

PLANT COMMUNITIES OF GLACIER NATIONAL  
PARK, MONTANA.

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## GEOGRAPHY AND GEOLOGY

Glacier Park is located in the northwest corner of Montana, extending from the east front of the Rockies across the Lewis and Livingston ranges. The east front of the mountains rises abruptly from the Great Plains, as a result of the formation of the great Lewis overthrust fault which pushed the mountain strata out over the great plains formation in places as far as fifteen miles. This front or escarpment has been trenched by many streams which flow down from the plateau and find their way northeastward through the St. Mary's river to Hudson Bay or through the Milk River into the Missouri. The continental divide runs south along the crests, first of the Livingston and farther south of the Lewis Range, and the waters from the west side of the divide flow eventually into the Pacific Ocean. These streams in their lower valleys have developed narrow flood-plains, but they rapidly become steeper and their head waters are located in mountain ponds and springs on an average not more than 8 or 10 miles west of the plains. The mountain sides are very steep and are covered by slides of gravel occasionally broken by horizontal ledges formed by the protruding edges of the strata of which the mountains are composed. These strata dip gently in both directions toward a central valley between the two ranges, forming a great syncline. They are generally almost horizontal, though occasionally crumpled into many short wavy folds.

Near the summits of the mountains on protected ledges and in saucer-shaped depressions are located the glaciers from which the park gets its name. They are mostly small and decreasing in size, but they produce characteristic ridges of clay and gravel known as moraines, and their melting supplies the streams which cut narrow gorges down the mountain sides. Where two glacial valleys start opposite each other on the divide, their heads have cut the ridge down and a saddle or pass has been

formed. On an average the valley floors have an elevation of 4000 feet above sea level, the passes 6000-7000 feet and the mountain summits 9000-10,000. There are only six mountains in the park above 10,000 feet and of these the highest, Mt. Cleveland, is 10,500.

#### PLANT COMMUNITIES OF THE VALLEYS

The dominant plant formation of the region is the Rocky Mountain conifer forest which is found in the river valleys and on the lower slopes of the east side of the divide. The forest of the central valley and of the west slopes is similar but has an admixture of many of the species of the Pacific Coast.

The vegetation of the Great Plains adjoining the east front is of the grassland or prairie type. This consists chiefly of several species of grass with some herbaceous dicotyls, including a prickly pear cactus, and the shrubby sage-brush. In the river valleys, cottonwoods and willows fringe the streams and in smaller valleys and gullies thickets of shrubby willows, alder, and aspens are generally found. On the rolling hills adjoining the east front, aspen thickets are found and on the summits of the hills there are occasional stands of scattered stunted conifers.

In the ponds and marshy spots scattered over the prairie and along the stream valleys are characteristic aquatic communities. In most localities are the usual swamp communities including cattails, arrowhead, water-plantain, water smart-weed, and also such unusual forms as the pincushion plant, the owl-clover, and several genera of the evening-primrose family. Many of the depressions are strongly alkaline with such halophytic plants as salt-grass, shad scale, and the alkali buttercup.

The conifer forest (Fig. 1) is found at its best in the river and lake plains in the deep valleys of the east front. Here the trees grow in close stand to a height of 60 or 70 feet, and there is a dense mesophytic undergrowth of shrubs and ground plants. The chief trees are the lodge-pole pine, the Englemann spruce, the Douglas fir or false hemlock and the alpine fir. The low trees and shrubs include the mountain ash, mountain maple, the service-ber-

ry, the buckthorn, the buffalo-berry, the deerbrush, the snowberry, and honeysuckles, with blueberries, gooseberries, and raspberries. Among the ground plants are such characteristic forms as the queencup, the rattlesnake plantain, the baneberry, the pyrola, the bishop's cap, and several ferns. Occasionally rounded shoulders or knobs, usually on the north side of a valley, show very xerophytic conditions and have a vegetation resembling that of a pine barren. The trees are chiefly lodgepole and lumber pines and poplars, and they have a stunted growth and open stand. The chief shrubs are blueberries, mountain spray, and deerbrush, and the ground plants include bergamot, harebell, fireweed, beardtongue, stonecrop, and a xerophytic selaginella.

#### PLANT COMMUNITIES OF THE MOUNTAIN-SIDES

On the valley sides the soil rapidly becomes drier than that of the flood-plains, the trees are not so tall and have a more open stand, and the undergrowth becomes more xerophytic. The forest also becomes discontinuous, with alternating patches of shrubby thickets or of mountain meadow. In the thickets, alder and willows predominate, with elder and red osier dogwood and stunted specimens of mountain ash, mountain maple and service berry.

