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SOLAR ENERGY-WATER-ENVIRONMENT NEXUS PROJECT

Restoring Resilience in the Nevada Desert

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How NEXUS science is mitigating renewable energy impacts on arid ecosystems

Solar power might be a climate friendly and an air friendly source of energy, but the impacts of large-scale solar production on the surrounding landscape prove less than benevolent.

"The end result of these solar facilities is a net loss ecologically," says NEXUS scientist Scott Abella, an assistant professor in the School of Life Sciences, University of Nevada, Las Vegas (UNLV)."They are making ecosystems less resilient and adaptable to climate change."

Construction and deployment of solar power facilities can fragment the land resulting in loss of habitat for natural species such as the Nevada State reptile, the Desert Tortoise. It can also destroy the topsoil and land cover, hailing dustier conditions, and greater fire risk if the disturbances promote non-native plants. With the changing conditions, opportunistic invasive species can proliferate, tipping the entire ecosystem out of balance even further.

But Abella and his team are striving to adjust the scales back in the direction of the natural resilient ecosystem by using a three-pronged approach. In the hot desert sun, they toil, hands in the soil, to restore disturbed areas back to their previous condition and they are also investigating new techniques that can help them in their long term efforts to conserve habitats many species depend on. In addition, they are also working to improve the condition and resilience of protected areas, which they hope will become examples of healthy desert ecosystems to partly compensate for habitat losses from renewable energy development.

A Mojave Makeover

In Nevada, much of Abella's mitigation research is done in the Mojave Desert, an area of land that includes Death Valley and supports nearly 2,000 species of plants. As the driest of the American deserts, however, it proves a challenging place to work.

When Abella first arrives at a site to restore, his first objective is to conduct a detailed assessment of the state of the land. "What we do we have? Do we have a dust problem? Are we lacking native plants as cover for the wide variety of animals? Is this site just infested by non-native plants?" Abella says. "These are just some of the questions we might ask."

When the disturbance has been a short-term one, such as the building of temporary access roads, the main problems will be due to bulldozed soils and the removal of vegetation. The team's immediate focus will be on getting plants back on the land as quickly as possible and stabilizing the soil so that dust doesn't become an issue. "There's lot of research showing how dust is a huge human health concern," Abella says.


The scientists will collect seeds and grow plants in greenhouses until they've developed root systems that will enable them to survive in the wild. After about a year, the team plant the seedlings on the disturbed soil. Often, to become established, the plants require protection from the hot sun and from the many animals trying to eat them. In both disturbed and protected areas, these proactive plantings are designed to increase the available habitat for Desert Tortoises and other rare or endangered species.

The scientists may also remove the non-native plants that often take over disturbed land. These plants, which provide a dense source of fuel, are one of the reasons the desert has seen abundant wildfires in the last decade, Abella says.

Both the non-native plants, and the wildfires, take their toll on animal habitats in the Mojave. "We're losing all this habitat to these solar facilities, we don't want to be losing other habitats too," Abella says. "So again, that's where the mitigation in protected areas comes into play."

A Helping Hand from Science

Healthy soil, seeds, water, sun, and insects like pollinators of plants are the vital ingredients needed to restore a desert ecosystem. But with increased use of the land for renewable energy facilities, only the sun shining is a given. The thin top layer of soil, which contains the major pools of plant-available carbon and nutrients, as well as the microorganisms critical in making nutrients and water available to plants, is easily disturbed by new construction.

In anticipation of future impacts to this topsoil, Abella's graduate student at UNLV, Lindsay Chiquoine, has developed techniques to extract the lichens and mosses and microorganisms in the soil's crust. Chiquoine was able to store the crusts for over a year and put them back at restoration sites successfully. Now the team is working on techniques to cultivate and mass-produce the soil crust organisms in the laboratory, with the goal of producing slurry that could be sprayed over large areas.

In parallel to these efforts, Dominic Gentilcore, Abella's graduate student funded by NEXUS, is investigating how deserts respond to disturbances and how to reduce soil erosion after the event.

"If we can have these techniques to actually stabilize soils and prevent wind erosion and the generation of dust, that would be a huge step forward," Abella says.

The team also uses a slow release irrigation gel to provide the plants with additional moisture when both the soil and atmosphere prove lacking. They place the gel near plant roots where it gradually breaks down over time, supplying the plants will a slow and steady supply of water.

"If we can restore plants in these areas, then those plants are producing seeds, attracting pollinator insects and really helping that ecosystem recover," Abella says. "Such successes are one of the most rewarding aspects of this work."

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