Predicting plant responses to drought

February 10 2015

A new U.S. Geological Survey study shows how plants' vulnerability to drought varies across the landscape; factors such as plant structure and soil type where the plant is growing can either make them more vulnerable or protect them from declines.

Recent elevated temperatures and prolonged droughts in many already water-limited regions throughout the world, including the southwestern U.S., are likely to intensify according to future climate model projections. This warming and drying can negatively affect vegetation and could lead to the degradation of wildlife habitat and ecosystems. It is critical for resource managers and other decision-makers to understand where on the landscape vegetation will be affected so they can prioritize restoration and conservation efforts, and plan for the future.

To better understand the potential detrimental effects of climate change, USGS scientists developed a model to evaluate how plant species will respond to increases in temperature and drought. The model integrates knowledge about how plant responses are modified by landscape, soil and plant attributes that are integral to water availability and use. The model was tested using fifty years of repeat measurements of long-living, or perennial, plant species cover in large permanent plots across the Mojave Desert, one of the most water-limited ecosystems in North America. The report, published in the *Journal of Ecology*, is available online.

"The impacts of drought are not going away, and sound science to understand how water-limited ecosystems will respond is important for

managers to plan climate adaptation strategies," said Seth Munson, USGS scientist and lead author of the study. "By using monitoring results that scientists and managers have diligently reported for the last several decades, our study helps forecast the future state of drylands."

Results show that plants respond to climate differently based on the physical attributes of where they are growing in the Mojave Desert. For example, deep-rooted plants were not as vulnerable to drought on soils that allowed for deep-water flow. Also, shallow-rooted plants were better buffered from drought on soils that promoted water retention near the surface. This information may be helpful for resource managers to minimize disturbance in areas that are likely vulnerable to water shortages.

Water moves horizontally and vertically through the landscape, which affects the amount of water plants can take up through their roots. There is more to plant water availability and use than the precipitation that falls out of the sky. Understanding how water moves through ecosystems is critical in regions that already have marginal water available for plant growth. Predicting climate change impacts in these areas requires more than an understanding of climate alone.

Provided by United States Geological Survey