

Chapter 4 ECOSYSTEM RESTORATION

INTRODUCTION

The Department of the Interior extensively supports—through its mission, policy, programs, and funding—the study, planning, implementation, and monitoring of ecosystem restoration. This commitment is reflected in the Department's FY2011-2016 Strategic Plan¹¹:

Mission Area 1, Provide Natural and Cultural Resource Protection and Experiences, GOAL #1: Protect America's Landscapes. We will ensure that America's natural endowment – America's Great Outdoors – is protected for the benefit and enjoyment of current and future generations. We will maintain the condition of lands and waters that are healthy, and we will restore the integrity of natural areas that have been damaged. We will strive to retain abundant and sustainable habitat for our diverse fish and wildlife resources, and we will reduce or eliminate threats to at-risk plant and animal species.

In a nutshell

- ❖ Restoration, rehabilitation, remediation, and reclamation activities play an important role in maintaining the health and vitality of DOI lands and managed resources.
- ❖ Ecosystem monitoring and adaptive management help ensure that lessons learned are integrated into ongoing and future decision making at Interior.
- ❖ Physical measures of restored stream-miles or acres are valuable indicators of restoration success, but they do not easily facilitate quality comparisons for future decisions. Interior's scientists and managers are actively working on the development of improved endpoints and more meaningful criteria for measuring restoration success.
- ❖ Jobs and economic contributions from restoration are important, though they do not represent the full economic value of ecosystem restoration. Developing values for the resources and associated services under Interior's trust would help ensure that the public's benefits are maximized from investment in DOI restoration activities.

¹¹ Available on-line at http://www.doi.gov/bpp/data/PPP/DOI_StrategicPlan.pdf

The described strategy includes a mandate to improve land and water health through maintenance and restoration of the wetlands, uplands, and riparian areas on DOI lands. Efforts include controlling invasive¹² plants and animals, restoring land to a condition that is self-sustaining, and ensuring that habitats support healthy fish and wildlife populations. Over 1.1 million acres of land and 879 riparian (stream/shoreline) miles are targeted to be restored to specifications in management

America's rivers are the lifeblood of America's economy – from the water for farms that produce our food to the fish and wildlife that sustain our heritage. Today as we begin the restoration of this river system, we look to a bright future that recognizes rivers for their many contributions to our economy and environment. – Interior Secretary Salazar on the launch of the Elwha River restoration project, Washington, 9/17/11.

plans between FY 2011 and FY 2016. The Office of Surface Mining Reclamation and Enforcement (OSM) has a target of 14,000 acres of federal, private, and tribal land and surface water acres to be reclaimed or mitigated from the effects of natural resource degradation from past coal mining. Almost 600,000 non-DOI acres are planned to be restored through partnerships with the U.S. Fish and Wildlife Service (FWS). Because the vast majority of fish and wildlife habitat managed by FWS is on non-federal lands, partners play a critical role in conserving and restoring lands to improve wildlife values.

Ecosystem monitoring of restoration is critical for ensuring cost-effective implementation of today's restoration projects and those planned in the future. Monitoring can also inform adaptive management efforts to help ensure successful outcomes.¹³ For example, where opportunities exist, the Bureau of Reclamation has begun adaptation actions in response to climate stresses, as well as land use, population growth, invasive species, and others. These activities include extending water supplies, water conservation, hydropower production, planning for future operations, and supporting rural water development. The

adaptation actions span a wide array of Reclamation's mission responsibilities from water supply planning efforts and retrofitting of hydropower turbines to the restoration of rivers and ecosystems.

The FY 2011 budget reflected Secretary Salazar's ongoing commitment to ecosystem restoration,

Restoration through Reclamation's WaterSMART Program
To implement the SECURE Water Act (P.L. 111-11), Secretary Salazar established the WaterSMART (Sustain and Manage America's Resources for Tomorrow) program in February 2010 (Secretarial Order 3297). Through WaterSMART, Interior works with states, tribes, local governments, and non-governmental organizations to secure and stretch water supplies for existing and future generations to benefit people, the economy, and the environment. Reclamation plays a key role in the WaterSMART program as DOI's main water management agency by administering grants, scientific studies, technical assistance, and scientific expertise. To date, the program has assisted communities in improving conservation, increasing water availability, restoring watersheds, resolving long-standing water conflicts, addressing the challenges of climate change, and implementing water rights settlements. The program has provided more than \$85 million in funding to non-federal partners, including tribes, water districts, and universities, including \$33 million in 2011 for 82 WaterSMART grant projects.

¹² Controlling and preventing invasive species play a major role in restoration. More information on the issue of invasive species at Interior and the role of the National Invasive Species Council is provided in Chapter 4 of the FY 2010 DOI Economic Contributions Report (available on-line at <http://www.doi.gov/ppa/upload/DOI-Econ-Report-6-21-2011.pdf>).

¹³ Information on adaptive management is available in the Departmental Manual, at 522 DM 1.

including major efforts to restore, protect, and preserve the California Bay-Delta (see the Sources of Funding section of Appendix 3), Everglades, Gulf Coast of Louisiana and Mississippi, and the Chesapeake Bay. The Department also actively coordinated with EPA on Great Lakes restoration efforts. As part of the commitment to understanding landscapes at the broader level and the potential effects of climate change, the number of Landscape Conservation Cooperatives (LCCs) was expanded from 9 to 22 by the end of 2011 (see Chapter 3 for more information on LCCs). LCCs are expected to play a significant role in FWS's ecosystem restoration efforts across the Nation. For example, in the Chesapeake Bay watershed, Service programs will coordinate efforts with the North Atlantic and Appalachian LCCs to meet the highest priority needs for achieving a healthy watershed and supporting sustainable populations of fish and wildlife. In the Everglades, landscape level partnerships will work to protect Florida panther habitat, sea turtles and other highly imperiled species in the Florida Keys. The California Bay Delta region will use the LCC and Strategic Habitat Conservation business model to work in this changing ecosystem, ensuring that FWS's actions are driven by good science, respect for partners, and a focus on outcomes.

Future Restoration Practitioners: In addition to providing youth with work experience, DOI's bureaus are extensively involved in youth education. For example, Hands on the Land (HOL) is a national network of field classrooms sponsored by Partners in Resource Education, a collaboration of federal agencies (BLM, FWS and NPS for Interior; EPA; NOAA; and USDA), a non-profit foundation, schools, and other private sector partners. Through this network, federal agencies are providing a diverse array of hands-on learning opportunities for teachers and students. For example, a module on Great Sand Dunes National Park and Preserve allows youth in grades 4-9 to play an interactive web game as an ecologist tasked with the restoration of a fictitious ecosystem to learn about the adverse effects of invasive species. Students are also engaged in environmental monitoring programs. BLM's 258 million acres host a growing number of Hands on the Land sites, where education programs have been developed in conjunction with local schools. One example is the Blanca Wetlands case study analyzed in this chapter. More information about these sites is available on-line at http://www.blm.gov/wo/st/en/res/Education_in_BLM/Learning_Landscapes/For_Teachers/hol.html

A February 2011 report to the President, "America's Great Outdoors: A Promise to Future Generations," defined an action plan for conservation, restoration, and recreation on public lands in the 21st century. The resulting blueprint for restoration of cultural and natural resources on public lands recognizes that spending taxpayer dollars needs to return positive net economic benefits (i.e., total benefits greater than total costs). It can be difficult, though, to quantify the value of restoration to help justify spending on restoration projects. Although the jobs and economic contributions from restoration are substantial and important, they do not represent the full economic value of ecosystem restoration, because they do not capture the net benefits associated with environmental goods and services not bought and sold in markets. Similarly, the physical measures of restored stream-miles or acres are valuable indicators of restoration success, but they do not easily facilitate quality comparisons for future decisions. Quantifying and valuing the new or additional ecosystem services from restoration continue to be a challenge.

The remainder of this chapter helps define restoration, describes some of the restoration efforts of Interior's bureaus and offices, reviews economic valuation methods, and presents a series of original case

studies developed by the USGS on the jobs and economic impacts from select DOI restorations. Appendix 3 provides additional information on the case studies and also describes sources of restoration funding for departmental restoration efforts.

Defining Restoration

At Interior, every bureau and several offices engage in some form of restoration, of physical structures as well as ecological and human use resources. Figure 4-1 illustrates that there are a number of activities that may be employed to help improve injured ecosystems. Terms like restoration, rehabilitation, remediation, and reclamation are often used interchangeably in practice, but their definitions vary by authorizing laws and implementing agencies. The red line in the figure illustrates the degradation of the original ecosystem to an impaired state. The degraded ecosystem exhibits a lower level of structure and function, compared to the original ecosystem. The degraded ecosystem can be returned to its original state using removal, cleanup, remediation and other restoration activities. Along the black arrow pointing toward “Reclamation,” the figure shows reclamation activities improving the structure and function of the ecosystem. Restoration activities (shown as occurring along the dotted arrow) further improve the ecosystem structure and return the ecosystem to its original state. Off-site mitigation can be used alone or in combination with other approaches to return ecosystems (perhaps in a different location) to their original state.

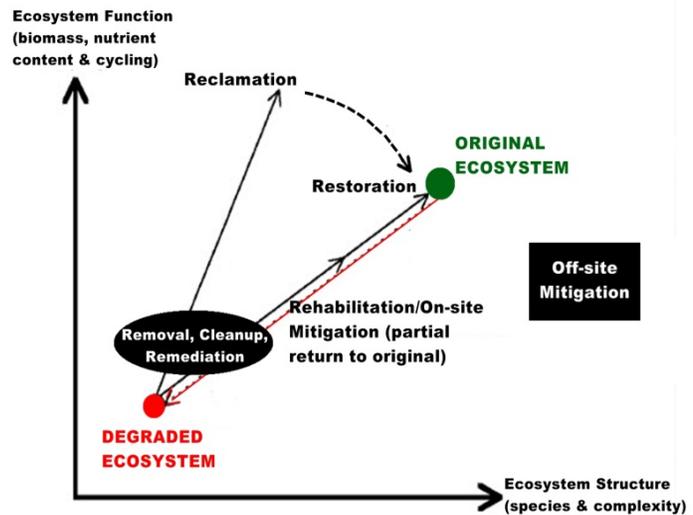


Figure 4-1. Restoration Relative to Other Efforts to Improve Degraded, Damaged or Destroyed Ecosystems

Source: Adapted from Bradshaw (1987).

