

Biology and Invasive Species in the Western U.S.

The diversity of environments that characterizes the West is responsible for the region's rich biological heritage. This ecological diversity also means that opportunities for invasive species are many, varied, and complex. Island ecosystems are notoriously vulnerable to invaders as demonstrated in Hawaii and West Coast offshore islands. Aquatic invaders impose high economic and environmental costs in systems as varied as San Francisco Bay and desert springs in the Great Basin. Although the West's arid and montane ecosystems may seem resistant to plant and animal invaders, we now know that exotic species have altered physical processes related to fire and hydrology in a manner favoring further expansion and persistence of invaders. Natural resource managers value analytical, mapping, and genetics tools developed by USGS scientists to monitor invasive species and help conserve biological systems. USGS biologists conduct research to assist land and water managers' efforts to control invasive species and restore natural systems. Throughout the West, the USGS carries out studies for early detection and rapid assessment of invaders. The following are some examples of how the USGS is making a difference in the western United States.

Islands in the Incoming Tide

Introduction of invasive plant and animal species threatens to damage Pacific island ecosystems and inflict high economic cost. Because native island species often lack resistance, the natural resources of Hawaii and other Pacific islands require protection from pests and parasites not recognized as problematic elsewhere. These isolated oceanic archipelagoes are highly susceptible to invasions, and extensive loss and endangerment of species have already occurred. The future of Hawaii's native biodiversity depends on successful control of established invasive species and prevention of establishment of new ones. Biologically rich national parks and wildlife refuges, as well as over 400 listed endangered species, are at risk. USGS scientists work with



Photo Credit: John & Karen Hollingsworth, USFWS

Biological Science Capabilities

- ◆ *Development of tools to analyze and map data*
- ◆ *Development of genetic probes for rapid detection*
- ◆ *Inventory and monitoring system development*
- ◆ *Biology of species ranging from microbes to large vertebrates*
- ◆ *Ecosystem science and restoration science*

partners to develop tools for reducing species introductions, to develop collaborative survey methods for detecting invasions, and to establish mechanisms for evaluating the effectiveness of prevention measures.

Invaders Find Their Way to Alaska (With Help)

Historically, Alaska's National Parks have been nearly free of exotic species, but the rate of alien plant invasion is increasing rapidly. As in other places in the West, the USGS is conducting comprehensive studies in Alaska National Park Service units for early detection and rapid assessment of invaders. Results are available in online databases for use by resource managers. Scientists in Alaska have found that remote units with few visitors and limited access have near-pristine conditions. In contrast, parks with heavier visitation and easier access demonstrate a widespread occurrence of non-native plants in disturbed areas. USGS scientists are testing methods for early detection and rapid eradication in Denali National Park, as well as methods to identify factors that predict the potential for further spread.



An Invasive Plant Provides Habitat for an Endangered Species

Tamarisk (saltcedar), an invasive, exotic shrub first introduced into the Southwest over 100 years ago, is now dominant



Photo Credit: Lawrence Abeita, BIA

in riparian systems throughout the arid West. In many places, tamarisk has replaced native willow and cottonwood, negatively affecting both wildlife habitat and water consumption by riparian vegetation. Yet tamarisk also provides important habitat for migratory and resident birds, including approximately 25% of the endangered southwestern willow flycatcher's breeding population. Use of tamarisk by avian species presents a management paradox for state and federal

agencies that are working to reduce or eradicate invasive plants while also conserving sensitive and endangered species. The USGS is conducting research to understand how birds such as the flycatcher use tamarisk, how the ecology of flycatchers nesting in tamarisk compares with those in native habitats, and how managers can balance tamarisk control and wildlife conservation.

Introduced Species without Parasites – One's Loss Is the Other's Gain

The impact of invasive species is a function of how efficiently they establish dominant populations. Research points to parasites, specifically a lack thereof, as being highly important in biotic invasions. USGS biologists have found that exotic animals are less affected by parasites where they have invaded than where they are native. Having about half as many parasites, introduced European green crabs may have an advantage over native competitors that are restricted by their full complement of parasites. This "super-pest" decimates shellfish in Pacific Coast bays and estuaries. Where introduced, green crabs become large and abundant in the absence of a parasitic barnacle found in the crab's natural range. Effective biological control could depend on testing green crab parasites that are also safe for native species.



ceous plants, and shrubs such as sagebrush. Eurasian annuals such as cheatgrass have invaded millions of acres throughout the West, perpetuating fires and threatening human communities, wildlife, and ranching. Rapidly-recurring fires have a significant impact on the native plant and animal communities that have few defenses against frequent successive burns. USGS researchers are investigating how increased fire size and frequency affect arid ecosystems, how fire changes nutrients in the soil, how invasive plants and fire are related, and how to protect native plants and animals from further impacts of invasive plants. Research is also underway to understand how rangeland systems may be restored following exotic plant invasion and fire.

Alien Hitchhikers Affect our Waterways

Ocean-going ships transport non-native nuisance species in ballast water and on their hulls. Activities like recreational boating and intentional introductions also spread aquatic



Photo Credit: Erik Ackerson

nuisance species in western rivers, streams, lakes, and estuaries. Invasive aquatic plants and animals pose risks in systems ranging from salmon-bearing streams in the Columbia Basin to isolated desert springs hosting rare invertebrates. Many of the native species in these systems are listed under the Endangered Species Act. USGS scientists are testing methods to inventory, control, and remove non-native species from aquatic habitats, working with regulators and the shipping community to develop methods for early detection and eradication.



Invasion of Annual Grasses – It's About More Than Just Plants

Extensive areas of western rangeland were once dominated by native grasses, herba-



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