

Research Support for BLM Mission

The Western Ecological Research Center (WERC) of the U.S. Geological Survey (USGS) has a strong and productive history of working with the Bureau of Land Management (BLM). That history started when many of our past and present research scientists were transferred from BLM into the National Biological Survey (Service) in 1993. In 1997, those scientists became part of the Biological Resources Division of USGS, thus strengthening their capability to conduct integrated natural resources research that meets the needs of BLM. The mission of BLM is to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations. WERC's 12 field stations are strategically located in California and Nevada, and many of these field stations conduct research in support of needs identified by BLM. Over 25 research projects are underway that focus on land management concerns of BLM, such as fire ecology, invasive species, threatened and endangered species, inventorying and monitoring, and ecosystem impacts of contaminants, at a cost of over \$5 million. Several of the projects benefiting BLM are highlighted below. WERC also conducts research on natural resource issues of concern to other federal agencies such as the Fish and Wildlife Service, National Park Service, Minerals Management Service, and the Department of Defense. Many of these projects have crosscutting application to BLM research needs.

Highlighted Projects

Threatened and Endangered Species

BLM is responsible for managing millions of acres of public land in the Mojave and Sonoran deserts of California, Nevada, Arizona, and Utah. Over 4.7 million acres of this land have been designated as Critical Habitat for the federally-listed threatened desert tortoise. Scientists at the Las Vegas and Box Springs (Moreno Valley, Calif.) field stations are studying the biology and habitat needs of the desert tortoise at numerous study sites throughout this vast area. At the Box Springs Field Station, research focuses on long-term population trends, demographics, social behavior,

anthropogenic effects, and causes of ill health and high mortality rates of tortoises. Research on upper respiratory tract disease in desert tortoises is being conducted in collaboration with veterinarian pathologists at the University of Florida. Scientists at both the Las Vegas and Box Springs field stations are in the second year of a long-term study to determine the effects of translocation of desert tortoises from Fort Irwin to nearby BLM land in the Superior-Cronese Desert Wildlife Management Area of BLM. Other research is focusing on desert tortoise nutritional physiology, comparing the nutritional benefits of native versus exotic plants; long-term growth patterns; and reproduction.



Other endangered species research has focused on Lane Mountain milk-vetch, an endangered plant species that occurs at Fort Irwin and on adjoining BLM land. WERC scientists have studied the effects of dust on productivity of this rare plant.

Other Species of Management Concern

In addition to federally-listed species, WERC scientists conduct research on other species of management concern to BLM. Studies include assessing the effects of recreational use on bighorn sheep in several mountain ranges in the Mojave Desert and the effects of the urban edge on reptile communities (including Gila monsters) at the Sloan Canyon National Recreational Area, just



outside Las Vegas, Nevada. Elsewhere in the Mojave Desert, where little is known about the status of burrowing owl populations, WERC scientists have developed a protocol to more effectively conduct inventories for breeding populations. In Mono County, California, on the edge of the Great Basin, WERC scientists have provided valuable information on sage grouse movements, demography, and habitat use for development of a local species conservation plan.

Desert Fire Ecology and Invasive Species

Fire was not an important factor in shaping the prehistoric structure and dynamics of plant communities in Southwestern deserts. The low density and wide spacing of perennial shrubs, coupled with sparse ground-cover to support and propagate flames, protected desert plant communities from frequent or intense fires. The invasion of highly combustible exotic annual grasses

has allowed fire to become a prominent force in shaping the modern desert. Native perennial plants are poorly adapted to frequent or intense fires and are often replaced with fire-adapted exotic annual grasses. The effects of such dramatic and widespread habitat change on native plants and animals are poorly understood and are a major focus of research at the Las Vegas Field Station. In 2007, a team of WERC scientists is beginning a long-term study in southern Nevada and north-eastern Arizona on the effects of fire on desert tortoises and their habitat. This study will evaluate how fire has affected the soil seed bank, the effectiveness of aerial and hand seeding of burned habitat, and desert tortoise use of burned habitat as habitat restoration occurs. Other research focuses on development of effective techniques to control and eradicate invasive species, including cheatgrass, Sahara mustard, and saltcedar. Additional information on our fire ecology and invasive species research can be found at (<http://www.werc.usgs.gov/fire/>) and (<http://www.werc.usgs.gov/invasive-species/>).