For purposes of this chapter, ecosystem (or ecological) **restoration** is defined as an intentional activity that initiates or accelerates the recovery of a degraded, damaged, or destroyed ecosystem with respect to its health, integrity, services, and sustainability (Society for Ecological Restoration International 2004). Ecosystem health provides a useful metaphor for human health, and helps emphasize that most of DOI’s lands and managed resources play an integral role in the welfare of many Americans and most of these resources have been altered by people. For example, chemicals or oil may be present and need to be addressed prior to restoration through **removal, cleanup, or remediation** of the land.¹⁴

Some ecosystems may have been changed so dramatically that a return to the original landscape is no longer possible and **rehabilitation** or **on-site mitigation**—a partial return to a previous state—could be the only option. **Reclamation** is the process of reconverting disturbed land to its former or other

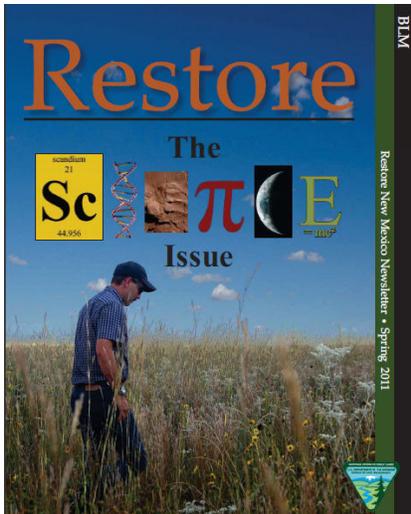
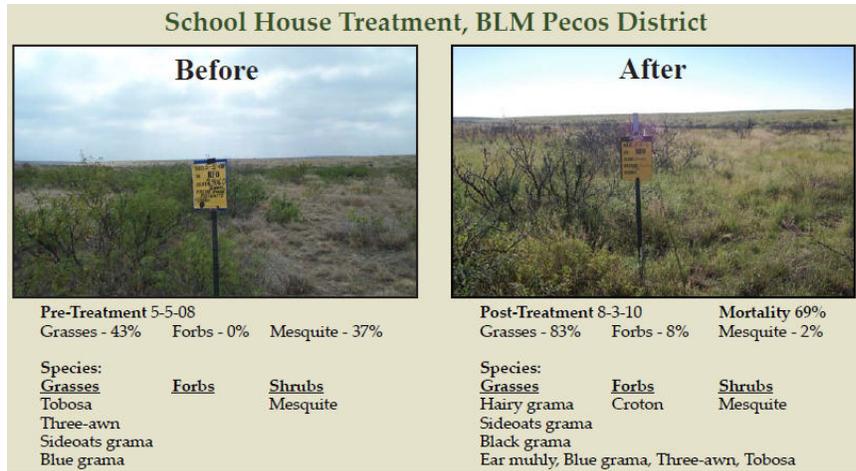
¹⁴ The National Academy of Sciences suggested definitions for the terms restoration, reclamation, and rehabilitation (NAS, 1974). These definitions were carried forward in the seminal works on mined land reclamation, including Reclamation of Drastically Disturbed Lands (Schaller and Sutton, 1978), which was relied upon by Bradshaw (1987).

productive uses. It is commonly used in the context of mined lands. The main objectives of reclamation include the stabilization of the terrain, assurance of public safety, aesthetic improvement, and usually a return of the land to what, within the regional context, is considered to be a useful purpose. Reclamation projects that are more ecologically based can qualify as rehabilitation or even restoration.¹⁵ **Off-site mitigation** is an action intended to compensate for environmental damage. Regardless of approach, monitoring is needed to ensure the desired goals are actually achieved.

¹⁵ See Stahl, P.D. *et al.*, 2006, for more discussion on reclamation and ecosystem restoration.

Box 4-1. BLM’s Restore New Mexico Program – High-Quality Science Generating Environmental and Economic Benefits from Restoration

Restore New Mexico is a partnership to restore grasslands, woodlands, and riparian areas to healthy and productive condition. The program began in 2005 and has treated more than 1.4 million acres of impaired federal, private, and state land, with millions more planned. With the \$8 million in funding that has been received from Natural Resource Conservation Service and BLM, the program has been able to leverage over \$7.1 million in funding from ranchers, the oil and gas industry, sportsman conservation groups, and others. This money was used for on-the-ground projects to restore habitat for threatened and endangered species, game species, and other wildlife adversely affected by historic overuse of the land. By improving the health of the land and incorporating best management practices, Restore has been able to help meet the local demands for energy, food and recreation, while also helping to improve the health of the land. BLM and its partners rely on high quality science to ensure the efforts of Restore New Mexico provide the greatest benefits to the land, resources, and wildlife.



Weaver Ranch, a 25,000-acre operation in New Mexico, is a special laboratory of innovation for vegetative treatments and scientific monitoring. Owner Jim Weaver and manager Willard Heck have been conducting scientific monitoring on their ranch for years, some of which has been funded by BLM. According to Heck, “In dry environments, once a landscape has been sufficiently altered, it will not return to its original state in a time frame relevant to humans without a management input. Just stepping back is not a fix to the problem, and simply removing the cows won’t magically restore overgrazed land either... No doubt this is hard work, and landscape restoration treatments aren’t cheap, but afterwards we had seven times more grasses, so it was like we had seven more ranches. This doesn’t mean you can put seven times as many cows out there, but it does mean you can do a lot you couldn’t do before... We hope to show [through monitoring] that we’ve created a more diverse, healthier environment that is more profitable to the rancher and benefits wildlife with proper management.” More details on BLM’s Restore New Mexico efforts, including the work at Weaver Ranch, are available on-line at http://www.blm.gov/nm/st/en/prog/restore_new_mexico.html.

Box 4-2. Restoration to Ensure a Refuge for the Future—Addressing Climate Change at the Alligator National Wildlife Refuge on the Shore of North Carolina

Natural resource managers face difficult decisions on whether to restore locations where climate change is projected to permanently shift ecological systems away from their historical status. It is an enormous challenge to determine how and what to restore to ensure that the expected long-term benefits exceed the costs given this future uncertainty. Using oyster reefs, water control structures, teams of students, and thousands of seedlings, land and resource managers at Alligator River National Wildlife Refuge on the coast of North Carolina are trying to address just this challenge.

A guided paddle tour at Alligator River National Wildlife Refuge (Cindy Heffley, FWS).



The Refuge lies in the Albemarle and Pamlico Sounds, North Carolina's most vulnerable region to sea level rise. Rising seas combined with storm surge could claim the entire Refuge within a lifetime. Threats from wildfire and invasive species could be worsened by climate change. This system has a wide range of ecological and human use values and is home to the rare pocosin wetlands and other habitats, including marshes, hardwood swamps, and Atlantic white cedar swamps. The Refuge is one of the last strongholds for black bears on the East Coast and is also inhabited by red wolves, alligators, ducks, geese, and river otters. This unique assemblage draws about 45,000 visitors each year, including many from overseas.

The Refuge has partnered with The Nature Conservancy, local residents, and others to protect and restore what can be sustained for the long run. Restoration work in combination with other strategies like building new reefs, removing invasive species, and plugging drainage ditches to prevent the influx of salt water, has multiple benefits for the Refuge, including providing habitat for species, preventing wildfire, and limiting the impact of floods. Restoration is playing an unusual role—buying time. Biologists are restoring bald cypress and black gum in areas that they expect will be inundated by estuarine waters in the not-so-distant future. These activities will buy time, providing crucial shelter and habitat for at-risk species, while conservationists protect upslope habitat to harbor the species in the future.



Black bears (Larry Wade, FWS).

In addition to sea level rise, many freshwater systems are projected to be warmer in the future (Kaushal et al., 2010), which could make habitat unsuitable for species and a questionable restoration investment. Forest systems are expected to shift to higher latitudes (Iverson et al., 2008), lowering the value of restoring them at lower latitudes. Removing non-native species may not make sense if those species are shifting their habitat in response to changing climate. As part of an overall protection and adaptation strategy, the Refuge and its partners have planted 20,000 saplings in areas that have been denuded of forest vegetation. To support these growing saplings, freshwater is being retained in areas that were previously drained. It is hoped that the favorable conditions will allow the forest to grow and sustain itself, at least for a while.

RESTORATION ACTIVITIES – INTERIOR’S BUREAUS AND OFFICES

The long-term missions, objectives, policies, and plans of DOI’s bureaus and certain offices reflect a broad departmental commitment to restoration:

- **Bureau of Indian Affairs (BIA).** BIA’s Tribal Management/Development Program includes funding for three restoration-related programs: 1) Inter-Tribal Bison Restoration and protection for restoration of bison on Indian homelands; 2) Wetlands/Waterfowl Management (Circle of Flight) of existing contracts to support tribal wetland rehabilitation, waterfowl enhancement and wild rice production projects on Indian lands in Minnesota, Wisconsin, and Michigan. This effort helps support tens of thousands of additional ducks and geese in spring and fall migrations, provides expanded hunting opportunities for tribal members and the general public, and offers enhanced wild rice gathering opportunities and economic development possibilities for tribes; and 3) Watershed Restoration, a joint fish habitat recovery project being carried out by the Northwest Indian Fisheries Commission, an intertribal organization representing 20 Western Washington treaty tribes since 1974, and the state of Washington.
- **Bureau of Land Management (BLM).** BLM plays a major role in restoration of its lands to improve the health of entire watersheds to sustain and enhance a variety of biological communities. For example, BLM manages 30 million acres of sagebrush habitat occupied by the greater sage-grouse in 11 states. This is about half of the remaining sagebrush habitat in the United States. The sage-grouse is a Candidate Species for listing under the Endangered Species Act (ESA), and BLM, FWS and others are working to maintain and restore sagebrush landscapes on public lands to conserve sage-grouse populations. As another example, BLM’s Western Oregon Reforestation and Forest Development Program guides forest regeneration and restoration activities on commercial and non-commercial forest lands that result in the establishment of young stands, including habitat restoration activities in riparian and other reserve areas. In FY 2011, Secretary Salazar designated two pilot projects to demonstrate the ecological and economic merits of the landscape restoration strategy in the Roseburg and Medford, Oregon, districts. Other BLM programs with a focus on restoration include the Hazard Management and Resource Restoration Program (HMRRP), Abandoned Mine Lands (AML) Program, and the National Landscape Conservation System (NLCS) (135 DM 3). The HMRRP is an administrative program with the objective of maintaining public land health by remediating contaminated sites and restoring natural resources injured by releases of hazardous substances and oil. The AML Program addresses physical safety and environmental hazards associated with abandoned hardrock mines on public lands administered by BLM. As discussed in Chapter 3, the mission of the NLCS is to

Role of the National Environmental Policy Act (NEPA) in Restoration

NEPA plays a major role in DOI projects to improve damaged, degraded or destroyed ecosystems. Specifically, the NEPA process requires that DOI:

- *Assess the environmental impacts of federal projects, which include issuing permits, spending federal money, or actions on federal lands;*
- *Consider the environmental impacts in making decisions; and*
- *Disclose the environmental impacts to the public.*

NEPA is intended to help public officials make decisions based on an understanding of environmental consequences and identify actions that protect, restore, and enhance the environment. Public involvement is an integral part of complying with NEPA. Information on Interior’s implementation of NEPA is available at 43 CFR Part 46.

conserve, protect, and restore nationally significant landscapes recognized for their outstanding cultural, ecological, and scientific values for the benefit of current and future generations.

