



Nature Notes

Indian Paintbrush: Artistry in Architecture

Picture this: Zion National Park without a vivid flower called paintbrush. Not a pretty picture, in my mind. No feathery blooms adding their artistic touch of orange, scarlet, or even yellow to hillsides, making us giddy in the spring. The good news is that this iconic flower is here to stay in Zion's palette of colors, inspiring yet another season of eager artists.

Known to vary widely in color, most of Zion's paintbrush tends to be kaleidoscopic shades of red. But look closely—what is truly the flower on this plant? Those colorful “petals” are actually modified leaves called bracts. The long, tubular green spikes sticking out of the bracts are the fused flower parts. Being red, and having a slender, tubular flower, paintbrush is engineered to attract the attention of the perfect pollinator: hummingbirds. But the paintbrush's beauty is not just skin deep (or should I say “bract deep”?). Paintbrush has been brilliantly designed to survive in a huge range of habitats. From Zion's West to East Rims and down into the canyon, paintbrush is there, holding its own in varied landscapes.

Found only in North America, five of the 150 species of paintbrush (*Castilleja*) call Zion home. They range from species that grow in most habitats, to those that specialize. The Eastwood's, or slickrock paintbrush, is one that specializes. As one of its common names hints, it ranges from desert to high plateau and grows where few others dare: Zion's slickrock, that undulating land of layered sands we see on the east side. Reaching roots down into rock crevices, this plant can find water pockets when there is little available on the surface. On the other hand, the annual paintbrush, which is the only paint-



The colorful “petals” of paintbrush are actually modified leaves called bracts; the tubular green spikes are the true flowers. Both the color and shape are designed to attract hummingbirds. Photo by Sonja Hartmann

brush in Zion that lives for one short season, is found specializing at the other end of the habitat spectrum—wet places. These flowers, like the wet areas they grow in, are rare. The desert paintbrush is aptly found in the lower, warmer sections of Zion, such as the Chinle Trail, and is Zion's earliest bloomer, setting seed before the hottest summer months arrive. Wyoming paintbrush can be found in most of Zion National Park, except the desert areas. Look for the park's largest species in the fall on the Watchman Trail, or at the Emerald Pools, as it is one of the latest to bloom, getting started in July.

The uniting brilliance in architecture for all these species is that they are hemi-parasitic and share a specialized root structure called a haustoria root. This structure allows them to tap into the water and nutrients of their neighbors, supplementing those they already

produce. This does not kill the neighbor plant (the host) but is critical for the paintbrush. Without these resources, they will be stunted, will never flower, and will eventually die. The importance of this stolen water and nutrients varies wildly within paintbrush species. Hosts in Zion tend to be other native plants, such as sagebrush, grasses, and penstemons, but lupine plants

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may be an even better choice because they can make nitrogen from the air available to paintbrush by a process called nitrogen fixation. Lupines also contain chemical

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What's Blooming in Zion?

Datil Yucca (*Yucca baccata*-Agavaceae Family) captures our attention as its dramatic blossoms rise up on the plant's central stalk. Native Americans use the root, whisking it into water, to create a sudsy shampoo. Tough fibers within the leaves are woven into sandals, baskets, and nets. Women chew the leaf tip until it becomes a paintbrush with which to decorate pottery. The datil yucca can be found in front of the Zion Human History Museum.

Sego Lily (*Calochortus nuttallii*-Liliaceae Family) is the state flower of Utah. After Mormon pioneers arrived in the area, their provisions ran out, and the Southern Paiutes taught the settlers how to use the lily as a food source. The edible root bulb saved many families from starvation. Its singularity and simplicity make it a showy early bloomer. The cup-shaped white blossom sits on a short single stem. Watch for it along the Lower Emerald Pool Trail.

Palmer's Penstemon (*Penstemon palmeri*-Scrophulariaceae Family) makes its presence known. As the tallest (sometimes reaching three and one-half feet) and most captivating penstemon species in Zion, it can be seen along roadsides, slopes, and trails within Zion Canyon. Large pale-pink blossoms with purple veins scale a sturdy stem. Opposing, boat-shaped leaf pairs clasp the lower half of each stalk. Smell the flowers, and you'll be reminded of roses.

Remember, it is against park policy to pick flowers. Please heed signs that say, "Stick to the Trail," and give plants a chance.



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On August 1, 1929, the first issue of *Nature Notes* was published. Written and produced by the Education Departments at Zion and Bryce Canyon, its purpose was to provide information to "those interested in the educational opportunities, the natural history, the scientific features or the scenic beauties of this region." Eighty-one years later, *Nature Notes* continues this tradition by covering subjects pertinent to Zion National Park and its employees.

Halting the Green Invaders

The green invaders are coming! In fact, they've been arriving for a long time and have infiltrated our well established and productive communities. These aliens raid our food supply and drain our land of life-giving water. We have been fighting with our most powerful weapons to halt their attack, and slowly, against great odds, we are succeeding.

These aliens are not from another planet, but from another landscape. They stand between three inches and two feet tall, depending on conditions, and are common throughout the Southwest. Their ancestors found their way here in the mid 1800s, hidden in shipments from Eurasia. Can you identify these pesky intruders?

If you identified cheatgrass as our opponent, you are correct. Zion National Park has become home to a great abundance of cheatgrass because of its homesteading history and periodic fires. This aggressive grass thrives in areas of disturbance. Farming and cattle ranching created areas of bare soil perfectly suited for germination of cheatgrass seeds. Fires on the surrounding plateaus clear many native plants and leave areas open for the weed to establish itself before native communities have an opportunity to rebound.

