Chapter 3 INVESTING IN CONSERVATION

INTRODUCTION

Investments toward the conservation of landscapes provide benefits to society in the form of species and habitat protection, maintenance of working landscapes, the provision of ecosystem services (such as clean water, timber, fisheries habitat, and carbon sequestration), and activities, such as tourism, outdoor recreation, and cultural observances. Economics can help measure the value of these benefits to humans, and prioritize investments in conservation to utilize constrained budgets to obtain the greatest value for society. This chapter discusses several economic issues related to land conservation including measuring the value of conservation, evaluating conservation investments, targeting investments, the relationship between land values and conservation, and options for land acquisition.

In a nutshell

- Conservation investments provide value to society in terms of species and habitat protection, maintenance of working landscapes, the provision of ecosystem services, and human use benefits.
- Economic techniques allow the benefits and costs of conservation investments to be represented in monetary terms, enabling comparison across locations or projects in a common metric.
- Such calculations can provide valuable information to evaluate, target and prioritize land acquisition decisions or other conservation activities.

CONSERVATION INVESTMENTS AT DOI

Governments and private organizations around the world invest in conservation efforts through the establishment of biological reserves and other protected lands. The Department of the Interior (DOI or Interior) supports conservation efforts through public land and water resources administered by the Fish and Wildlife Service (FWS), the National Park Service (NPS), the Bureau of Land Management (BLM), and the Bureau of Reclamation (Reclamation). These areas provide opportunities for recreation visitors and support conservation of natural resources and wildlife habitat.

The FWS administers Federal biological reserves in the United States, including the National Wildlife Refuge (NWR) system and Waterfowl Production Areas (WPA). These areas are intended to conserve fish, wildlife, and plant resources as well as their habitats; and are home to more than 700 species of birds, 220 species of mammals, 250 reptile and amphibian species and more than 200 species of fish. Many of these areas also support habitat for threatened and endangered (T&E) species, with 59 NWRs established with the primary purpose of conserving T&E species. Human uses are also

Mission of the National Wildlife Refuge System: *To 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. The Refuge System is estimated to have received 45.4 million visits in 2011.*

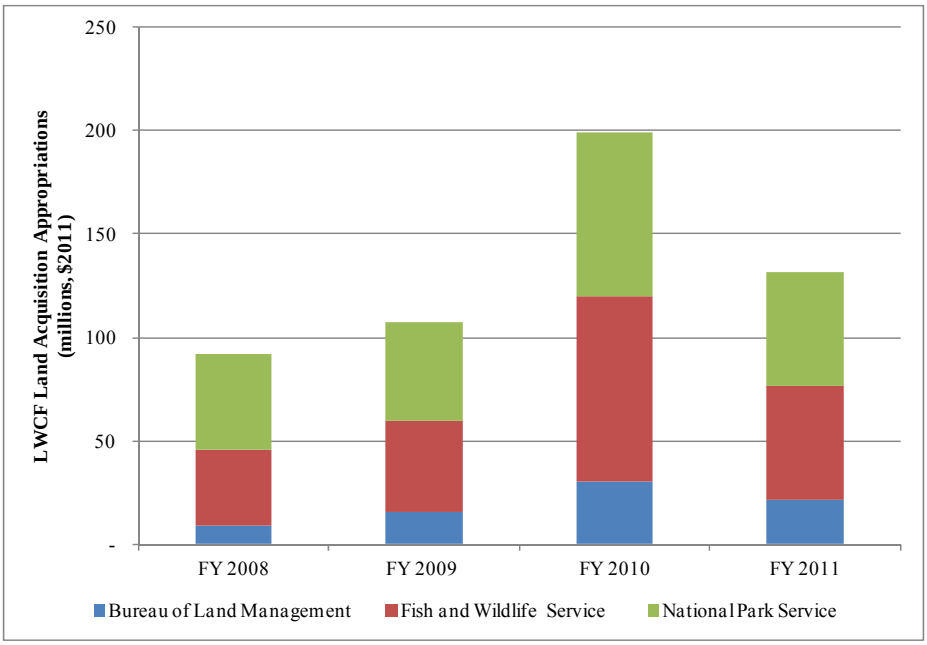
important to these areas, including hunting, fishing, wildlife observation, photography, environmental education, and interpretation. An estimated 45.4 million recreationists visited NWRs in 2011.

The BLM supports conservation efforts through its National Landscape Conservation System (NLCS), which designates certain areas of BLM lands to be specially managed to enhance conservation. The mission of the NLCS is to "conserve, protect, and restore nationally significant landscapes recognized for their outstanding cultural, ecological, and scientific values."

The NPS also supports conservation efforts with lands "which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

One of the primary ways Federal land management agencies can expand conservation efforts is through additional land acquisition. The Land and Water Conservation Fund (LWCF) is the principal source of funding for federal public land acquisition. The LWCF Act of 1965 was established to help provide additional public lands that are accessible for outdoor recreation (Vincent 2010). Figure 3-1 shows Interior LWCF appropriations for land acquisition from FY2008 through FY2011 (all values have been converted to 2011 US$, totals do not include Forest Service funding or LWCF funds not used for land acquisition).