- **Bureau of Ocean Energy Management (BOEM).** BOEM (formerly part of BOEMRE) is responsible for managing development of the nation's offshore resources in an environmentally and economically responsible way. A number of BOEM's programs support restoration goals. For example, BOEM's Environmental Studies Program (ESP) is focused on advancing applied research to ensure that programmatic decisions regarding energy and mineral development on the OCS are informed by the best scientific information available. BOEM relies on this and other information when completing its environmental reviews in support of programmatic decisions, consistent with the National Environmental Policy Act (NEPA). These analyses help BOEM to determine, among other things, what mitigation measures may be needed to protect resources and the environment.

- **Bureau of Reclamation.** Supporting the Department's priority on ecosystem restoration is a key underpinning of Reclamation's mission *to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.* As a key water supplier in the West, restoration better positions Reclamation to address the ongoing challenges presented by drought, climate change adaptation, increasing populations, growing water demand associated with energy generation, and environmental needs. For example, the goal of Reclamation's Resource Management Plans (RMP) is to create a balance of resource development, recreation, and protection of natural and cultural resources for the lands and waters being managed. The plans outline for Reclamation, other managing agencies, and the public, resource management policies and actions that will be implemented over each plan's 10-year life. Reclamation's Ecosystem Restoration program involves a large number of activities, including its ESA recovery

National Ocean Policy and Restoration

Executive Order 13547 was issued in July 2010 and established a National Ocean Policy to protect, maintain, and restore the health and biological diversity of ocean, coastal, and Great Lakes ecosystems and resources. The National Ocean Council, which is charged with implementing this policy and includes Secretary Salazar, identified two ongoing restoration initiatives in its draft Implementation Plan (p. 48) that exemplify the principles of the National Ocean Policy: (1) the Great Lakes Restoration Initiative, and (2) the Gulf Coast Ecosystem Restoration Task Force. Both initiatives, which involve Interior bureaus, demonstrate how regional, State, and local entities can work together to address common goals for protecting and restoring natural resources in concert with building strong coastal economies and resilient communities. As a principal steward, Interior's resources include:

- *More than 35,000 miles of coastline;*
- *34 million acres in 84 marine and coastal national parks;*
- *180 marine and coastal refuges;*
- *Energy and mineral leasing and production on the 1.7 billion offshore acres of Outer Continental Shelf managed by BOEM and BSEE;*
- *More than 20,000 small islands, rocks, exposed reefs, and pinnacles between Mexico and Oregon comprising the BLM-managed California Coastal National Monument;*
- *Hundreds of thousands of square miles in FWS-managed marine national monuments; and*
- *Extensive ocean, coastal, and Great Lakes research and mapping by USGS and bureaus to predict, assess, and manage impacts on coastal and marine environments.*

programs.¹⁶ In particular, Reclamation's Pacific Northwest Region is involved in a variety of fish and wildlife programs which include cooperative watershed planning and the design and installation of fish passage devices. Working with the Northwest Power Planning Council's "Strategy for Salmon," Reclamation is participating with state and local interests in water conservation demonstration projects and model watershed programs in Oregon, Washington, and Idaho. Reclamation's efforts to empower tribal nations range from endangered species restoration to rural water and implementation of water rights settlement actions.

- **Bureau of Safety and Environmental Enforcement (BSEE).** BSEE (formerly part of BOEMRE) is a major contributor in NEPA activities throughout the offshore leasing and exploratory planning processes. Under BSEE, the Environmental Enforcement Division (EED) is specifically tasked with ensuring NEPA compliance for all BSEE-issued permits, the decommissioning of offshore production platforms, and managing the Idle Iron and Rigs-to-Reefs programs. These restoration programs ensure that marine and coastal environments are protected, and either improved or returned to their "pre-resource development" condition at the end of oil and gas activities. Additionally, BSEE also reviews industry reports, conducts field verifications and evaluations, and coordinates with BOEM to adaptively manage both environmental mitigation measures to ensure their effectiveness and enforceability.
- **U.S. Fish and Wildlife Service (FWS).** The Service plays a major role in restoration as manager of the Refuge System, and by providing biological, ecological, and contaminant expertise on FWS-managed resources through a wide variety of programs. Discussed at greater length in Chapter 3, the mission of the Refuge System is *[t]o administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans* (601 FW 1). As the principal federal partner responsible for administering the ESA, the Endangered Species Program takes the lead in recovering and conserving the nation's imperiled species. Working with partners, FWS uses a range of conservation tools, including restoring and acquiring habitat, removing introduced animal predators or invasive plant species, conducting surveys, monitoring individual populations, and breeding species in captivity and releasing them into their historic range. For an example see Box 4-3.

The Fisheries and Habitat Conservation Program promotes the protection, conservation, and restoration of the nation's fish and wildlife resources. This cooperative program provides partnership-based habitat restoration, protection and conservation projects in its effort to restore aquatic and terrestrial trust species, populations and habitats. When oil or chemicals enter the environment and injure FWS-managed resources, the Environmental Contaminants Program provides the expertise to assess and restore these resources. FWS reported that they provided over 5,200 landscape-related contaminant actions benefitting other federal, state and local agencies and/or partners in FY 2011. For example, in FWS Region 5 (New England, NY, mid-Atlantic), contaminants staff have been investigating endocrine disruption of smallmouth and largemouth

¹⁶ Summary information on 16 different Reclamation river restoration or species recovery programs, along with questionnaire results from program managers on six potential institutional challenges, is available at http://www.usbr.gov/river/docs/RR_Prgms_and_Inst_Chllngs_Smry120118.pdf.

bass, white-nose syndrome in bats, and the effects of wastewater from hydrofracturing of natural gas on mussels. These studies are critical for future restoration efforts, as they help land managers understand the effects on the affected species, and how to guide future restoration actions to best benefit the injured species. Analyses of jobs and economic impacts from restoration activities at Bandon Marsh National Wildlife Refuge in Oregon and the Glacial Ridge National Wildlife Refuge in Minnesota are provided in the case studies section.

- **National Park Service (NPS).** The Organic Act of August 25, 1916, other applicable laws, and the NPS strategic plan inform NPS' long-range objectives for protecting, restoring, and maintaining natural and cultural resources in good condition and managing them within their broader ecosystem and cultural contexts (145 DM 1). NPS' largest restoration implementation effort is in the Everglades, including Big Cypress National Preserve and Biscayne, Everglades, and Dry Tortugas national parks. Abandoned mining and oil and gas exploration and production sites represent a substantial portion of the disturbed lands requiring restoration in parks. In 2011, NPS reported managing an estimated 3,000 abandoned mineral land sites with more than 11,000 hazardous openings and over 33,000 acres of disturbed land.

Box 4-3. Lone Mountain Restoration

The Lone Mountain restoration was conducted to address natural resources injured when failure of a coal slurry impoundment resulted in a release of 6 million gallons of coal “fines” into the Powell River in western Virginia. This release injured 12 species of federally listed endangered mussels, supporting aquatic habitat, and designated critical habitat for two federally listed threatened fish species. FWS, with help from state, academic, and non-governmental partners, protected and restored over 500 acres of riparian habitat within a critical water recharge area of the upper Powell River watershed, released thousands of hatchery-reared juvenile mussels representing 15 species, released over 800 hatchery-reared yellowfin madtom fingerlings, and provided educational opportunities for students through the Lee County Public School Meaningful Watershed Educational Experience.



Powell River freshwater mussels spill and upstream habitat preservation locations. (Virginia Department of Game and Inland Fisheries)

Box 4-4. Restoration in a Rapidly Changing Arctic

The Arctic is facing significant and rapid impacts from climate change. The International Panel on Climate Change (IPCC) estimates that the Arctic is warming twice as fast as the rest of the world. As the manager of over 213 million acres of land and offshore areas in Alaska, Interior is responsible not just for understanding, protecting, managing these resources, but also responding to these changing conditions through adaptation and restoration activities. Two of the most urgent threats to public lands and resources in the Arctic are thawing permafrost and coastal erosion. Land subsidence (sinking) associated with thawing permafrost presents substantial challenges to infrastructure in Alaska, including roads, runways, water and sewer systems, and oil and gas activities. For example, the number of days per year in which travel on the tundra is allowed under Alaska Department of Natural Resources standards has dropped from more than 200 to about 100 days in the past 30 years, resulting in a 50% reduction in days that oil and gas exploration and extraction equipment can be used. This in turn has economic implications for local communities that benefit from petroleum activities on public lands.

NPS has recognized that restoration efforts are an important means for enhancing species' ability to cope with stresses and adapt to climatic and environmental changes. The NPS Climate Change Response Program is monitoring conditions across NPS Arctic units, where scientists are predicting that the average temperature may rise 10°F by 2080. Denali National Park contains some of the southernmost continuous permafrost in Alaska and recent measurements show that some of Denali's permafrost may be within a degree of thawing. With over 378,000 visitors in 2010, Denali is an important destination for visitors to Alaska, and restoration



Coastal erosion along the Alaskan Beaufort Sea.

and adaptation efforts will help preserve the natural resources and recreational opportunities that are important to local economies.

Coastal erosion is also likely to have significant impacts on DOI resources. Shoreline erosion rates along parts of the Alaskan Beaufort Sea have increased significantly, from 28.5 ft per year (1979 to 2002) to 44.6 ft per year (2002 to 2007). Coastal erosion in this area has also threatened old exploratory wells

drilled before BLM became manager of the National Petroleum Reserve-Alaska. A \$16.8 million American Recovery and Reinvestment Act of 2009 (ARRA) project remediated health and safety threats to local communities by plugging the Drew Point Well, which was threatened by coastal erosion. The contract to remediate the well was awarded to a small native-owned company, providing employment opportunities to the communities of Nuiqsut, Barrow, and Atqusuk. In addition to plugging and abandoning the well, the contractors remediated the reserve of harmful contaminants, removing diesel fuel petroleum-contaminated mud from site. This project has prevented the release of harmful contaminants that would have impacted fisheries and marine mammals in the Beaufort Sea. Native Alaskans are dependent on these resources for a subsistence lifestyle.

