowers and grasses more profuse in disturbed areas as along roads, in burned, mined, and logged open areas and along streams in upper montane region.
Upper Montane	Engelmann spruce Limber pine	Kinnikinnik ( <i>Arctostaphylos uva-ursi</i> ) Shrubby cinquefoil Planeleaf willow Wild rose Thimbleberry ( <i>Rubus parviflorus</i> ) Wax Currant Mountain common juniper ( <i>Juniperus communis</i> )	Aster Golden banner Paintbrush Fireweed Larkspur Lupine	Timothy Blue-grass ( <i>Poa agassizensis</i> ) Broom-grass ( <i>Bromopsis porteri</i> ) ( <i>Bromopsis ciliata</i> ) Blue grama ( <i>Bouteloua gracilis</i> )	
Subalpine	Engelmann spruce Limber pine Subalpine fir Bristle-cone pine ( <i>Pinus aristata</i> )	Myrtle blueberry	Forest (P)	Slender wheat-grass Reed-grass Timothy Sedge ( <i>Carex</i> ) Rush ( <i>Juncus</i> ) Mountain mulch	Forest occurs as straggly stands in the most forward areas and a dense cover at lower elevations. Areas above 10,000 ft generally Engelmann spruce, limber pine, and the rare Bristle-cone pine. At lower elevations, stands of lodgepole pine, Limber pine, and some Douglas-fir. Along streams willow, alder, and birch are found.
Upper Montane	Engelmann spruce Lodgepole pine Douglas-fir ( <i>Pseudotsuga monticola</i> ) Quaking aspen	Mountain common juniper Kinnikinnik Red-berried elder ( <i>Sambucus racemosa</i> )	In open areas: Paintbrush Fireweed Daisy; Fleabane Lupine Chiming bells Jacob's ladder Yarrow Columbine Aster	Timothy Blue-grass Broom-grass Blue grama	
Upper Montane	Quaking aspen Lodgepole pine Less common: Douglas-fir Subalpine fir Ponderosa pine ( <i>Pinus ponderosa</i> )	In open areas: Mountain common juniper Wild red raspberry ( <i>Rubus idaeus</i> ) Thimbleberry Wild rose	In open areas: Lupine ( <i>Lupinus borealis</i> ) Paintbrush Fireweed Daisy; Fleabane Lupine Jacob's ladder ( <i>Polemonium foliosissimum</i> ) Golden banner Yarrow Columbine ( <i>Aquilegia caerulea</i> ) Aster	Timothy Blue-grass Broom-grass Blue grama	Unit pa represents 25-50 percent aspen in forest; unit ap represents 50-75 percent aspen in forest.
Upper Montane	Quaking aspen	In open areas: Mountain common juniper Wild red raspberry Wild rose	Forest aspen (pa) Aspen-forest (ap)	Timothy Blue-grass Broom-grass Blue grama	Aspen forms groves; good soil and moisture necessary. Many flowering shrubs, grasses, and flowers found beneath aspens.

VEGETATION MAP OF THE WARD QUADRANGLE, BOULDER COUNTY, COLORADO

By