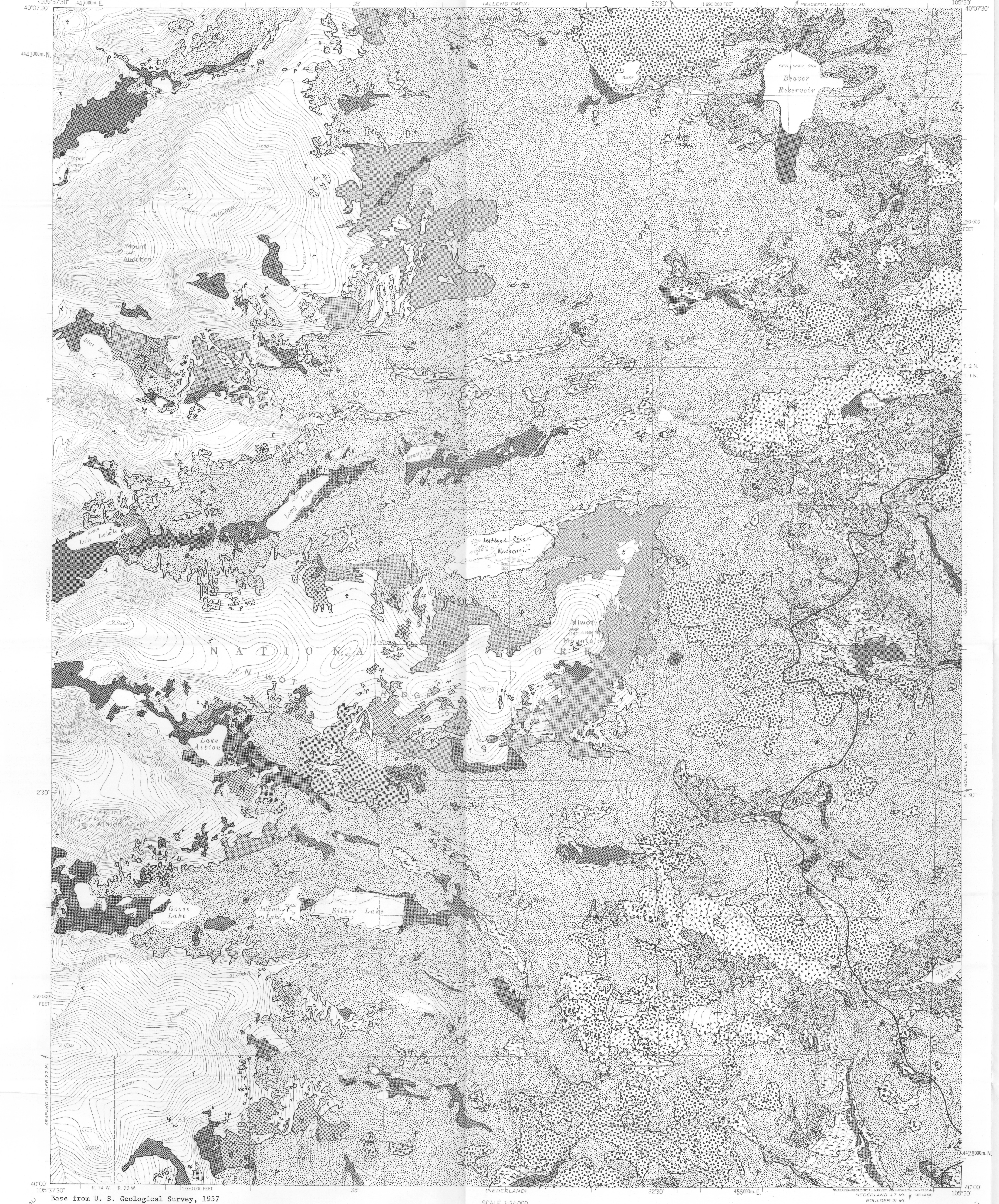


DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY



EXPLANATION OF MAP UNITS

- Meadow
- Tundra
- Tundra forest--Area of 50 percent tundra and 50 percent forest
- Scrub
- Scrub-forest--Area of approximately 50 percent scrub and 50 percent forest
- Forest
- Forest-aspen--Area of 25-50 percent aspen
- Aspen-forest--Area of 50-75 percent aspen
- 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, 6,000-8,000 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-2¹ stereoplotter and aerial photos from 1956 and 1967; the photo scales are 1:20,000 and 1:15,840 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 down-slope 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 alpine and windy, (2) moist depressions of valleys that are more protected, and (3) alpine meadows and "foll 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.