*(Sources of information: <http://www.usgcrp.gov/usgcrp/nacc/education/alaska/ak-edu-3.htm>;
<http://alaska.usgs.gov/science/geography/coastalerosion.html>;
<http://recovery.doi.gov/press/wp-content/uploads/2009/04/alaska-drew-point.pdf>).*

As part of NPS's Disturbed Lands Restoration Program, the Abandoned Mineral Land Restoration Program encourages the full restoration of lands affected by mining activities, addresses environmental concerns (metals contamination, acid mine drainage), safety hazards (vertical mine openings, unstable slopes), and the sustainability of bat species, which may rely on mine shafts for habitat. The Park System Resource Protection Act (PSRPA) gives NPS authority to collect damages for injury to park resources. NPS' Environmental Response, Damage Assessment, and Restoration Branch provides support to parks in the prevention or minimizing of damage to park resources or their loss of use when incidents occur, including chemical releases, oil spills and physical destruction of property. The funds recovered are used to restore, replace, or acquire the equivalent of the resources that were lost or injured.

- **Office of Surface Mining and Restoration (OSM).** The mission of OSM is to carry out the requirements of the Surface Mining Control and Reclamation Act (SMCRA) in cooperation with the states and tribes. Two of OSM's three primary objectives relate to restoration: (1) assure that the land is restored to beneficial use following mining, and (2) address the effects of past mining by aggressively pursuing reclamation of abandoned coal mines. Environmental problems associated with AMLs include surface and ground water pollution, entrances to open mines, water-filled pits, unreclaimed or inadequately reclaimed refuse piles and mine sites, sediment-clogged streams, damage from landslides, and fumes and surface instability resulting from mine fires and burning coal refuse. SMCRA authorized an AML Reclamation fee (see Appendix 1) based on coal production in order to hold the entire coal industry responsible for reclaiming coal mine lands left abandoned across the country. OSM's Environmental Restoration Program funds operations and projects for the AML Program. The Office of Technology Transfer provides information for surface mine design, evaluation, environmental protection, reclamation design, and bond release, and posts information about mining and reclamation conferences, forums, meetings, symposia and workshops.

- **Office of Restoration and Damage Assessment (ORDA) and the Restoration Program.** When hazardous substances or oil enter the environment, fish, wildlife, and other natural resources can be injured. Interior, along with state, tribal and other federal partners, acts as "trustee" for these resources on behalf of the public. The Department's trust resources include national parks, national wildlife refuges, lands managed by BLM, Indian lands, and natural resources held in trust by the federal government, waters managed by Reclamation, and

NPS' Restoration Activities: *Parks contain many examples of watersheds, landscapes, and marine resources disturbed by past human activity or other adverse influences that require:*

- *Restoring disturbed lands associated with abandoned roads and mines.*
- *Protecting wildlife habitat threatened by changes in water flow or quality such as prairies and wetlands.*
- *Controlling exotic plant species that impact native vegetation and wildlife habitat.*
- *Restoring fire effects to fire-dependent vegetation and wildlife habitat where natural fire regimes have been disrupted.*
- *Providing special protection of threatened and endangered plant and animal populations at risk.*
- *Perpetuating karst, cave, geologic processes and features by protecting groundwater quality.*
- *Managing marine fisheries to protect coral reefs and reef fish populations.*

Restoration Program Success: *In FY 2011, the Restoration Program restored, enhanced, and protected 87,709 acres and 401 stream/shoreline miles.*

federally protected migratory birds and endangered and threatened plants and animals. Under the authorities of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (also known as CERCLA or “Superfund”), the Clean Water Act, and the Oil Pollution Act of 1990, trustees seek to identify and restore injured natural resources through the Natural Resource Damage Assessment and Restoration Program (NRDAR). The Restoration Program ensures the responsible parties, not taxpayers, bear the cost of restoring these injured resources to the quality and level of services provided had the event not occurred. Trustees assess the magnitude of injury during the response and cleanup or afterwards, and recover funds from responsible parties to carry out restoration activities. Trustees may also recover costs for the lost public use of the land or resources and for money spent by trustees to assess damages. A restoration plan is developed with public input that specifies the actions necessary to restore the injured resources. These actions can be carried out on the lands where injury occurred or at an alternate site which, when restored, provides a suitable replacement for the injured or lost resources. Trustees monitor the restoration actions to ensure long-term goals have been met. The Restoration Program is administered by ORDA and comprised of staff from BIA, BLM, FWS, NPS, Reclamation, Solicitor’s Office, USGS, and the Office of Policy Analysis. ORDA’s Restoration Support Unit (RSU) assists with all aspects of natural resource restoration planning, implementation, and monitoring. The Office manages the Department’s Restoration Fund (see Appendix 3); develops guidance, policy and regulations to facilitate restoration; and works in partnership with other affected natural resource trustee agencies.

- **Office of Environmental Policy and Compliance (OEPC).** OEPC chairs a multi-bureau effort to clean up DOI sites through the Central Hazardous Materials Fund (CHF; see Appendix 3). This multi-bureau effort integrates the Department’s interests in remediation and environmental restoration of the contaminated sites it manages by incorporating Interior’s natural resource management concerns into CERCLA response actions. The CHF cost-effectively leverages DOI’s legal, technical, and project management expertise to address the highest priority cleanup sites. The CHF focuses on the sites that pose the highest risks to employees, public health and welfare, and the environment; and typically, are so costly and complex to clean up that they cannot adequately be addressed using available bureau resources. Some of the larger sites include the Crab Orchard National Wildlife Refuge, Illinois; Valley Forge National Historic Park, Pennsylvania; Red Devil Mine, Alaska; Phosphate Mines, Idaho; and Orphan Mine, Grand Canyon National Park, Arizona. Since 1995, the Department has undertaken response actions at more than 65 sites and completed cleanup at 20 sites.
- **Office of Insular Affairs (OIA).** OIA is primarily involved in ecosystem restoration-related activities through control of the invasive Brown Treesnake (BTS), which was unintentionally introduced to the island of Guam following World War II. The BTS is directly responsible for the extinction or local extirpation of 10 of 13 native forest birds and three of 12 native lizards, which has caused a series of cascading impacts on the native forest structure and the entire terrestrial ecosystem of Guam. These snakes also currently cause nearly 200 outages per year, and their bite is responsible for approximately one in 1,200 emergency room visits on Guam. This program is a cooperative effort involving OIA (financial assistance and grants management), USGS (basic and applied research), FWS (Pacific and overall program coordination), the U.S. Department of Agriculture (USDA; control management), the Department of Defense (financial assistance and

control management on military facilities), and the governments of Hawaii, Guam, and the Commonwealth of the Northern Mariana Islands (restoration, control and management). The National Invasive Species Council (NISC) is an active member of the Brown Treesnake Technical Working Group and

ensures that BTS concerns are incorporated into broader planning efforts on invasive species issues throughout Micronesia and Oceania.

- **U.S. Geological Survey (USGS).** USGS conducts research and monitoring to develop and a

USGS' Social Values for Ecosystem Services (SolVES): *To address some of the needs to quantify and map social values for use in ecosystem services assessments, USGS and Colorado State University developed a public domain tool, SolVES. This geographic information system (GIS) application is designed to use data from public attitude and preference surveys to assess, map, and quantify social values for ecosystem services. The recently released SolVES 2.0 enhances the opportunities for decision makers and researchers to weigh the tradeoffs among different ecosystem services in a variety of physical and social contexts, ranging from forest and rangeland to coastal and marine.*

fundamental understanding of freshwater, terrestrial, and marine ecosystems. Examples of restoration-related research efforts include:

- Cutting-edge work by USGS geneticists for use in making management decisions on fish and wildlife, including habitat and conservation.
 - Conducting a wide range of contaminant and restoration-related scientific expertise on CHF sites, NRDAR cases, and AMLs. For example, USGS scientists and mapping and digital data collection experts are collaborating to provide the scientific knowledge needed for effective cleanup of AMLs. In addition to providing scientific expertise on NRDAR cases, USGS has been working with ORDA on a restoration science initiative to develop protocols and metrics to better measure the ecological outcomes of restoration activities.
 - Informing the restoration efforts of the Great Lakes Restoration Initiative (GLRI), an interagency program that addresses the most significant environmental problems in the Great Lakes ecosystem. Results from USGS scientific studies and monitoring are helping guide restoration planning. For example, USGS is identifying the techniques and strategies that are most likely to succeed in restoring native fish. The goal is to accelerate the recovery of specific fish in Lake Ontario and to improve the resiliency and stability of Great Lakes fish communities by enhancing ecosystem function. See Appendix 3 for more information on the GLRI.
- **Wildland Fire Management Program.** The goal is to achieve both a cost-efficient and technically effective fire management program, which includes preparedness, suppression, hazardous fuels reduction, and restoration of ecosystems. Management activities are performed by BLM, FWS, NPS, and BIA. USGS provides fire science expertise and research. The Office of Wildland Fire Coordination coordinates the Department's efforts among the Interior bureaus and with other agencies. Multi-bureau operational programs are managed by the National Interagency Fire Center in Boise, Idaho. Interior's major partner in wildland fire management is the U.S. Forest Service (USFS).

Box 4-5. Sea Turtle Emergency Restoration, Texas

The Gulf Coast is home to one of the most ecologically complex regions in the country and site of a number of refuges, national parks, and national seashores. Following the April 2010 BP Deepwater Horizon drilling rig explosion and oil spill, the Deepwater Horizon Oil Spill Natural Resource Trustees identified three potential emergency restoration projects, including the Kemp's Ridley Sea Turtle Emergency Restoration Project. More Kemp's Ridley sea turtles were documented oiled as a result of the spill than any other sea turtle species, and the spill location overlapped the known distribution of important Kemp's Ridley foraging habitat.



NPS Padre Island National Seashore employee releasing recently hatched Kemp's Ridley sea turtles (Ray Kirkwood).

Emergency restoration actions are taken by trustees prior to the completion of the NRDAR planning process to prevent or reduce continuing natural resource injuries, and avoid potential irreversible loss of natural resources. Actions implemented for this project included enhanced support of Kemp's Ridley nest detection and protection activities on the Texas Gulf Coast, and construction of facilities to decrease response time and improve Kemp's Ridley nest detection and protection on Padre Island National Seashore. BP agreed to fund the project for the purpose of increasing nest detection and collection activities on Padre Island National Seashore, San Bernard National Wildlife Refuge, and state lands on the upper Texas coast. All located nests were transferred to existing egg incubation facilities at Padre Island National Seashore. Funds were used for enhanced nest detection surveys, field supplies, and construction of a temporary base camp and nesting corral at Padre Island National Seashore. This emergency restoration project helped reduce further injury to populations by protecting nests and increasing hatchling recruitment. The Kemp's Ridley Sea Turtle Emergency Restoration Project was completed in August 2011.