Once established, this invasive plant has weapons to outcompete native flora and dominate the ecosystem. It begins its growth cycle in the winter when native plants are still enjoying their winter slumber. As native plants begin to emerge in the spring, cheatgrass has taken much of the nutrients and water from the soil to fuel its growth and is now ready to spread its seeds. These seeds have hooked ends which allow them to latch onto animals or people. We can unknowingly increase the monopoly of this tenacious competitor in Zion.

How do we combat the takeover? The Zion vegetation and fire crews are leading the charge to eradicate cheatgrass. They are working with scientists to reclaim Zion's stolen land. They have conducted studies to find the best tools to restore cheatgrass-ridden areas, such as around the Zion Lodge. They've teamed to stop a new incursion in

recently burned soils such as those from the 2006 Kolob Fire. Many techniques have been tried. A few have found success.

The best way to decimate the invaders' population, researchers found, was by using fire, herbicides, and trained warriors; this trio was employed in 2009 around the Zion Lodge. In the spring, a prescribed burn was conducted to destroy the cheatgrass before it had gone to seed. An herbicide—one with very minimal negative effects on native

Cheatgrass has weapons to outcompete native flora and dominate the ecosystem.

plants—was then applied to the area to stop any seeds from germinating. It was followed by a second herbicide spot treatment in the fall to kill the few that survived the initial attack. This is now the common tactic used to fight the unwanted grass in Zion, but can it be successful when nature takes the first step and burns cheatgrass in a wild fire? The 2006 Kolob Fire gave Zion the opportunity to find out. If a fire burns cheatgrass, scientists discovered, it completes the first step in reclaiming the area for native plants. Then, Zion's vegetation warriors just have to apply herbicides. Delivery and accuracy

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A sea of drying cheatgrass, like this one below a Zion peak, can fuel an intense fire. Photo by Jennifer Thelen

Protecting Zion's Canopy of Green

When visiting Zion National Park, we are inspired by the soaring towers of Navajo Sandstone, but if we bring our eyes down to the valley floor, we see a different drama unfolding.

After a landslide blocked the Virgin River thousands of years ago, a lake formed that extended through Zion Canyon from the Court of the Patriarchs nearly to the Temple of Sinawava. As debris from the surrounding plateaus settled in the bottom of the lake, it created a floor hundreds of feet thick in places. Over time the river cut through the earthen dam, once again carrying material from the canyon, and carved the lake deposits to their present level.

These geologic processes altered the flood plain. Though this part of the river bed happens to be dry most of the time, deep soil, groundwater, and additional river disturbances allowed the canyon floor to develop a wooded canopy, as reported by pioneer settlers. Their need to cultivate the land led to early forms of river management, and later the National Park Service advocated river



New cottonwoods are protected from greedy browsers by wire cages. Photo by Amy Gaiennie

pathway (flood) control to protect infrastructure, such as roads and buildings.

In the early 1930s the U.S. Government's Civilian Conservation Corps (CCC) built levees to control the river's path and protect important park structures, such as the Zion Canyon Scenic Drive and the Zion Lodge. While successful in controlling the river, this work appears to have retarded new tree establishment, especially that of the Fremont cottonwood (*Populus fremontii*), the tall, graceful trees that overarch the river. The majestic cottonwoods are so strongly

adapted to river banks that, in order to grow, they need saturated soil—most often achieved by flooding. Then, the river must recede to allow the seedlings to develop. Channelizing the river for flood control stopped both this process, creating a knotty challenge for park managers entrusted with the mission of conserving natural and cultural resources while protecting the safety of visitors.

What is Zion doing about its cottonwoods? Until an approved conservation plan is in place, the park will continue its visual monitoring. In the meantime, Zion's vegetation crew planted 65 cuttings at the Grotto picnic area last fall, taken from trees in the canyon to preserve the genetic stock; replanting this fall will replace those that were not successful. An irrigation system was also installed, and wire cages protect the new trees from browsing mule deer. These steps are being taken to ensure that Zion's cottonwoods continue to thrive, providing food, shelter, and shade for future plants, wildlife, and human visitors within the canopy of green. *-Bernie Jwaszewski*

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have proved difficult, but techniques are improving. Cheatgrass will still move in from the surrounding areas, but the hope is that the native vegetation will have time to establish before that happens.

Can we win the battle to restore and keep Zion in a natural state? That is still an unanswered question, but armed with increased knowledge we can be confident we are a strong contender in this battle. When you visit Zion, you can help by stopping the spread of cheatgrass seeds. Stay on the trails, and if you do walk through cheatgrass—a straw colored grass in the summer and fall—clean off your clothes before you leave the area. Only all of us working together can stop these unwanted plants.

-Jennifer Thelen

"We are here on the planet only once, and might as well get a feel for the place."

Annie Dillard

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compounds called alkaloids that are often toxic. Paintbrush can absorb these alkaloids and concentrate them in their leaves, making the leaves less palatable to animals that might otherwise eat them. Amazingly enough, these alkaloids are not found in paintbrush nectar, so the nectar stays tasty to the pollinators needed to produce seeds. Paintbrush that parasitizes lupine plants have been known to produce three times more seed and be more attractive to pollinators than those parasitizing other plants.

All of these amazingly engineered traits ensure that paintbrush will prosper in Zion for years to come. This spring I hope to celebrate this fact and quench my thirst for flowers by getting out in search of the many myriad paintbrush that call Zion home. I hope you, too, take the time to get out in your national park and view the flowers. You will find many reasons to hold this Zion gem in high regard and will marvel at its strategies for survival.

-Sonja Hartmann



Paintbrush, one of the first spring flowers, creates kaleidoscopic splashes of red and orange throughout Zion. Photo by Sonja Hartmann