



Climate Change at City of Rocks National Reserve

While the granite monoliths for which the City of Rocks National Reserve (CIRO) was named are the result of tectonic events that occurred millions of years ago, the effect of natural processes and human activities over the last two centuries is more evident in the plant and animal communities found in the reserve today. Originally set aside to protect a portion of the California National Historic Trail used by thousands of 19th century emigrants, CIRO has pinyon pine and juniper woodlands that were present when Shoshones and Bannocks camped in the area more than 300 years ago. The reserve's unique biogeographic setting provides an outdoor laboratory for studying the effects of climate change on these tree species as well as on many other native plants and animals.

Wildland Fire

Wildland fire is a natural process that helps recycle nutrients, regulate plant succession, and stimulate the regeneration of some species such as aspen. However, the trend toward reduced snowpack, earlier snowmelt, and warmer-than-average spring and summer temperatures in the West during the last 20 years is increasing the risk of more frequent and larger fires. With nearly one-third of the 14,407 acres within CIRO's boundary privately owned and much of the public land used for grazing allotments, all fires are put out as quickly as possible. Nonetheless, about 25% of the reserve has burned since 1926, and more than 18% since 1999, when a fire of unknown cause burned 565 acres. In 2000, a lightning ignition in Utah burned across more than 17,000 acres, 2,090 of them in CIRO. In 2008, the quickly detected Circle Creek Fire was limited to 1.5 acres.

Sagebrush Steppe

About 70% of the land cover in CIRO is sagebrush steppe, where native perennial forbs and grasses were historically interspersed with stands of sagebrush, providing habitat for wildlife including the sage-grouse (*Centrocercus urophasianus*) and songbirds like the Brewer's sparrow (*Spizella breweri*). The



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Sagebrush steppe vegetation in the foreground at City of Rocks.

sagebrush overstory has increased and conifers have expanded into the reserve's grasslands and aspen stands as a result of fire suppression. However, fires that occur now tend to foster the spread of some non-native plants such as the highly flammable cheatgrass (*Bromus tectorum*) which increases the likelihood of more frequent fires, preventing the recovery of native vegetation. Evidence from recent monitoring suggests that sagebrush areas burned in recent fires have much higher amounts of cheatgrass, and that many areas of the reserve that remain in good ecological condition may be increasingly vulnerable to cheatgrass invasion because of climate change.

Woodlands

The singleleaf pinyon pine (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*), as well as rodents such as the cliff chipmunk (*Tamias dorsalis*) and pinyon mouse (*Peromyscus truei*) which live in this woodland habitat, reach the northern extent of their range in and around CIRO. Plant and animal populations at the range margins are particularly subject to the effects of climate change as their ranges shift.

An outbreak of the pinyon bark beetle (*Ips confusus*) has impacted about 15% of the woodlands in the reserve. These beetles are native to western forests, but elevated temperatures can speed up the beetles' reproductive cycle and reduce their winter mortality. Drought stress, which may make pine trees more vulnerable to beetle infestations, has been implicated in the widespread die-off of pinyon-juniper woodlands in the Southwest.

For More Information

Upper Columbia Basin Inventory and Monitoring Network
<http://science.nature.nps.gov/im/units/ucbn/>



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Old growth pinyon near rock outcrops are favored by cliff chipmunks.