ECONOMIC VALUATION OF RESTORATION

As described throughout this report, the resources and activities of Interior enrich the nation in many ways. In some areas, determining value is relatively straightforward, such as for minerals or grazing lands, which are traded in established markets. Other areas may represent emerging markets, such as carbon sequestration and alternative energy, that are becoming better defined. However, few markets exist for experiencing a day of hiking or fishing, maintaining and interpreting cultural heritage, enhancing the health of wetlands and rangelands, or preserving habitat for endangered species. These are just some of the many non-marketed ecosystem services provided by Interior's resources.

As discussed in Chapter 3 of the FY 2010 DOI Economic Contributions Report (available on-line at <http://www.doi.gov/ppa/upload/DOI-Econ-Report-6-21-2011.pdf>), ecologists currently classify ecosystem services into four categories:

1. **Provisioning services** are goods such as food, timber, fuel, and water (i.e., commodities);
2. **Regulating services** such as flood and disease control;
3. **Cultural services** such as spiritual, recreational, and cultural benefits; and
4. **Supporting services** such as nutrient cycling that maintain the biophysical conditions for life on Earth.

Box 4-6. Great Lakes Legacy Act Funds Partnered with NRDAR Settlement in Indiana

Over many decades, steel mills, refineries, and manufacturing facilities have released hazardous substances and oil into the Grand Calumet River in northwestern Indiana, severely degrading the quality of water and sediments and causing injury to aquatic resources and migratory birds. Restoration efforts have been underway for over a decade, including dredging contaminated sediments from the riverbed, restoring in-stream habitat for fish and aquatic invertebrates, restoring migratory bird habitat within the riparian corridor, acquiring 139 acres of dune and swale habitat to become part of the National Park Service’s Indiana Dunes National Lakeshore, and acquiring 77 acres of state-managed riparian habitat along nearby Salt Creek. More recently, FWS and the State of Indiana have partnered with EPA to clean up and restore the heavily polluted west branch of the Grand Calumet River by removing 71,000 cubic yards of contaminated material and capping a half mile of the river near Hammond, Indiana. This \$33 million project was funded in part by the Great Lakes Legacy Act (\$21.5 million) and in part by NRDAR settlement funds (\$11.6 million). Along with sediment removal and capping, habitat restoration activities included planting native grasses, forbs, and woody vegetation along the riverbank and upland areas along this stretch of the river. The Great Lakes Water Quality Agreement calls for Remedial Action Plans to restore and protect 14 beneficial uses in Areas of Concern. Since the cleanup and restoration began in the west branch, two of the 14 “beneficial use impairments” have been delisted—the restriction on drinking water and added costs to agriculture—leading to tangible economic benefits to the area.



Placing sand cap and grading the north slope of Grand Calumet river bank (SulTRAC).

Interior’s lands and managed resources produce a wide range of these valuable ecosystem services, including agriculture, drinking water, energy, flood and disease control, carbon sequestration, recreation, and cultural resources. Interior’s ecosystem restoration activities play an important role in maintaining and enhancing the services from departmental lands and managed resources. Although the jobs and economic contributions from restoration are substantial and important, as described in the next section, they do not represent the full economic value of ecosystem restoration because they do not capture the net benefits associated with environmental goods and services not bought and sold in markets. Physical measures such as restored stream-miles or acres are also important for understanding and conveying restoration success, but they do not offer a complete measure of restoration benefits.

In economics, restoration benefits are valued in terms of the new or additional ecosystem services that are created as a result of the project. Economic value is defined as the amount society is willing to pay for the ecosystem service benefits created by the project. Net economic value is that willingness to pay less

the cost of the project (i.e., net benefits). Why does a complete measurement of restoration project benefits matter? A fundamental question for most decision makers is whether the total benefits exceed the total costs (i.e., generates positive net benefits). Restoration, reclamation, rehabilitation, remediation, and cleanup projects are often costly. While investment in these projects provides value to the public by restoring ecosystem function and structure to damaged, degraded, and destroyed ecosystems, they are often non-market benefits. If proper economic analysis is not conducted, an incomplete measure of these benefits could lead to under-investment in restoration or selection of a project option with lower actual net benefits than other alternatives.

Economic Approaches. Non-market valuation methods are one way to estimate values for changes in environmental quality such as those resulting from ecosystem restoration projects. These techniques can use data from related markets (such as the cost of traveling to a given site or property values) or data from questionnaires asking respondents their willingness to pay for a given change in quality to estimate these values. Some studies have used contingent valuation and choice experiment techniques to analyze survey data and estimate respondents' willingness to pay for restoration efforts related to wetlands or water resources (Loomis et al., 2000), wildlife habitat (Garber-Yontz et al., 2004), and forests (Adamowicz et al., 2000). Other studies have used data on travel costs (Bergstrom et al., 2004) or property values (Williamson et al., 2008) to develop statistical estimates of the economic value of restoration efforts.

Production function approaches are another method that can be used to value environmental quality provided by ecosystem restoration efforts. These methods estimate the value of ecosystem services as one input into productive economic activities. Some examples of production function approach applications include commercial and recreational fishing, agricultural systems, invasive species control, watershed protection, and damage cost avoidance (Barbier 2007).

Cost-based methods (also known as restoration-based) are used to estimate the value of ecosystem services by measuring the amount individuals would be willing to pay to avoid damages (i.e., avoided losses), the cost of restoring or replacing the lost services, or the cost of producing substitute services. Habitat equivalency analysis (HEA) and resource equivalency analysis (REA) are examples of cost-based methods that can be used to approximate the value of ecosystem goods provided by restoration projects, such as the cost of restoring habitat after an oil spill. These methods can give a rough indication of economic value, and the ease of analysis can be advantageous. However, their use requires the assumption that the public's value of the original resource is equivalent to that of the replaced or restored resource, which may not be the case. These methods are only as good as the quality of the inputs, which can be time-consuming and expensive to develop. Restoration projects are usually site-specific and costs can vary extensively by resource type, location, methods, and timing.

Challenges. There is clearly an extensive literature indicating that individuals value improvements in environmental quality and are willing to pay for such improvements, including restoration projects. However, estimating the economic value of ecosystem restoration as a change in environmental quality and the associated flow of ecosystem services presents several challenges. Notably, scientists identify that restoration research is still evolving for many resources. Baseline scientific data necessary to quantify changes in services may not exist. Site studies are often time-consuming and expensive to plan, implement, and monitor for success. Long-term monitoring of restoration projects provides a critical feedback loop to inform future restoration. However, priority-setting of funds can cut monitoring short,

effectively short-changing the quantity and quality of available restoration data. Similarly, economic valuation data collection and studies can be time-consuming and expensive. Valuation of cultural losses, such as resources with spiritual and religious uses, have been particularly challenging for economists. Many of the commonly used economic valuation methods described above are difficult to apply in the case of Native American communities, since many tribal members may feel the cultural losses are not commensurable with a dollar value (O'Neill 2009).

CASE STUDIES OF THE ECONOMIC CONTRIBUTIONS OF SELECTED DOI RESTORATION PROJECTS

As discussed above, federal investment in ecosystem restoration and monitoring protect federal trusts, ensure public health and safety, and preserve and enhance essential ecosystem services. These investments also provide economic contributions and jobs. Given constrained budgets and competing demands for investment, there is a need to better understand the connection between restoring the health and productivity of ecosystems, and the resulting economic benefits to local communities. This section includes nine case studies that highlight the economic contributions of a wide range of restoration projects supported by DOI bureaus and partners. The restoration projects were implemented on BLM, FWS, and NPS lands, and include river, riparian, forest, wetland, grassland, prairie, and coastal resources, as well as the demolition of a hazardous building.

OVERVIEW OF CASE STUDY METHODS

Economic and employment contributions are estimated for each of the case study projects. Restored ecosystems are expected to benefit local communities beyond the completion of the restoration project. Thus, these projects will create additional future jobs and non-market benefits by providing increased opportunities for tourism, improving and sustaining fisheries and wildlife habitat, and reducing risk from flooding and other natural disasters. These future benefits are not accounted for in this analysis.

Job and income contributions for each case study were estimated using IMPLAN. IMPLAN is a widely used input-output software and data system for estimating the job and income effects resulting from the interdependencies and interactions of economic sectors and consumers (see Appendix 3 and Appendix 7 for more information on IMPLAN and how the restoration cases discussed in this chapter were modeled).

Restoration projects involve spending in a local economy on services such as construction and environmental consulting. The firms providing these services purchase materials such as rocks and riprap, monitoring equipment, and grass seed to accomplish their work. In many cases, materials for projects are purchased within the local economy. In order to meet the resultant increase in demand, input suppliers must also increase their purchases of inputs from other industries, thus creating additional economic activity. This economic activity supports jobs and generates income. Local firms and input suppliers need to maintain or hire additional employees to meet project demands. Subsequently, employees of directly affected businesses and input suppliers use their incomes to purchase goods and services in the local economy, generating further economic activity, and thus amplifying the ripple effect. Reported impacts reflect restoration expenditures external to DOI; the impacts do not include job and labor income impacts supported directly by DOI employees. Output and employment contributions for DOI employees are included in Chapter 2.

The case studies illustrate the substantial economic benefits that restoration projects provide for local communities, and the variation in impacts across projects emphasizes the need to take caution when transferring impact estimates from one project to another. Restoration type, costs and availability of inputs and labor, and modeling methods all play large roles in the final impact estimates. Each of these factors need to be considered when comparing or transferring impact estimates. See Appendix 3 for a detailed discussion.

Table 4-1 provides a summary of the case study results and presents value of industry output and employment contributions.