The mountain meadows consist of a dense ground cover of grasses and herbaceous plants which are famous for the variety and bright color of their flowers. Among these are paint brush, columbine, bear grass, mariposa lily, beard-tongues, louseworts, larkspur, Jacob's ladder, shooting star, spirea, stonecrop, saxifrages, sulphur plant, bistort, wild onions, lupines and other legumes, and several showy composites. Where there is plenty of water in the soil, as along the mountain streams, will be found the globe flower, little elephant, pasque flower, anemones, and hydrophytic saxifrages and mosses.

Farther up the mountain side the plants get more and more stunted. At timberline the conifers form extensive thickets of trees not over 3 or 6 feet tall. Above timberline there are no trees and the ground plants grow in clumps with a very open stand. All have short stems and many show the cushion habit, but the flowers are still



brightly colored and generally full size. Characteristic species are the mountain dryad, mountain pink, several saxifrages, red and yellow stonecrops, dogtooth lily, cinquefoil, mountain sorrel, mountain forget-me-not, and wild candy tuft. These plants continue in very open stand as far as any gravelly soil can be found. Among those which are found at the highest levels are the dryad, mosspink, a saxifrage, a hedysarum, a dandelion, and chickweeds. On the bare rock surfaces there is a profusion of lichens, predominantly greenish-gray, but also black and white, brown, lavender and even yellow and red.

#### PLANT COMMUNITIES OF ALPINE PARK.

Near the summits of the mountains, small level tracts are occasionally found which may be called mountain parks. These contain slight depressions in which snowbanks accumulate and frequently remain until late in the summer. The vegetation of these parts resembles the tundra of the arctic regions interspersed with scattered clumps of stunted conifers. (Fig. 3.) In the drier portions of the tundra, the main groundcover consists of grasses and sedges with such characteristic flowering plants as the red and white heathers (*Phyllodoce*), the shooting star, the Rocky Mountain laurel, the dwarf willow, the alpine speedwell, fringed gentian, Indian warrior, and rock cress.

The snowbanks have a different and a very characteristic vegetation. In the early part of the season, the dogtooth lily grows around the edges of the snow, even coming up through the snow and blooming before it has melted away. When the snow has completely melted, the bottom of the little hollow is found to contain not the dogtooth lily but the alpine spring beauty. The conifer clumps are usually found on the shallow dry soil which overlies rock ledges and they follow the outlines of the buried rock ridges. The species include fir, spruce, the white-bark pine, and the Rocky Mountain juniper.

On the sides of the parks near the mountain slopes, the rock ledges often protrude through the scanty cover of soil and here the plant communities are quite different.

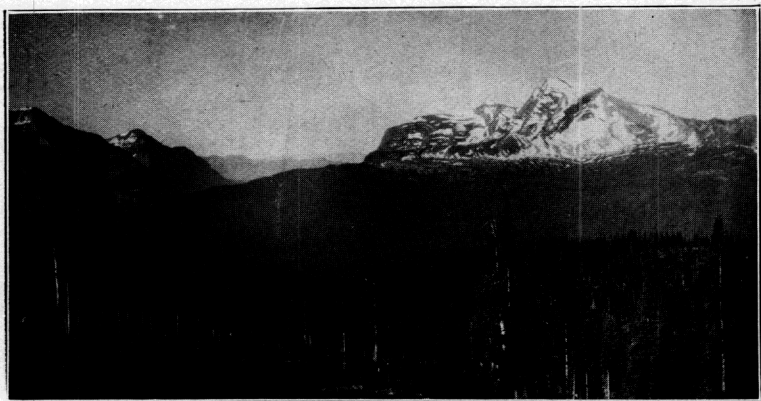


Fig. 1. Conifer forest in stream valley. Mountain meadow in foreground.

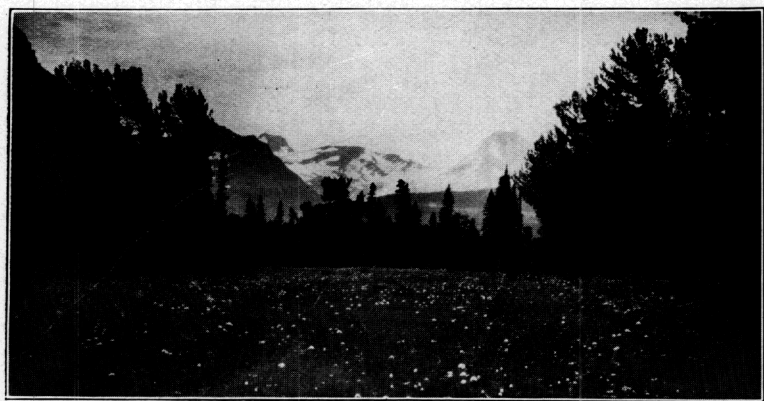


Fig. 2. Flowers in mountain meadow surrounded by conifers.