¹Use of a specific brand name does not necessarily constitute endorsements of the product by the U.S. Geological Survey.

References

Komárková, Vora and Weber, P. J., 1978, A alpine vegetation map of Niwot Ridge, Colorado: Arctic and Alpine Research, v. 10, no. 1, (in press).

Marr, J. W., 1967, Ecosystems of the east slope of the Front Range in Colorado: Colorado Univ. Studies Ser. Biology no. 4, 134 p.

Nelson, R. A., 1961, Plants of Rocky Mountain Park: U.S. National Park Service, 201 p.

Poorman, W. W., 1975, West the natives, [7th ed.], Denver, Colo., Denver Botanic Gardens, 909 York St., 220 p.

Ramaley, Francis, 1927, Colorado Plant Life: Boulder,

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	Common shrubs	Prominent herbs (flowers)	Common herbs (sedges and grasses)	Remarks
Alpine	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 stictica</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 floricola</i>) Myrtle blueberry (<i>Vaccinium myrtillus</i>)	Shooting star (<i>Dodecatheon pulchellum</i>) Elephantella (<i>Pedicularis groenlandica</i>) Marsh marigold (<i>Caltha leptocarpa</i>) Parry's primrose (<i>Primula parryi</i>) Chiming bells (<i>Mertensia viridis</i>) Jacob's ladder (<i>Polemonium delicatum</i>) Sky pilot (<i>Polemonium viscosum</i>)	Slender wheat-grass (<i>Agropyron trachycaulum</i>) Reed-grass (<i>Calamagrostis, purpurascens</i>) Alpine timothy (<i>Pholus, commutatum</i>) Sedge (<i>Carex</i>) Rush (<i>Juncus</i>) Blue-grass (<i>Poa nemoralis, Poa nervosa</i>) Mountain muhly (<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 ramosum</i>) Paintbrush (<i>Castilleja linearisefolia</i>) (<i>Castilleja minima</i>) Daisy; Fleabane (<i>Erigeron, numerous sp.</i>) Lupine (<i>Lupinus argenteus</i>) Chiming bells (<i>Mertensia ciliata</i>) Golden banner (<i>Thermopsis divaricata</i>) Yarrow (<i>Achillea lanulosa</i>) Aster (<i>Aster porteri</i>)	Slender wheat-grass Reed-grass Alpine timothy Sedge (<i>Carex</i>) Rush (<i>Juncus</i>) Blue-grass Mountain muhly	
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 minute shrubs. Compel-turbation (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	Tundra forest (tp)	Kobresia Tufted hairgrass	Tundra forest is a transition area; although an absence 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 muhly	
Subalpine	Engelmann spruce Limber pine Subalpine fir	Willow Bog birch Shrubby cinquefoil Myrtle blueberry	Paintbrush Daisy; Fleabane (<i>Erigeron, numerous sp.</i>) 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 muhly	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 phylicifolia</i>) Wild rose (<i>Rosa woodsii</i>) Wax currant (<i>Ribes coccineum</i>)	Aster Golden banner Paintbrush Fireweed (<i>Chamerion angustifolium</i>) Larkspur Lupine	Slender wheat-grass Alpine timothy Sedge (<i>Carex</i>) Rush (<i>Juncus</i>) Blue-grass Mountain muhly	
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	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 Plainleaf 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>) Blue-grass Mountain muhly	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 menziesii</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	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	Gaillardia (<i>Gaillardia aristata</i>) Fairy trumpet (<i>Ipomopsis candida</i>) Beard-tongue (red) (<i>Penstemon barbatus</i>) Alpine penstemon (<i>Penstemon alpinus</i>) Fireweed Columbine Common Harebell (<i>Campanula rotundifolia</i>) Chiming bells Paintbrush	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	Aspen (a)	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