Table 4-1. Summary of Restoration Case Studies (2011\$)

Project Name	Lead Bureau/ Partners	Location	Restoration Type	Total Expenditures (\$2011)	Project Duration	Avg Expenditure/yr	Local Job Impact (avg/yr)	Local Labor Income Impact* (avg/yr)	Local Economic Output (avg/yr)
Ex 1:Truckee River	BLM and TNC	Nevada	River Rechanneling	\$18.9M	5 years	\$3.8M	37	\$2.7M	\$5.7M
Ex 2:Gerber Stew	BLM	Oregon	Forest	\$3M	8 years	\$370,000	19	\$870,000	Not calculated
Ex 3:Blanca Wetlands	BLM	Colorado	Wetlands	\$75,000/year	ongoing	\$75,000	< 1	\$29,000	\$103,000
Ex 4:Las Cienegas	BLM	New Mexico	Grassland/ Invasives Mitigation	\$1.5M	2 years	\$767,000	10	\$600,000	Not calculated
Ex 5:Jaite Paper Mill Planning and implementation	NPS	Ohio	Hazardous Building Demolition	Planning: \$600,000 Implementation: \$1.3M	Planning: 2.5 years Implementation: 3 months	—	Planning: 4 Implementation: 36	Planning: \$214,000 Implementation: \$755,000 (3 months)	\$479,000
Ex 6:Glacial Ridge	FWS, TNC, NRCS	Minnesota	Prairie/ Wetland	\$24M	11 years	\$2.2M	15	\$839,000	\$1.9M
Ex 7:Niles'tun/Bandon Marsh	FWS and DU	Oregon	Tidal Marsh (restoration only)	\$1.4M	2 years	\$700,000	5	\$453,000	\$1.1M
Ex 8:CT Easement	FWS and TNC	Connecticut	Riparian/ Farm Preservation	\$58,000	5 years	\$12,000	< 1	\$12,000	\$23,000
Ex 9:RI Plover Nesting	FWS and TNC	Rhode Island	Public Education/ Habitat Management	\$130,000	4 years	\$32,000	< 1	\$41,000	\$58,000

*Labor income impacts include all salaries, wages, and benefits accruing to local workers, and are reported on an annual basis in 2011 dollars (\$2011).

Case example 4-1. Partners Help Conserve, Enhance, and Restore Nevada’s Lower Truckee River

The Lower Truckee River originates in the Sierra Nevada and flows through public, private, and tribally owned lands, including 31 miles of the Pyramid Lake Paiute Tribe (PLPT) reservation, terminating in Pyramid Lake within the reservation. Once remarkably productive, a century of man-made changes have heavily degraded the river system, leaving it inundated with invasive weeds. Significant damage occurred as part of a 1960s flood control project, including river downcutting, depression of the groundwater table, and lowering of Pyramid Lake by as much as 81 vertical feet. By the 1970s, the river had lost roughly 90% of its forest canopy, 40% of its resident bird species, and had no resident Kooyooe (also spelled Cui-ui) or Lahontan cutthroat trout. Since then, many policies have been initiated to restore the lower river, including the purchase and dedication of water rights to improve flows, changes in reservoir operations to support cottonwood recruitment and Kooyooe spawning, and the removal of some barriers to fish passage. BLM, Reclamation, and FWS have partnered with the PLPT, The Nature Conservancy (TNC), and at least 10 other federal, state, and local agencies on a wide variety of ambitious conservation, recovery, and restoration projects designed to achieve economic, cultural, environmental, and human health benefits in the Lower Truckee River.



Since 1974, the PLPT have managed fisheries designed to maintain the Kooyooe and Lahontan cutthroat trout at desirable levels. The PLPT have called Pyramid Lake home for countless generations and are known as the Kooyooetukadu or the “Kooyooe Eaters.”

In addition to their active fisheries recovery program, the PLPT is working to restore sections of the Lower Truckee within the reservation. The restoration work involves treating noxious weeds and replanting with native vegetation to help stabilize the river banks and reduce sediment loads. The selection of plant materials is done in consultation with tribal elders to ensure that plants with ethnobotanic values are accessible to all members of the tribe for traditional use and management. Some of this work has been funded by FWS, including a \$200,000 grant announced in May 2011 for habitat restoration to promote reproductive success of the Kooyooe below a nearby dam.



TNC wetland restoration at McCarran Ranch.

Further upstream, TNC is implementing a phased approach to restore natural channels and vegetation along the Lower Truckee River. The TNC Truckee River Project began with the purchase of the McCarran Ranch. Pilot work was implemented in 2003 and full restoration was started in 2006. With the success of the McCarran Ranch restoration,

TNC began partnering with public land managers to restore additional stretches of the river. Work proceeded in 2008 with restoration at the Lockwood property owned by Washoe County. TNC also entered into an agreement with BLM in 2008 to allow TNC to restore approximately 408 acres of public land at the 102 Ranch and the Mustang Ranch. The premise of the restoration approach is that the biology of the river can recover only after the physical foundation—especially the channel geometry and groundwater elevation—has been returned to forms that approximate their original conditions. The supporting Environmental Assessment¹⁷ describes the high restoration potential and habitat values of this effort, including benefits to several tribal interests from improved

According to BLM, conservation efforts along the Truckee River have made important strides in restoring degraded habitat, and serve as a model of what can be achieved when partners work together to achieve goals that would otherwise be unattainable if attempted alone.

¹⁷ Available on-line at http://www.usbr.gov/mp/nepa/documentShow.cfm?Doc_ID=3485

water quality and quantity, fisheries, and availability of traditional native plant species.

Between 2006 and 2011, TNC reintroduced sinuosity into the river course, sloped the river banks, and planted the banks with native species. Monitoring of birds, fish, and vegetation is ongoing to help assure restoration success.

Economic Impacts of Restoration. The restoration work at Lockwood and on the McCarran, 102, and Mustang ranches includes nearly 9 river miles, 19 new wetlands, 13 new river meanders, 31 in-stream riffles, and 263 acres of revegetation. Restoration expenditures have so far totaled \$18.9 million (\$2011) over the combined projects' five year duration, averaging \$3.8 million spent annually (2006-2010). Much of the projects' work - from initial design to major earthmoving to monitoring - was awarded to local contractors with TNC oversight. In addition to TNC, 12 firms worked on the Truckee River Project, nine of which were located within 60 miles of the river in Washoe, Storey, and Lyon Counties. Project expenditures directly accounted for 15 jobs in the local area each year and nearly \$1.5 million annually in local labor income (salaries, wages, and benefits). Over 90% of the materials for the project were purchased from local suppliers, with over half of these expenditures going to purchase rocks and rip-rap from local mining and quarrying businesses and the remaining expenditures going toward construction supplies purchased at local retailers. More than 99% of all labor income went to employees living in the area who subsequently spent much of their income in local communities. The resulting spending by the suppliers and site workers accounted for an additional 22 jobs and an additional \$1.2 million in local labor income per year. To date, the Truckee



Equipment-intensive construction on 102 Ranch project (Chris Segal, TNC, 2008).



102 Ranch in 2006, before restoration work, and after in 2009 (TNC).

River Project has supported an average of over 37 jobs and \$2.7 million in labor income to the local economy each year. These benefits will continue in future years, with projects being planned for two additional sites in the near future and other sites being evaluated for more restoration work.

Beyond these economic impacts, local communities are expected to benefit in the long-term from improved water quality as wetlands and native plants filter nutrients from the water; more flood attenuation as floodwaters spread out during high flows without doing damage elsewhere; added open space and recreation for kayakers, hikers, bikers, birdwatchers, and others; and enhanced educational opportunities for local students and recreational users.

Case example 4-2. Gerber Stew BLM Stewardship Contract in Southeast Oregon Aims to Improve Rangeland and Wildlife Habitat, Increase Forest Resiliency, and Reduce Hazardous Fuel Loads

BLM has the ability to enter into “Stewardship Contracts” to make forests and rangelands more resilient to natural disturbances. The contracts allow companies and communities to retain forest and rangeland products in exchange for services like thinning trees and brush or removing dead wood. Long-term contracts foster a public-private partnership to restore forest and rangeland health at a savings to taxpayers by allowing contractors to invest in equipment and infrastructure for making wood products or producing biomass energy.



Clearing juniper stands from riparian areas like Norcross Spring benefits the area’s wildlife populations.

The Gerber Stew Stewardship Contract was awarded in September 2004 to a firm based in Bend, Oregon to implement restoration treatments and projects in BLM’s Klamath Falls Resource Area. Western juniper is cut, burned and thinned to improve forest and rangeland health, and to reduce hazardous fuels as part of the National Fire Plan. Under the contract, forest-health projects generated timber that the contractor could use at local mills. The Gerber Stew Stewardship Contract provided an opportunity for BLM to meet restoration goals, while supporting timber utilization markets, reducing wildfire risk, and providing employment for local rural communities.

Economic Impacts of Restoration. To date about \$3 million has been spent on restoration work, providing \$300,000 of forest products to help offset the cost of this work. Activities have included hazardous fuel reduction, rangeland restoration, riparian/spring enhancement, wildlife habitat improvement, road improvement and obliteration, fence repair, biomass utilization, and forest health restoration. Rural and community benefits include employment opportunities, a substantial reduction in smoke emissions as a result of utilizing over 38,000 tons of biomass, restoration treatments on over 6,000 acres, and miles of road

improvement. The biomass material removed included fuel that was delivered to a power generation facility, clean chips that went to a product manufacturer for hardboard production, commercial sawlogs, and sawlogs used for a variety of landscape and household products. Forest and road restoration, logging activities, and processing of biomass from the Gerber Stew Stewardship Contract directly accounted for 12 jobs and over \$660,000 in labor income per year (salaries, wages, and benefits) in the local area. Spending by contractors and site workers accounted for an additional 10 jobs and an additional \$350,000 in local labor income per year. Combined, the Gerber Stew Stewardship contract is estimated to have supported 22 jobs per year in rural counties in southern Oregon and northern California for the eight years (2004-2011) and over \$1 million per year in local labor income.



Western Juniper trees used to make hardboard by a nearby mill.



Timber used for hog fuel sent to a nearby power generating facility.

Case example 4-3. BLM Blanca Wetland Restoration, Critical Habitat for Threatened, Endangered, and Sensitive Species, and Reliable Annual Contracts for Local Small Businesses in South-Central Colorado

For thousands of years, much of the San Luis Valley basin of south-central Colorado was made up of a series of lakes, marshes, and shallow playa basins that were integral to the lives of indigenous peoples. By the mid-1900s, the basins had dried up from the diversion of water sources for irrigation and became known as the “Dry Lakes.” In 1965, BLM began a series of wildlife habitat projects to restore some of the historic wetland characteristics and processes, and 9,600 acres of the former “Dry Lakes” area became known as Blanca Wetlands. BLM designated the Blanca Wetlands Area (BWA) as an “Area of Critical Environmental Concern” (ACEC) in 1991, due to its high importance for wildlife and recreational values. Today the BWA and the South San Luis Lakes system are managed by BLM to restore wetland habitat and provide wetland connectivity in the valley. BLM conducts wetland restoration activities across a 14,000-acre landscape, providing habitat to over 160 species of birds and 13 threatened, endangered and sensitive species, including bird, amphibian, fish, and plant species.



View of Blanca Peak (BLM).