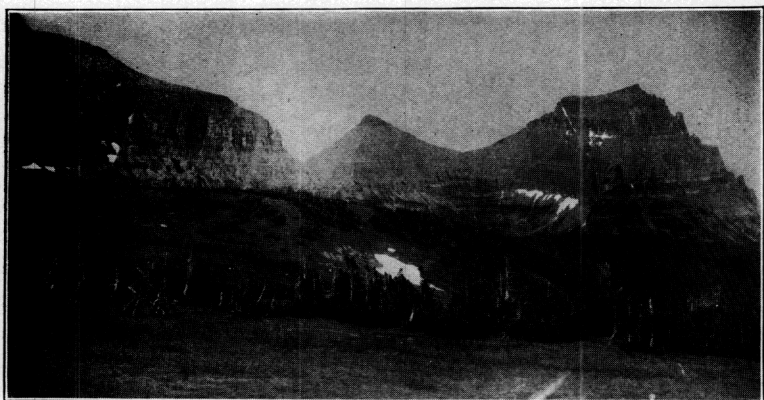


Fig. 3. Elongated patches of stunted conifers in Alpine Park,—indicators of buried rock ledges.

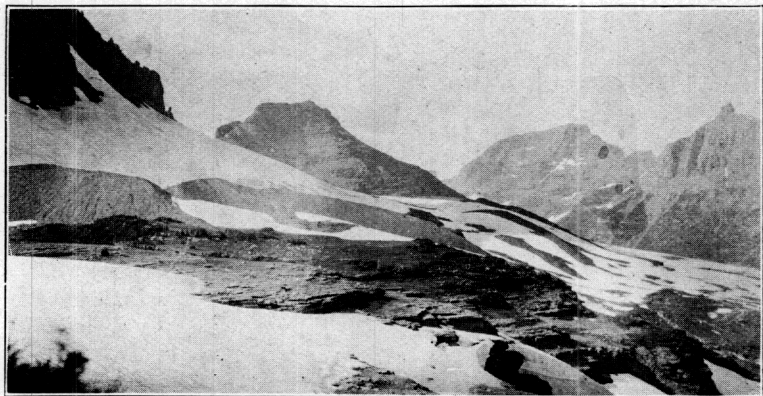


Fig. 4. Moraines and rock ledges surrounding Two-Ocean Glacier.



The outer edges of the rock ledge which are exposed and relatively dry are occupied first by elongated patches of stunted conifers of the species already mentioned. The inner part of the ledge is lower and the scanty soil is water-soaked from melting ice and snow, and in this depression a moisture-loving community develops. The plants here include grasses and sedges, the heathers, and the Rocky Mountain laurel, the globe flower, a buttercup, a cinquefoil, the queencup, a white paint-brush, the meadow rue, the rock-cress, and in protected spots several delicate ferns.

When water drips over the face of the ledge, the projections and pockets in the rock face contain hydrophytic mosses and ferns, and such unusual plants as the mist-maiden (*Romanzoffia*) and the butterwort (*Pinguicula*). In especially cold, wet spots a bit of real arctic wet tundra may be found with sphagnum and the arctic heather *Cassiope*.

Still another type of community is found occupying the clay-gravel moraines around the melting fronts of the glaciers. (Fig. 4.) Here the conditions are extremely hard for plants on account of the character of the soil, and the exposure and the absence of moisture on these dry, clay ridges. The first plants to appear after the retreat of the glaciers are stunted and scattered, as they are able to become established only in the most favorable spots. The first pioneers are usually grasses, with chickweeds, fleabane, alpine beardtongue, the mosspink, and the alpine poppy. The last mentioned is especially interesting and characteristic as it is a true poppy, but only two or three inches high. It has only a few leaves and one orange-colored flower which is perfectly formed and easily recognized as a poppy.

On the older moraines these plants form layer clumps and are found closer together. Other less hardy species come in and scanty clumps of stunted conifers begin to appear. Those are the same species that are found on the dry tundra and on the rock ledges.

## PLANT COMMUNITIES OF THE WEST SIDE OF THE DIVIDE

The same general conditions prevail on the west side of the divide, but the plant communities there are interesting because of the presence of many species from the Pacific coastal forests. Among the trees are the western hemlock, giant cedar, western larch, western white pine, and white birch. Among shrubs and ground plants are the yew, the devil's club, the mountain lover, and the Oregon grape. Other plants found chiefly on the western slopes in Glacier Park are the nine-back, the Labrador tea, the bunch-berry and the high-bush cranberry.

The forests of the valley floors are very damp and the heavy undergrowth resembles in luxuriance as well as in species that of the forests of Washington and Oregon. The trees are draped with the bearded lichen and there is a profusion of fungous forms on the rich humus.

In some of the ponds above the head of Lake McDonald are sphagnum bogs which resemble those of the eastern states and Canada. The characteristic feature of these bogs is the floating mat of sphagnum which supports such bog plants as sun-dew, swamp cinquefoil, and cottongrass as well as the Rocky Mountain laurel, the orchid lady's-tresses, the water hemlock, and several club mosses.