

## Research at the Nevada Test Site: The Nevada Desert FACE Facility (NDFF)



*The FACE Facility at the Nevada Test Site*

Nevada Site Office. Students and faculty from several universities in the U.S. are also conducting research at these ecological study sites. The NTS provides a secure, controlled, unique environment ideal for research and data collection.



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### Introduction

Since the industrial revolution the amount of carbon dioxide (CO<sub>2</sub>) in the atmosphere has risen sharply. It is important to determine how deserts, which comprise nearly 40 percent of the Earth's land mass, will respond to the effects of this increase in CO<sub>2</sub>.

A collaborative ecological study is being conducted at the Nevada Test Site (NTS) by a group of organizations to do just that. The participating entities include the University of Nevada Reno (UNR), University of Nevada Las Vegas (UNLV), and the Desert Research Institute (DRI), with support from Brookhaven National Laboratory and the National Nuclear Security Administration

### What is the purpose of the Nevada Desert Free Air Carbon dioxide Enrichment Facility?

At the Nevada Desert FACE Facility (NDFF), scientists are using nine plots of undisturbed desert land to measure changes in the earth-including plants, roots, microbes, insects, animals, and soil to determine how elevated CO<sub>2</sub> will affect the desert ecosystem. Free Air Carbon Dioxide Enrichment (FACE) is a system developed by Brookhaven National Laboratory that applies air containing elevated CO<sub>2</sub> concentrations to large areas of land.

By studying the processes of photosynthesis and respiration, and how CO<sub>2</sub> is exchanged between the atmosphere and the land where it is sequestered, scientists are gathering information to

address the following questions in order to predict climate changes:

- Will there be changes in the rate at which plants grow over the next hundred years?
- Will the storage of carbon in the desert ecosystem change?
- Will the water balance change in this arid environment?
- Will the composition of desert plant species change?



## FACE results to date

The responses of plant and ecosystem processes to elevated CO<sub>2</sub> in the Mojave Desert are complex. Rainfall is a major controlling factor that is further influenced by soil nitrogen availability (a major plant nutrient). Major shifts in the nitrogen cycle of desert ecosystems occur rapidly when exposed to elevated CO<sub>2</sub> and may be due to increased microbial activity.

For example, red brome grass has a much larger response to elevated CO<sub>2</sub> than native plant species, suggesting that global change might result in this exotic invasive grass replacing native plants. This could accelerate the fire cycle, reduce biodiversity, and alter ecosystem function in the Mojave Desert.

The Mojave Global Change Facility (MGCF) - working in tandem with the NDFF - is examining other global change factors in the desert. The MGCF global change experimental treatments are based on the following model predictions:

- Global climate change models have predicted that rising levels of atmospheric carbon dioxide and global warming will increase summer monsoon rains in the Mojave Desert.
- Predicted increases in urban activities-such as automobile use and energy production-will result in increased nitrogen deposition that will affect and possibly alter the nitrogen cycle.
- The cryptobiotic crust, which is present at the surface of most desert soils, plays an important role in making nitrogen available to desert plants. Increased grazing and off-road vehicle use will disturb/destroy these crusts and hence impact the nitrogen cycle.
- Treatments based on these predictions are being applied to 96 new research plots. These treatments include summer irrigation, nitrogen addition and crust disturbance activities.

The results from the MGCF will be combined with data from NDFF to make predictions on the overall impact of future climate on the Mojave Desert. These predictions can assist with better land management, restoration, re-vegetation, and various clean-up efforts.

The Nevada Desert FACE Facility and Mojave Global Change Facility are jointly operated by UNLV, UNR and DRI under the Nevada Desert Research Center. NDFF is a flagship experiment of the Terrestrial Carbon Process research program of the U.S. Department of Energy. The NDFF was developed in conjunction with the National Science Foundation and the Department of Energy's Experimental Program to Stimulate Competitive Research.

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