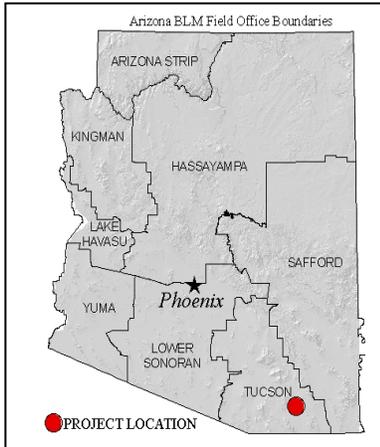
Blanca Wetlands 1968, pre- and post-restoration (BLM).

Wetland restoration in the BWA includes drawing water from an irrigation canal and a series of artesian wells and developing an infrastructure system of ditches and dikes to promote water movement through the area. BLM also has an active science program, collecting and analyzing a variety of data

to continually improve wetlands management. These activities have resulted in the restoration of over 200 playa lakes, ponds, and marshlands. This area that was once dry due to human-induced dewatering has now become a nationally significant migration and nesting area for many wildlife species, including Colorado’s largest breeding population of Western snowy plover. In FY 2011, BLM started investigating the possibility of enlarging the boundary of the ACEC to promote focused efforts toward wetland connectivity and restoration on a landscape scale.

Economic Impacts of Restoration. Restoration and monitoring activities in the BWA have been ongoing since the 1960s. Annual expenditures have been about \$75,000 (\$2011). Annual activities include site maintenance and infrastructure development, weed management, well certification, monitoring (to collect bird, amphibian, fish, macroinvertebrate, groundwater and water quality, soils, and vegetation data). These annual expenditures provide local firms with a reliable stream of work and support an average of over \$29,000 in local labor income (salaries, wages, and benefits) each year. Over the next 10 years, BLM anticipates increased expenditures on deferred maintenance for wells and structures. Economic impacts in these years could support as much as \$150,000 in labor income per year for local well drillers, welders, and heavy equipment operators.

Case example 4-4. Las Cienegas National Conservation Area Native Grassland Restoration



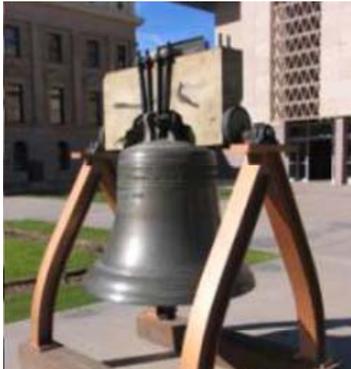
The desert grasslands found within the Las Cienegas National Conservation Area (LCNCA) include some of the rarest habitats in the American Southwest and are home to six endangered species. These grasslands have degraded over the last 100 years into mesquite woodlands due to grazing practices, fire suppression policies, and the introduction of non-native plant species. The loss of grassland has encouraged erosion, reduced watershed function, and decreased available habitat for pronghorn antelope and other species. In 2009 and 2010, BLM implemented a grassland restoration project on over 3,000 acres, out of an identified 20,000 acres of degraded grassland found within the LCNCA. The project has removed mesquite trees from the area, helping to restore habitat for pronghorn antelope and rare migratory and grassland birds. The project also helped to stabilize the regional watershed by increasing water infiltration and reducing

erosion. The project has also provided local communities the opportunity to use the biomass generated from the thinning process.

The LCNCA is an archeologically significant site. Prior to ground disturbance, BLM completed cultural resource surveys and inventories to comply with the National Historic Preservation Act. Nearly 10,000 acres were surveyed, identifying 53 new archeological sites and an additional 378 isolated artifacts dating as far back as 3,000 B.C. The newly identified cultural sites will be entered into the State of Arizona Cultural Resource database operated by the Arizona State Museum. Many of the archaeological sites are eligible for entry into the National Register of Historic Places. Following the flagging of all identified archeological sites, mechanical and hand removal treatments were used to remove mesquite



(Above) Grubbing a mesquite tree to restore native grasslands.
(Right) Pronghorn



A mesquite slab from the project site was provided to a contractor to replace the yoke for the Arizona Liberty Bell.

the flagging of all identified archeological sites, mechanical and hand removal treatments were used to remove mesquite

trees from the grasslands. The restoration resulted in the removal of nearly 1,500 tons of biomass through stewardship contracts and wood permits issued to the local public and local Native American tribes for firewood collection. Permits were also issued to a local mesquite mill that utilized otherwise unmerchantable root balls, trunks, and branches to create unique, hand-crafted furniture and household items.

Economic Impacts of Restoration. Project funding was provided by ARRA and averaged \$767,000 (\$2011) per year for the two years (2009-2010). Ten primary vendors were awarded contracts and multiple other local vendors provided sub-contract work, supplies and materials purchasing, equipment rental and repair, and fuel. Project expenditures directly accounted for 4 jobs and over \$330,000 in local labor income (salaries, wages, and benefits) per year. The emphasis on local

contracting resulted in an additional 6 jobs in the local area and an additional \$270,000 in local labor income per year generated through contractor expenditures. The project also employed a BLM youth hand crew to cut and spray mesquite on 196 acres of land. The college-aged youth were provided summer jobs working and learning about firefighting, land management, and conservation.

Case example 4-5. The Jaite Paper Mill Demolition in the Cuyahoga Valley National Park Removes a Human Health and Safety Hazard While Providing Engineering and Construction Jobs

The 24-acre Jaite Paper Mill site is located on a natural floodplain at the confluence between the Cuyahoga River and Brandywine Creek at Brecksville, Ohio. The Mill Site is immediately adjacent to the popular Ohio and Erie Canal Towpath Trail. Originally constructed in 1905, the Mill was operated continuously until 1984, by which time the size of the plant had grown to 180,000 square feet. In 1985, the Mill became part of the Cuyahoga Valley National Park. A fire in October 1992 severely damaged a large part of the plant. After this fire, the plant began deteriorating rapidly and became increasingly dangerous to park staff and visitors. The demolition and removal of the Mill was intended to eliminate a human health and safety hazard and to restore



Demolition of mill building and fugitive dust abatement (NPS).



the site back to a natural, visitor-friendly area.

The project involved demolishing and removing all above-ground materials, including concrete, metal, wood, and glass. Mitigation work was needed for lead paint and asbestos-containing materials, including the active control of fugitive dust during demolition activities. Certain historical features were preserved so that the park can interpret the site for visitors in the future. These features include some railroad posts and a key part of the paper-making process, a

“fourdrinier” which dried the paper (see photo).

Economic Impacts of Restoration. The project was implemented by NPS with nearly all of the planning, engineering, and construction tasks contracted to an environmental engineering firm and local construction subcontractor. Planning for the project took approximately 2.5 years to complete with expenditures totaling \$600,000 (\$2011). Planning activities supported a total of 4 jobs per year and over \$535,000 (\$214,000 per year) in local labor income (salaries, wages, and benefits).

The actual demolition and removal fieldwork occurred during the spring of 2006 and took approximately three months to complete. Expenditures for the demolition phase totaled \$1.3 million (\$2011). The demolition directly supplied jobs for approximately 27 construction workers for the three-month duration and supplied over \$380,000 in labor income to the local economy. Salary spending and equipment purchases for the demolition project increased demand for products and services from local vendors and are estimated to have supported an additional 9 jobs and \$375,000 in labor income within the local economy during 2006.



South end of the mill site after the demolition was completed (NPS).

Case example 4-6. Largest Prairie Grassland Restoration Project in U.S. Leads to New National Wildlife Refuge and Local Economic Impacts, Including New Small Businesses

The Agassiz Beach Ridges landscape is located in the Red River watershed of northwestern Minnesota, and falls within the larger Prairie Pothole Region (PPR). The PPR has been identified as being responsible for producing 50-80 percent of the continent's waterfowl, while accounting for only 10% of the available breeding habitat. It is estimated that less than 1% of Minnesota's historic native prairie remains intact, with much of the remnant prairie scattered about in small clusters. Restoration of key sites within this landscape has been identified as the most important strategy to create a contiguous expanse of prairie/wetland mosaic and improve the ecological functioning of these systems.



The Glacial Ridge National Wildlife Refuge (TNC).

In the fall of 2000, The Nature Conservancy (TNC) purchased the 24,000-acre Glacial Ridge property near the town of Crookston, Minnesota. Native cover and the natural functioning of over 90% of the property (22,000 acres) had been degraded or eliminated, primarily through conversion to row crop agriculture, wetland drainage activities, and gravel mining operations. The purchase and subsequent restoration of this property will provide native habitat and connect nearly 7,800 acres of existing native prairie and wetland communities. The project will become part of a mosaic of protected lands in the area, connecting several other ownerships that harbor native plant communities. In addition to supporting wildlife, the project will help protect water quality levels for the nearby town of Crookston and will contribute to flood control along the Red River. TNC subsequently transferred ownership of the property to FWS, and the property now makes up the majority of the new Glacial Ridge National Wildlife Refuge (NWR). This Refuge was established in 2004 and has a planned final size of 37,756 acres.¹⁸ The Glacial Ridge restoration project has been identified by FWS as the largest tallgrass prairie and wetland restoration project in U.S. history.



A bulldozer fills a drainage ditch as part of a wetland restoration on the Glacial Ridge property (TNC).

Economic Impacts of Restoration. Restoration of the Glacial Ridge property began in 2001 and concluded in 2011. Through funding provided by over 20 partner agencies/organizations, including significant contributions from USFWS and USDA's Natural Resource Conservation Service, restoration and management activities brought substantial economic benefits to the surrounding rural counties in northwestern Minnesota each year over the course of this 11-year project. Yearly project expenditures averaged about \$2.2 million (\$2011). These expenditures directly supported 6 jobs in the local communities surrounding the property and provided nearly \$476,000 in local labor income (salaries, wages, and benefits) each year. In addition to these direct impacts, the Glacial Ridge project supported another 9 jobs each year, which provided an additional \$363,000 in local labor income. The Glacial Ridge project also supported the creation of new small businesses. Each year the project purchased over \$430,000 worth of native seed from local vendors. Four new seed supply businesses and a new seeding and mowing business were created to meet this substantial new demand for seed. Other local vendors have expanded as a result of the new demand, with two new seed storage sheds built at one company and new seed cleaning equipment purchased at another.

