Zion and Bryce Nature Notes

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This bulletin is issued monthly for the purpose of giving information to those interested in the natural history and scientific features of Zion and Bryce Canyon National Parks. Additional copies of these bulletins may be obtained free of charge by those who can make use of them by addressing the Superintendent, Zion National Park, Utah. PUBLICATIONS USING THESE NOTES SHOULD GIVE CREDIT TO ZION-BRYCE NATURE NOTES.

P. P. Patraw, Superintendent C. C. Presnall, Park Naturalist

WATERFALLS

By C. C. Presnall, Park Naturalist

To speak of waterfalls in a region of cactus and sagebrush, where the rainfall is but fifteen inches per year, may seem comparable to the stories of lakes and springs told by thirst-crazed victims of desert mirages. Nevertheless, there are real waterfalls in Zion at certain seasons, usually during July and August when torrential thunderstorms occur at frequent intervals. Few of the resultant waterfalls flow for more than a few hours, but their great abundance and variety during a storm are sources of wonder to those who have been so fortunate as to see them.

Such an opportunity occurred on September 5 when a series of heavy local storms soaked up the dry rocks, and started dozens of streams cascading over the vertical walls of Zion. In driving from the Zion tunnel to the Temple of Sinawava, a distance of nine and one-half miles, I counted seventy-six separate and distinct falls. From one vantage point alone, the second gallery in the tunnel, I counted twenty-two falls, some of them over seven hundred feet high. Mr. T. C. Parker, Assistant Superintendent of Zion National Park, tells me that on a previous occasion he counted twenty-seven from the same point, but even that is surpassed by a total of fifty falls which were visible from the administration building during an unusually heavy storm in 1930.

Those who doubt the accepted idea that Zion Canyon has been eroded by stream action would have all their skepticism removed by such a spectacle, for the falls and cascades of Zion are so loaded with earth, sand and

boulders that they do considerable damage in scouring out trails and cutting deep gullies at their bases. The temporary streams which feed all the falls have intrenched themselves so deeply that the falls when seen from one side often appear to spout from holes in the mountainside, only a direct front view revealing the narrow clefts from which they flow. Travelers on either the East or West Rim Trails have excellent opportunity to see such narrow defiles at Echo Canyon or Refrigerator Canyon respectively.

The feature of Zion waterfalls which causes most comment is the varying color of different falls, depending on the amount and kind of sediment carried by each. "White water", so commonly associated with swift currents, is the exception in Zion Canyon during summer storms. Most of the waterfalls are so charged with sand, debris, or just plain mud, that even the foam is colored dark. The most grotesque waterfall I have ever seen was that which poured down some 200 feet into Zion Canyon from the lip of Echo Canyon on September 8. Thirty falls were visible from the public campground that day, but I left them all to stare in fascination at the black fall of Echo Canyon. The water shot straight down from the brink in a solid stream of dark sotty-brown, then struck the boulders below Weeping Rock and billowed out in a great mass of black foam, like huge smoke clouds. The illusion of smoke was perfect when I viewed the fall upside down. Instead of a waterfall, there appeared to be a smoke column shooting straight up and spreading at the top into the typical form of a smoke cloud seen above a factory chimney. Even after resuming an upright posture, there still remained the illusion of belching fumes from a furnace, now inverted.

Although the volume of water in these temporary falls is usually small, some of them are of great height. The highest ones are of the "slide fall" type, not leaping clear of the rocks at any point, but sliding down very steep, unbroken surfaces for a thousand feet or more. As might be expected, the very highest of all are on the sides of the Great White Throne, which are nearly vertical for some 2200 feet. Among the thirty falls mentioned above, there were several over 1500 feet high on the south face of the Throne, all of them sliding at angles of 75 to 85 degrees. The highest leaping fall thus far measured is in the Temple of Sinawava. It makes a clear leap of just under 800 feet. There are two others, smaller in volume and running only during extra heavy storms, which I believe to be higher, but they have not yet been measured. One is near the Beehive, and the other in Pine Creek. Judging from contour maps, it is quite possible that leaping falls exceeding 1000 feet in height may sometimes occur in the Narrows, but the possibility of verifying this guess is remote, since the Narrows is an extremely dangerous place during a freshet.