Status and Trends

Properly designed inventory and monitoring is critical in determining the status and trends of plant and animal populations. For the desert tortoise, establishing population status and trends is difficult because desert tortoises spend the majority of their time underground. WERC scientists have conducted research and provided technical assistance to the Fish and Wildlife Service in its efforts to refine its line distance sampling technique for desert tortoises. WERC scientists have also been researching, in collaboration with the Desert Research

Institute and University of Nevada, the use of trained dogs as a more efficient and cost-effective way to locate tortoises in the field. New research is investigating the use of Radio Frequency Identification (RFID) technology to effectively locate hatchling and one-year-old tortoises in the field. Long-term plots on BLM land in California have been surveyed for desert tortoises since the early 1970s and have provided valuable information on status, trends, and demography of populations in the Mojave Desert.



Ecosystem Impacts of Contaminants

Mercury contamination is an issue of concern throughout much of northern and central California, including lands administered by BLM. California has abundant geologic sources of mercury and a long history of mercury contamination associated both with mercury mining, particularly in the Coast Ranges, and with gold mining in the Sierra Nevada and Klamath mountains. The Office of Environmental Health Hazard Assessment (OEHHA), part of California EPA, has issued fish consumption advisories for mercury for many water bodies in northern and central California, many of which include BLM lands. Data show that mercury from many of these sites is transported downstream to the Sacramento River Delta and San Francisco Bay. USGS has been cooperating with BLM since 1999 to determine mercury hotspots within California watersheds, including the Bear River, South Yuba River, Clear Creek, Trinity River, Putah Creek, Russian River, and the American River. USGS is also working to

evaluate remediation/restoration efforts by BLM by sampling sites after cleanup of mercury contamination. Analyses of mercury residues in macroinvertebrates, amphibians, fish, sediment, and water collected in the watersheds indicate that some mines, lakes, and streams are heavily contaminated with mercury. The most hazardous form of mercury is methylmercury, which is biomagnified through the food web and bioaccumulated by upper trophic level organisms. Human exposure to methylmercury, a neurotoxin, is almost entirely due to consumption of contaminated fish. Several recent fish advisories in northern California issued by OEHHA have been based on data collected by USGS.

Current Research Projects

Threatened and Endangered Species

- Changes in desert ecosystems, including natural, anthropogenic, and recovery from human-induced impacts; effects on tortoises
- Health, disease, epidemiology, and necropsies of desert tortoises in California
- Behavioral studies of desert tortoises at Fort Irwin
- Fort Irwin desert tortoise translocation study — evaluating the stress of translocation
- Fort Irwin desert tortoise translocation study — evaluating tortoise health status and development of an epidemiological model of upper respiratory tract disease
- Nutritional ecology of desert tortoises: a study of the effects of exotic forage on the nutrition and physiology of desert tortoises
- Responses of desert tortoises to post-wildfire habitat
- Desert tortoise ecology — long-term growth and reproduction
- Effects of dust deposition on Lane Mountain milkvetch

Other Species of Management Concern

- Population status and reproductive ecology of the western burrowing owl in the eastern Mojave Desert
- Influences of the urban edge and increased management on reptile communities at Sloan Canyon National Conservation Area, Nevada
- Development of a species conservation plan for greater sage grouse in Mono County, California
- The effects of recreational use on desert bighorn sheep populations



Desert Fire Ecology and Invasive Species

- The ecology and ecological effects of Sahara mustard
- Postfire control of cheatgrass (*Bromus tectorum*) at a sagebrush steppe site
- Effects of alien and native seed mixes in reducing cheatgrass, BLM postfire restoration
- Evaluating the effects of pinyon juniper thinning treatments at a wildland/urban interface
- Reducing wildfire risk by integration of prescribed burning and biological control of invasive saltcedar (*Tamarix* spp.)
- Monitoring protocol design and treatment effectiveness for the Emergency Stabilization monitoring of the Southern Nevada Complex fires
- Invasive weed removal and habitat restoration: Sahara mustard (*Brassica tournefortii*)
- The role of fire, rodents, and ants in changing plant communities in the Mojave and Sonoran Deserts
- Evaluating options for vegetation recovery following catastrophic fire — Grand Canyon/Parashant
- Monitoring the effectiveness of seeding burned critical habitat for the desert tortoise
- Monitoring invasive species and desert plant community dynamics
- The revegetation of disturbed areas associated with roads in the Mojave Desert

Inventory and Monitoring

- Population status and monitoring of declining amphibians in southern California — desert springs
- Modeling desert tortoise activity to improve precision of range-wide Line Distance Sampling
- Desert tortoise research and monitoring on federal and state lands
- Validation and development of a certification program for using K9s to survey desert tortoises
- Using RFID technology to develop a reliable technique to monitor young desert tortoises

Ecosystem Impacts of Contaminants

- Investigations of mercury contamination associated with abandoned mine lands in the Putah Creek watershed
- Contamination associated with abandoned mine lands, Bear River, South Fork Yuba and Trinity River watersheds: Mercury contamination of biota