¹⁸ More information about Glacial Ridge is available on-line at <http://www.fws.gov/midwest/GlacialRidge/>

Case example 4-7. Ni-les'tun at Bandon Marsh National Wildlife Refuge: The Largest Tidal Marsh Restoration in Oregon Relies on Partnerships, Provides Construction Jobs, and Supports Local Businesses

Migrating shorebirds and waterfowl are so dependent on the food supply and stopover estuary habitat in the lower Coquille River that Congress established Bandon Marsh National Wildlife Refuge (OR) in 1983.¹⁹ Through congressionally approved expansion, acquisition, and donation, the Refuge now encompasses 889 acres and is composed of two units: Bandon Marsh and Ni-les'tun (named by the Coquille Tribe and pronounced NYE-les-ton, which means People by the small fish dam). Historically, Ni-les'tun was a diverse tidal wetland like Bandon Marsh, but was diked and drained for agricultural purposes beginning in the mid to late 1800s. Restoring 418 acres of tidal marsh has required FWS and its many partners to collaborate through more than a decade of planning, land acquisition, scientific study, and extensive engineering design.

Restoration Success: *Since restoration construction activity stopped last September, wildlife has responded to the return of the tides to Ni-les'tun. Probably the most obvious response has been by waterfowl, most spectacularly a flock of up to 500 green-winged teal are taking advantage of the channels and pools filled by the tides. Compared to prior to the restoration, there have also been persistent flocks of sandpipers, plovers, dowitchers, scattered Wilson's snipe, as well as a greater presence of great blue herons and great egrets (Oregon Coast National Wildlife Refuge Complex, Restoration Update, 12/8/11).*



High tide aerial view of the Ni-les'tun tidal marsh restoration project, Nov. 2011, two months after the project was completed (Roy Lowe, FWS).

Construction funding was from a variety of sources including: small grants and donations, ARRA, Oregon Lottery funds granted through the Oregon Watershed Enhancement Board, and about \$1.35 million from the New Carissa oil spill NRDAR settlement.²⁰ With a total of about \$10 million of investment, the restoration of the twice daily tidal flush is now helping to rebuild a natural estuary foodchain, including an array of fish and birds that had sustained native tribes for thousands of years. The Coquille River's Chinook and Coho salmon runs will benefit from the habitat restoration. Local regional and national visitors are anticipated to visit the marsh to experience wildlife through hiking birdwatching, and waterfowl hunting.

Over two dozen public and private partners were involved in the restoration. Ducks Unlimited (DU), oversaw the design and construction of the restoration. Planning began 2001; construction began in 2009 and was completed in 2011. The final design included the removal of 6,700 feet of levee and three tidegates, construction of setback levees and a tidegate to protect neighbors, filling 15 miles of drainage ditches, removing 3,500 feet of old farm roads, excavating 4.5 miles of sinuous tidal and stream channels, installing large woody debris for fish habitat and planting native vegetation. The project included the restoration of 11 acres of freshwater wetlands, and stream channel and fish passage improvements. FWS also coordinated with Coos-Curry Electric Cooperative to relocate major electric utilities from above

¹⁹ More information about the Bandon Marsh NWR is available on-line at <http://www.fws.gov/oregoncoast/bandonmarsh/restoration/index.cfm>

²⁰ More information on the New Carissa Oil Spill is available on-line at <http://www.fws.gov/oregonfwo/Contaminants/Spills/NewCarissa/>

ground where they would pose a flight hazard to birds, to 40 feet beneath the river bottom. FWS, the U.S. Department of Transportation, and Coos County worked together to raise and repave the adjacent county road to improve safety and prevent tidal flooding.

Archeology was a very important design factor on this site. FWS directed that all construction would proceed with caution, and DU worked with tribal and contract archeologists and the State Historic Preservation Office to ensure that designs were compatible with cultural resources onsite. FWS instructed construction workers to keep an eye out for anything that archaeologists might want to investigate, and to stop work until they did. During the restoration, the construction unearthed evidence that powerful earthquakes and sands washed in by tsunamis had dramatically and repeatedly altered the landscape. They also found clues that humans occupied the area before and after those cataclysmic events, uncovering living sites, tools and shells dating back more than 4,000 years.

Economic Impacts of Restoration. As the largest tidal marsh restoration in Oregon to date, an extensive amount of work was coordinated with FWS and designed, engineered, constructed, and contracted by DU. Expenditures for the tidal marsh restoration portion of the project were about \$31,000 annually during the planning phase (2001-2009) and \$700,000 annually during the contracted implementation phase (2010-2011), accounting for a total restoration cost of \$1.64 million (\$2011). Of these costs, an average of \$98,000 annually went directly to local labor income (salaries, wages, and benefits) to employee construction workers in Coos County during the implementation phase. An additional \$165,000 annually went directly to scientists and project managers working within the state. Restoring the marsh was equipment intensive and required over \$970,000 in materials, which were rented and purchased from businesses in Coos County. These purchases supported local equipment rental, rock quarry, and greenhouse businesses, indirectly providing 5 jobs and \$190,000 in labor income annually in the county. In total, the project provided over \$1,130,000 in labor income over the life of the project.



Channel digging (Roy Lowe/FWS).

Case example 4-8. Conservation Easements in Connecticut Protect Habitat and Generate Local Income

Using funds from an NRDAR settlement, FWS obligated \$557,810 (\$2011) to TNC of Massachusetts for the purchase of permanent conservation easements on approximately 200 acres of riparian lands along the Housatonic River in Salisbury, Connecticut. Conservation of riparian habitat will help to: (1) protect water quality; (2) protect nesting habitat for migratory songbirds and other wildlife, including several rare and endangered plants, turtles, salamanders and dragonflies; and (3) maintain the scenic, agrarian character of the region. These efforts provide a beneficial tradeoff from the harm to the river and associated wildlife caused by historical polychlorinated biphenyls (PCBs) contamination.



Protecting a 13-acre property adjacent to the Housatonic River (FWS).

Economic Impacts of Restoration. From 2011 to 2015, it is anticipated that \$500,000 will be spent to purchase conservation easements. An additional \$58,000 will be spent to administer the easements, which includes identification, resource assessment, and management and restoration planning. These expenses will generate an average of \$12,000 per year in labor income (salaries, wages, and benefits) for local businesses, and will directly impact businesses providing management, technical service, and real estate consulting. Although insufficient information is available to estimate the economic impact of the easements on these private properties, it is generally expected that conservation easement purchases also will inject new money into the local economy. The sale of easements provides landowners with additional revenue, some percentage of which may be spent in the local economy, including purchasing new real estate, consumer goods, or services in the local area. In many cases, the sale of easements also allows farm owners to continue farming practices on their land. For example, for one of the easements in this case, the money will help the farmer continue to raise beef for local markets. The farmer's costs for equipment, supplies and materials will be spent in the local economy, thus supporting local businesses and local employment. Farm workers will also spend their salaries in the local economy, thus supporting further local employment. From a social perspective, conservation easements generate benefits for local residents, communities, and governments by protecting values associated with biodiversity and wildlife abundance, aesthetic beauty, local agriculture, and social and culturally significant features of landscapes and livelihoods.

Case example 4-9. Nesting habitat management program for the federally threatened piping plover

This case study illustrates that even modest restoration projects can provide benefits to the environment and local economy.

FWS provided \$130,000 (\$2011) over 2007-2011 to The Nature Conservancy of Rhode Island (TNC, RI) to implement a nesting habitat management program for the federally threatened piping plover, a shorebird that nests along sandy beaches on the Atlantic coast. The source of the funds was the NRDAR settlement for the North Cape Oil Spill. In 1996, the oil spill adversely impacted piping plover nesting habitat, resulting in fewer chicks produced during the following nesting season. To compensate for these impacts, natural resource trustees (FWS, RI, and NOAA) sought to increase the number of chicks produced in RI by providing funds to TNC to implement management actions aimed at reducing threats to piping plovers. At two nesting areas in Little Compton, RI, TNC staff conducted more than 70 public education programs to increase awareness about what people can do to reduce harm to piping plovers (e.g., keeping dogs off beaches, removing trash that attracts predators, staying out of nesting areas). Staff also monitored nesting beaches and informed recreational users about potential threats. Additionally, several predators (e.g., coyotes, skunks) known to consume adults and chicks, were removed from nesting areas. During five years with increased management efforts, piping plovers produced more chicks (108) than in the previous five years (80).



Piping plover on eggs (FWS).



TNC Saturday morning education program (TNC).

Economic Impacts of Restoration. The piping plover management program has supported three full time seasonal positions in Little Compton, RI each summer between 2007 and 2011. These positions have provided employees with quality experience in natural resource management and public education, and brought over \$32,000 per year in direct labor income (salaries, wages, and benefits) to the local area. Much of this income was spent within the local economy, and supported an additional \$9,000 in labor income for local businesses. This case study demonstrates how even small investments in restoration can support jobs in local communities. The average yearly cost of the program was \$32,000, and these expenditures supported over \$41,000 per year in labor income in the local community.

CONCLUSION

Restoration, rehabilitation, remediation, and reclamation activities play an important role in maintaining the health and vitality of DOI lands and managed resources. The Department's commitment of human capital and financial resources for these activities is substantial. Analysis by USGS demonstrates that investment in restoration supports many jobs and contributes extensively to local economies. Interior's investment is leveraged through federal, state, local, non-governmental, and private partners, who have been critical for funding, implementing, and monitoring the quality and quantity of DOI-related restoration projects. Ecosystem monitoring and adaptive management help ensure that lessons learned are integrated into ongoing and future decision making at Interior.

While there are numerous and compelling restoration success stories, some of which are described in this chapter, challenges remain. Clearly, Interior's land holdings and natural resource responsibilities are vast. While the Department has inventory and monitoring programs, resource conditions are often dynamic and the baseline conditions needed to quantify improvements from restoration are not always known. Further, restoration science is still evolving for many resources. Physical measures of restored stream-miles or acres are valuable indicators of restoration success, but they do not easily facilitate quality comparisons for future decisions. Interior's scientists and managers are actively working on the development of improved endpoints and more meaningful criteria for measuring restoration success.

Although there is an increasing understanding of ecosystem services through a number of federal and departmental efforts, there still tends to be a disconnect between restoring natural resources and restoring the benefits to the public derived from these resources, which can affect the goals, planning, and outputs of scientific study. Relevant, high-quality scientific outputs are critical inputs for economic analysis. Even with relevant science, though, the total benefits from restoration can be difficult for economists to quantify and value. While the jobs and economic contributions from restoration are substantial and important, they do not represent the full economic value of ecosystem restoration, because they do not capture the net benefits associated with environmental goods and services not bought and sold in markets. As discussed above, there are methods to estimate the total economic value of restoration. Making the effort to include non-market benefits is an exercise worth carrying out, with precision and rigor where feasible. Looking forward, developing well-established, tangible values for the resources and associated services under Interior's trust would help ensure that the public's benefits are maximized from investment in DOI restoration activities.

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