Unfortunately, only a small percentage of those who annually visit Zion National Park can hope to see these temporary falls. During July and August thunder showers are normally rather frequent, once a week more or less, but being local storms confined to small areas, a thunder storm does not necessarily mean a gorgeous display of falls. Nevertheless, such spectacles generally occur several times each summer (three times in 1933), and those who happen to be in Zion Canyon at such a time are fortunate indeed.

THE ROLE OF THE PRICKLY PEAR IN PLANT SUCCESSION

By Pauline Mead Patraw

The region along the east rim of Zion Canyon is made up of colorful sandstone hills dotted with plants which are beginning to gain a foothold on the bare surface of the rock. Occasionally fully developed vegetation covering of the final or climax type may be seen. Where this occurs on exposed south and west facing slopes and on open flats the pinon pine (Pinus monophylla), Utah juniper (Juniperus utahensis), live oak (Quercus turbinella), manzanita (Arctostaphylos platyphylla), mountain mahogany (Cercocarpus arizonica), and cacti (Opuntia rhodantha ?), the common prickly pear and the hedgehog cactus (Echinocereus coccineus), dominate the climax type of vegetation. The prickly pear plays an important role in the succession of plants from the appearance of the "pioneer" plants to the establishment of this climax group.

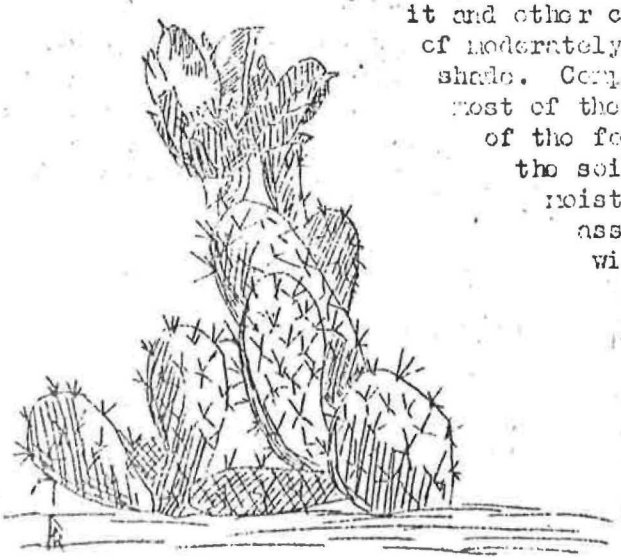
In the damp canyons and in those facing north there occurs different climax community, in most cases fully developed, which is characterized by Douglas fir (Pseudotsuga taxifolia), white fir (Abies concolor), yellow pine (Pinus ponderosa), and the big-tooth maple (Acer grandidentatum). In the establishment of this type of vegetation cacti play an unimportant part and usually are unable to grow under the shade and moisture conditions produced by these climax plants.

On the sandstone hills prickly pears are the first plants to follow the "pioneers". They prepare the way for many permanent plants, and grow abundantly with the climax vegetation, pinyon pine, juniper and live oak, whereas many of the plants first to appear are choked out. A "pioneer" plant, one which obtains a foothold and grows on the bare rock surface or even in cracks or pockets in the rock where soil may accumulate, must be hardy, for here moisture is scarce and exposure great. Lichens and drough-resistant mosses are common pioneers on the sandstone hills. The sulphur flower (Eriogonum stellatum) is the commonest pioneer herb here. Its tough root can find a way into small cracks and the body of the plant spreads in a mat over the surface of the rock, making a convenient place where soil may accumulate and other plants take root. Manzanita and mountain mahogany are important pioneer shrubs. The network of roots of the former holds soil on the rock surface while its deeper roots cling in crevices. Mountain mahogany is probably the commonest pioneer shrub here, growing in small crevices which its own roots gradually widen.

