USA: California: Restoration Research at Red Rock Canyon State Park

Overview

Red Rock Canyon officially became part of the State Park system in 1968. In 1989, 4000 acres were added to the park in a land transfer with the Bureau of Land Management. The South Flat area was included in these lands, and up until the land transfer had been heavily used by OHVs as a campground with large motor homes, a racetrack and a play area for 4WD vehicles and motorcycles. The State Park staff closed the area in 1989 and fenced the area off preventing further OHV activity. The Soil Ecology and Restoration Group (SERG) at San Diego State University (SDSU) began work at the site in 1991, and native species planting began in 1993.

Our efforts for this project were originally focused on the recovery of native annual species, which have been extremely slow to reappear in the more disturbed areas of the South Flat. Desert annuals in the Mojave are an important food source for the endangered desert tortoise (Gopherus agassizii) and other desert wildlife. Our initial objectives were also to evaluate micro-nutrient availability and mycorrhizal activity along a disturbance gradient and to

use these findings to create a restoration scheme that would enhance the establishment of desert annuals.

Since Red Rock Canyon State Park had experienced two consecutive dry seasons since 1997 due to the La Niña effect, we were unable to collect adequate annual seed for a field or greenhouse experiment. Thus the scope of the project was modified to continue revegetating the South Flat area with perennials. Seven hundred seedlings were grown from local seed in SERG greenhouses. Five hundred of the seedlings were planted at South flat in March 2000.

Quick Facts

Project Location:
Red Rock Canyon State Park, Abbott Drive, Cantil, CA, USA, 35.3730834, -117.99102900000003

Geographic Region:
North America

Country or Territory:
United States of America

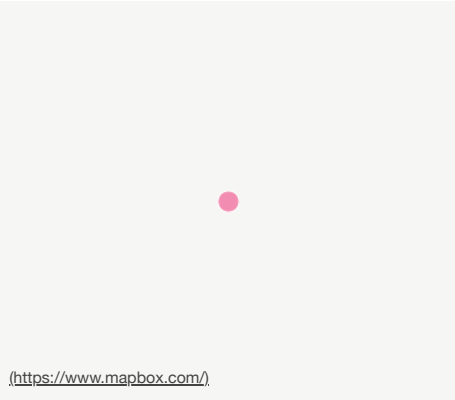
Biome:
Desert/Arid Land

Ecosystem:
Other/Mixed

Area being restored:
<100 hectares

Organization Type:
University / Academic Institution

Location



© Mapbox (https://www.mapbox.com/about/maps/) © OpenStreetMap (https://www.openstreetmap.org/about/)

TIMEFRAME

Project Stage:
Completed

Start Date:
19910331

End Date:
20000331

DEFINING THE PROBLEM

Primary Causes of Degradation

Urbanization, Transportation & Industry

Degradation Description

Until it was added to Red Rock Canyon State Park in 1989, the South Flat area had been heavily used by off-higway vehicles (OHVs) as a campground with large motor homes, a racetrack and a play area for 4WD vehicles and motorcycles. The State Park staff closed the area in 1989 and fenced the area off, preventing further OHV activity. OHV use produces a damaging effect upon vegetation, and plant rehabilitation efforts often are marginally

successful or unsuccessful.Â An investigation of plant cover loss at OHV use-areas has been found to range from 23% at the location of a one-time

PLANNING AND DESIGN

Reference Ecosystem Description

Red Rock Canyon State Park is characterized by a diversity of desert floral communities and landform features and contains six natural wildlife habitat types, including a biologically critical riparian zone in Last Chance Canyon and within Red Rock Wash. Red Rock Canyon SP is home to a number of sensitive animal and plant species, including the desert tortoise (Gopherus agassizi), Mohave ground squirrel (Spermophilus mojavensis), Golden Eagle (Aquila chrysaetos), prairie falcon (Falco mexicanus), Townsend's big-eared bat (Corynorhinus [Plecotus] townsendii), Spotted bat (Euderma maculatum), Red Rock tarplant (Deinandra arida), Red Rock poppy (Eschscholzia minutiflora ssp. Twisselmannii), Charlotte's phacelia (Phacelia nashiana), Mohave fish-hook cactus (Sclerocactus polyancistrus), creosote clone rings, various unique terrestrial invertebrates, and many others.Â Some species, most notably the Red Rock tarplant, are endemic to the park.Â Habitat for these plant and animal species often occur along the main routes of travel in the park.