The prickly pear is able to take root wherever these pioneer plants have accumulated a bed of soil. It grows well in shallow soil. Its many long roots lying close to the surface are able to take advantage of rain water before it runs off. The cactus is often seen growing where soil has collected at the base of manzanita and mountain mahogany and on mats of moss and sulphur flower.

The most important function of prickly pear in plant succession is its ability to prepare conditions favorable to succeeding plants and to protect them. Lotus wrightii grows most commonly in the protection of prickly pear. The two plants are almost always found together. In a certain area five feet square where several of the cacti grew, twenty-five plants of Lotus were counted. Other flowering herbs for which this cactus prepares the way are the fleabane (Erigeron divergens), red pentstemon (Pentstemon torreyi), and Palmer pentstemon (P. palmeri). Matchbrush (Gutierrezia sarothrae) and sagebrush (Artemisia tridentata) are small shrubs which first follow the establishment of the prickly pear.

The process of covering bare rocks with vegetation is usually a very long one, lasting over a period of many hundreds of years. It may, however, be greatly hastened by plants which spread their bulk over bare rocks where they themselves are unable to take root. The prickly pear accomplishes this. It is resistant to drouth and exposure because of its thick covering of two skins and its efficient method of absorbing and storing water. Thus equipped it is able to withstand severe conditions on the bare rock hills. After taking root in soil collected by pioneer plants, the cactus creeps over the bare exposed rock. Its prostrate, jointed stem acts as a drift fence, collecting sand, silt, leaves and sticks brought by water and wind. These stems give rise to roots, where they come in contact with soil, by means of the same organ (the areole) which produces spines, flowers and new stems. The new roots hold material collected by the "drift fence" and here other plants may rapidly gain a foothold. In this way the prickly pear itself acts as a pioneer.



With the climax vegetation of pinon pine, Utah juniper and associated plants, the cactus is at home. It is able to live in the environment that it and other climax plants produce, an environment of moderately deep soil, rather scant moisture and shade. Competition for water between cacti and most of the other plants is slight since roots of the former invade only the upper part of the soil, while those of the latter take moisture mainly from the subsoil. In this association it grows most frequently with service berry (Amelanchier pallida), single leaf ash (Fraxinus anomala), and live oak (Quercus turbinella). It seldom occurs under the trees.

From the first group of plants on the bare sandstone hills of Zion Canyon to the final stage of vegetation covering, the prickly pear plays its important function of hastening succession.

COTTONWOODS AND WILLOWS IN ZION CANYON

By C. C. Presnall, Park Naturalist

The Fremont cottonwood (Populus fremonti) is the largest and most common tree of the thirteen native species which make up the deciduous forest on the floor of Zion Canyon. To an observer looking into the canyon from above there seems to be nothing but cottonwoods and willows at the bottom, and a careful survey shows that such is very near the truth. About 85 percent of the forest cover on the level canyon floor consists of members of the willow family, principally Fremont cottonwood, with wetter areas occupied by five kinds of willows, at least two of which attain tree size (S. laevigata and S. lasiandra caudata). Cottonwoods are also found on a few wet spots along the talus slopes bordering the flat canyon floor, and they grow along the Virgin River for miles out through the desert beyond Zion Canyon, as well as along the tributary streams flowing from the Markagunt Plateau into the canyon.

Fremont cottonwoods attain large size in this region, occasionally rivaling the Black cottonwood of the Pacific Coast in base diameter, but never attaining such great height. The largest Fremont cottonwood that I have thus far seen measured five feet six inches in diameter, but was not over fifty feet tall. Trees two to three feet through are sometimes eighty or ninety feet tall, but older specimens always have low twisted crowns. Apparently they are not strong enough to resist the force exerted by a heavy wind storm against a ninety-foot crown, and so are decapitated, but continue to increase in girth and produce a low, broad crown.

The age of these large trees has not been determined, but their invariable occurrence near water would indicate a rapid growth. The following tabulation was obtained from ring counts on trees growing in sandy soil with present water table about ten feet below the surface. (Historical data indicates that the water table might have been less than three feet below the surface when the trees started growing).