Project Goals

The primary research aim of SERG has been to develop cost efficient restoration methods through various site treatments and revegetation procedures. Efforts for this project were originally focused on the recovery of native annual species, which have been extremely slow to reappear in the more disturbed areas of the South Flat. Since Red Rock Canyon State Park had experienced two consecutive dry seasons since 1997 due to the La Niña effect, it was not possible to collect adequate annual seed for a field or greenhouse experiment. Thus the scope of the project was modified to continue revegetating the South Flat area with perennials.

Monitoring

The project does not have a monitoring plan.

Stakeholders

This study was performed by the Soil Ecology and Restoration Group (SERG) at San Diego State University (SDSU). SERG began work at the site in 1991. Red Rock Canyon State Park is administered by the California Department of Parks and Recreation.

PROJECT ACTIVITIES

Description of Project Activities:

Soil Sampling "¨ Soil samples were collected on 12-13 March 1999, 14-15 April 1999 and on 18 March 2000. Samples were collected on three 30 meter transects along a selected disturbance gradient of less disturbed, moderately disturbed and very disturbed soils. Six samples were taken per transect. Soils were analyzed for available nitrate, phosphorus, total nitrogen, pH, organic matter and micro-nutrients. Available nitrogen was slightly higher in the very disturbed than in the undisturbed and disturbed areas. The higher levels in the relatively undisturbed area were higher than might be expected and may reflect deposition of nutrient rich litter and dust. Phosphorus levels were high but within previously observed levels. The very disturbed areas also had considerable available phosphorus. This has been observed before and probably results from vehicle oil leaks and detergents used by large camps. Desert soil is generally alkaline so the pH results were typical except for the very disturbed area, which was lower than the others. This probably reflects the effects of erosion, with wind blowing away fine calcium particles. Organic matter levels were typical for desert soils, ranging from 0.7-1.1 percent. The highest levels ever measured at RRCSP were under desert Senna at 2.2%. For minor nutrients, only potassium, zinc, and possibly boron currently demonstrate a distinct trend, increasing as the disturbance becomes greater. Zinc and boron are probably the result of vehicle operation, with runoff from galvanized materials, gasoline, oils and greases. A fire pit at the south flat measured during an earlier project had 60 ppm zinc, many times higher than the levels observed here. The higher levels of magnesium in the very disturbed site are again probably related to vehicle operation and fires. Seed Collection and Germination "¨ Seeds from native perennials and several native annuals were collected on 13-14 March 1999 and 15-16 July 1999 from the South Flat and surrounding areas within Red Rock Canyon State Park. Five hundred native seedlings were grown from this seed in the SERG greenhouse at San Diego State University. Seeds were germinated in flats that were misted twice daily. Once seeds had germinated, seedlings were transplanted into 2x8 inch plant bands and misted 3 times per week. Once established, plants received water on a weekly basis. One month before planting, plants were watered every 10-14 days. The soil mixture was one part organic matter/one part perlite/one part sand. Revegetation Planting Plants were placed in the numerous bare areas of the South Flat. Planting occurred on 11-12 and 17-18 March 2000. Planting holes were dug using a power auger and were saturated with water before and after planting. All plants were provided with tree-pees, plastic plant protectors 15-20 cm tall, to reduce herbivory and provide protection from the wind and blowing sand. Watering basins were constructed for each plant. For the test study, 30 plants (10 Atriplex polycarpa, 10 Isomeris arborea, and 10 Senna armata) were planted along each of the three disturbance transects for a total of 90 plants. Plants were randomly treated with one of the following amendments: fertilizer alone (13-13-13 slow release), fertilizer and microfertilizer (13-13-13 and Azomite), fertilizer and mulch (13-13-13 and cocoa mulch) or no amendments. These plants were also provided with treepees and height was measured for each individual after planting. Supplemental watering occurred on a monthly basis, unless enough natural precipitation had occurred, beginning in April 2000. Water was mechanically pumped into containers and plants were hand watered. Each plant received approximately 1/2 gallon of water at each watering. Total amount per plant over the year was about 6 gallons, plus natural precipitation. On 23 September percent plant survival was measured for total plants and for the experimental plots. Plant basins were reconstructed on an as-needed basis and missing plant protectors that had been blown off were located and replaced. Overall survival was 56% with Atriplex polycarpa having the highest survival at 87%. The lowest survival rate seen was for Senna armata at 39%. Survival at the experimental plots was 55%. Not enough data is available at this time to determine if there is a significant difference between treatments. Of the three species used in the experiments, Atriplex polycarpa did significantly better than Senna armata and Isomeris arborea.