Diameter B.H.	Age
1 ft. 10 in.	42 years
1 ft. 9 in.	42 years
1 ft. 9½ in.	68 years
1 ft. 7½ in.	47 years
2 ft. 4 in.	73 years

Heart rot is often found in trees over sixty years old, which, combined with weak wood, precludes longevity in the species, but this is offset by rapid and abundant reproduction under favorable circumstances. The dense growth of young cottonwoods which now exist on the floor of Zion Canyon is a good example of this trait, especially significant when considered in the light of past history. Early settlers, coming into Zion Canyon in the sixties, found an abundant growth of trees, shrubs and grass, but like the pioneer stock raisers of practically all other parts of the west, they very quickly changed the green valley into a veritable dust bed by unwise and excessive grazing. Over-grazing, which continued until 1916, was so heavy as to prevent the growth of seedling trees. Also, many mature trees were cut in clearing homesteads, and in at least one case, in the winter of 1915, a number were cut so that starving cattle might eat the twigs and bark. Even after grazing was prohibited in 1916, the resultant erosion in the loose soil not bound together with tree roots continued so severe as to prevent much natural reforestation on the gravel bars until about 1923, when construction of revetments and wing dams was begun by the National Park Service to control the river. Since that time there has been a very gratifying natural reseeding of cottonwoods throughout the canyon.

To learn the extent of this reseeding, the writer recently made a survey of forest conditions in a portion of Zion Canyon. The survey covered all of the level canyon floor between Birch Creek and the Temple of Sinawava, a narrow strip of land 4.8 miles long and so hemmed in by talus slopes and cliffs as to total a scant 450 acres. It was found that thirty-nine percent of this area was covered with young cottonwoods and willows (principally the former) less than ten years old. With the constant improvement in flood control by the Park Service, there is every reason to believe that at least three-fourths of this newly reseeded area will produce a mature stand of cottonwoods. It will, of course, require many years to even partially restore the primitive conditions existing in 1860. Over forty years of ruinous over-grazing can not be remedied in a decade, but the last ten years have at least shown a promising start toward restoration of the full beauty of Zion Canyon.

The importance of cottonwoods as erosion control agents is well shown in the two previous paragraphs. It should be emphasized that the Fremont cottonwood and the several species of willows present in wetter areas are the most important components of forest cover on the floor of Zion Canyon, an importance both economic and scenic. Hence they have been treated as one in this second of a series of articles on the silva of Zion Canyon.

Beginning with this issue of Nature Notes and continuing through the winter, the Notes will be issued bimonthly, with the anticipation of renewing monthly issues next May.

C. C. P.

ALONG NATURE'S HIGHWAY

A weasel, interrupted in the act of pursuing a chipmunk, became so curious as to what manner of two-legged creature had disturbed it, that it craned its neck from behind the rock where it had sought shelter, and finally came out in full view, standing on its hind legs and stretching itself to its full height in order to look me over more thoroughly. The chipmunk meanwhile scolded from the fancied security of a nearby yellow pine. C.C.P.

Among the many common migratory birds seen at Bryce Canyon in October the presence of a single Townsend Warbler was a distinct surprise. Years ago, in Oregon, I had experienced great difficulty in studying the nesting habits of this bird because of its restless movements in the tall treetops. Upon renewing its acquaintance at Bryce I again noticed its restlessness, but was able to observe it easily since the highest trees in the vicinity were ten foot Mountain Mahoganies. C.C.P.

Juniper berries, ripening in October, form a staple food for many inhabitants of the southwest. A list of creatures observed feeding upon them includes jays, Townsend solitaires, robins, bluebirds, ground squirrels, chickadees and chipmunks - not to mention Navajo children. C.C.P.

The rapidity with which birds respond to the presence of water in an arid region was recently demonstrated at Bryce Canyon where there is very little standing or running water except during rain storms. On October 14 a small temporary stream was created near the public campground by draining the water system to prevent freezing. Within five minutes after the drain had been opened there were fifteen birds drinking or bathing in the water: Pigmy and Rock Mountain nuthatches, chestnut-backed and mountain bluebirds, and Audubon warbler, and a crossbill. C.C.P.