PROJECT OUTCOMES

Ecological Outcomes Achieved

Eliminate existing threats to the ecosystem:
The overall survival rate of 56% is slightly better than most previous restoration projects that have been conducted at Red Rock Canyon State Park, especially since planting occurred in the middle of a two year drought period. The experimental plot survival rate at South Flat of 55% after six months is also slightly better than most desert restoration projects. The saltbush, Atriplex polycarpa, survived better than the other two species at 83%.

Factors limiting recovery of the ecosystem:
The lack of annual seed due to low rainfall in 1998 and 1999 changed the scope of this project. Revegetating with shrubs became the primary goal, with soil analysis and treatment methods being studied to improve methods used in desert restoration of native perennial species. When there is little or no rain, the effect of soil amendments is particularly slow to manifest itself because water is necessary for soil microbial actions to occur. It is expected that soil amendment effects may begin to appear in the future, but only if there is sufficient precipitation during the winter months to activate the below ground processes.

Socio-Economic & Community Outcomes Achieved

KEY LESSONS LEARNED

Key Lessons Learned

OHV and other human disturbances that occur in desert environments may take hundreds of years to recover without active intervention and restoration efforts. SERG has been successful in the South Flat area through a variety of soil and planting treatments. These restoration efforts, coupled with the restriction of OHV activity, has greatly increased the probability of habitat recovery in the South Flat area.

That the two saltbushes, Atriplex polycarpa and A. canescens, had higher survival rates than the other species is to be expected. Saltbush is a very hardy plant that has done well in all our previous Mojave Desert restoration projects, especially on highly impacted soils. The survival rates for the other species are also about average when compared to previous projects in similar habitats. Past experience has shown us that A. polycarpa is an excellent restoration species to use for heavily disturbed areas in the Mojave Desert. It normally has a high initial survival rate and demonstrates quick and heavy growth with minimal water.

Isomeris arborea, though low initial survival rates are common, is also an excellent restoration species. It suffers little from herbivory, being extremely unappetizing to most desert herbivores, and is a prolific producer of seed. As such, it produces many new seedlings through natural recruitment. Once established, it is a fast grower, quickly producing much needed cover and food for wildlife. Hummingbirds have often been found enjoying the flowers of Isomeris on the south flat. The low survival of Senna armata was expected, this species is susceptible to a number of pathogens and is not often found in great numbers.

Several factors from the initial soil sampling data are of interest. First, there are indications that the soil remains adversely affected by the OHV disturbance and camping at the South Flat, even though it has been closed to off-highway vehicle activity for over ten years. Both vehicle operation and camping apparently leave long lasting legacies in changed soil properties. Impacts to desert soils do not quickly heal themselves. The second concerns pH. Desert soils are usually slightly alkaline, having a pH normally above 7.0. Initial results show that soil pH decreases as the amount of disturbance increases. The third item of interest is the apparent increase in zinc and boron as the amount of disturbance increases. All soil samples were within previously observed levels and pose little concern for plant growth, although the elevated levels of boron are approaching the point where they may impact sensitive plants. Proper micro-nutrient availability is important to the growth and survival of all plants and the higher levels of zinc may in fact prove helpful. The lower pH in areas of increased disturbance should also increase micro-nutrient availability and make conditions better for plant establishment. The limiting factor appears to be the changes in soil structure, not nutrients, although the availability of nutrients may be different than the absolute levels. Not enough information is available in such a short time to make any type of judgement concerning the effects of micro-nutrients on plant growth and survival. We will continue monitoring to see what happens in the future.

LONG-TERM MANAGEMENT

Long-Term Management

The area will remain closed to OHV use. Vegetation will be monitored and survival and growth over time will be analyzed to determine the effects of differing soil amendments and micronutrient availability.

FUNDING

LEARN MORE

Other Resources

David Bainbridge
Alliant International University
10455 Pomerado Road
San Diego, CA 92131
Fax: (858) 635-4703
dbainbridge@alliant.edu

Publications:
Peer reviewed:
Lovich, Jeffrey E. and David Bainbridge. 1999. Anthropogenic Degradation of the Southern California Desert Ecosystem and Prospects for Natural Recovery and Restoration. Environmental Management 24(3): 309-326.

Not peer reviewed:
http://www.sci.sdsu.edu/SERG/restorationproj/mojave%20desert/redrock.html
http://www.parks.ca.gov/?page_id=24576

CONTACTS

Primary Contact

Organizational Contact

(http://ser.org)

(https://www.facebook.com/Society
ref=ayt(https://www.linkedin/SER
ref=a(https://www.linkedin/SERorat

© 2024 All rights reserved.