Figure 3-1. Interior LWCF Appropriations for Federal Land Acquisitions, FY 2008 - FY 2011



The Migratory Bird Conservation Fund (MBCF) provides funding for FWS land acquisition programs to purchase waterfowl habitat in major migratory bird conservation areas and WPAs. One of the major sources of funding for the MBCF is the sale of Federal Duck Stamps, which are required to hunt migratory waterfowl and can be used for admission to NWRs. In FY 2010, $27,085,599 of MBCF funding was disbursed for the acquisition of land and interests in land totaling 15,083 acres at major migratory bird conservation areas, and $23,857,203 for land and interests in land totaling 28,039 acres at WPAs.

DOI bureaus also provide funding for conservation efforts through a number of grant programs directed to states, territories, local governments, and individuals. For example, the FWS supports conservation though Coastal Wetlands Conservation grants, Cooperative Endangered Species Funds, the Multi-State Conservation Grant Program, and a number of other conservation grant programs. The NPS also provides grant funding for several natural and historical conservation programs.

The Department of the Interior and the U.S. Department of Agriculture have developed a land acquisition program that supports strategic interagency landscape-scale conservation projects while continuing to meet agency-specific programmatic needs. Under the Collaborative Landscape Planning (CLP) effort, Interior bureaus collaborate with the U.S. Forest Service to coordinate land acquisition planning with government and local community partners to achieve the highest priority shared conservation goals more effectively. The CLP process is designed to: use the LWCF to incentivize collaborative planning for measurable outcomes at the landscape scale; invest LWCF resources in some of the most ecologically important landscapes; and invest in projects that can reach shared goals grounded in science-based planning, are driven by and responsive to local community initiatives, and will make the most efficient use of federal funds.

DOI has made funding available for adaptive management efforts including Landscape Conservation Cooperatives (LCCs). Established in 2010 by Secretarial Order 3289, LCCs are a network of public-private partnerships that provide shared science to ensure the sustainability of America's land, water, wildlife and cultural resources. The 22 LCCs collectively formed a national network of land, water, wildlife, and cultural resource managers, scientists, and interested public and private organizations—within the U.S. and across international borders—to share a common need for scientific information and interest in conservation. FWS provides staff support for the majority of the LCCs, along with Reclamation, BLM, NPS, USGS, and the U.S. Forest Service (USFS). Other federal agency involvement includes the U.S. Environmental Protection Agency (EPA), Department of Defense, Natural Resources Conservation Service, and the National Oceanic and Atmospheric Administration (NOAA). The LCC Steering Committee is the principle leadership body for the LCCs, which are led or co-led by a wide variety of organizations, including state fish and wildlife or natural resources agencies, federal agencies, and Canadian provinces. States or territories are involved in all 22 LCCs.

Other DOI investments that support conservation efforts include science research, fish hatcheries, and conservation management activities. One recent effort is on-going climate research led by USGS which addresses carbon sequestration and other aspects of climate science. DOI conservation efforts also include activities involving ocean issues and invasive species. For example, Interior played an important role in the development of the recently released National Ocean Policy Implementation Plan, as a key member of the National Oceans Council.[9] The National Invasive Species Council (NISC) works to

[9] The draft implementation plan is available on-line at: http://www.whitehouse.gov/sites/default/files/microsites/ceq/national_ocean_policy_draft_implementation_plan_01-12-12.pdf.

ensure that that Federal programs and activities to prevent and control invasive species are coordinated, effective and efficient.[10]

ECONOMIC VALUE OF CONSERVATION

The benefits provided by conservation are often measured in terms of the values they have to humans. Although these benefits are often difficult to quantify, techniques exist to estimate their value in monetary terms. Benefits obtained from conservation include stocks of natural capital (materials that exist at one point in time) and flows (services that are provided from the natural capital stock over time). Stocks of natural capital include resources such as minerals that can be depleted permanently and trees that are replenished slowly over time. Natural capital also produces a flow of benefits over time including water, air and climate regulation; nutrient cycling; cultural uses; and recreation opportunities. The human use of natural capital can affect stocks and flows of benefits provided over time.

Conservation investments can also contribute to local economies by providing employment opportunities and additional economic output (though these measures are not metrics for economic value). These metrics can be very important to communities, particularly in a difficult economic climate. While economic contribution analysis can provide useful information on the distributional, employment and output impacts of a policy or program, investment decisions are typically made based on net economic benefits, i.e., estimates of *net returns* to capital invested, which contribution analysis ignores. Net economic value analyses can take the form of benefit-cost analysis, which measures both benefits and costs in monetary terms, or cost effectiveness analysis, which expresses costs in monetary terms and conservation benefits in biological or physical units. It should be noted that benefits from conservation investments can include not only environmental benefits, but also human use benefits including recreation and cultural benefits.

Conservation lands managed and acquired by DOI serve many important biological and ecological functions such as the production of plant and animal species, provision of clean water, carbon storage, and scenic amenities. Many studies have estimated values for ecosystem services at specific locations (see Box 3-1 for an example of grassland conservation in the Prairie Pothole region). Many factors can affect biological and ecological functions such as climate change, pollution, and changing land uses. These factors in turn can affect the conservation values and the net economic value of conserved lands. Additional research into the value of ecosystem services provided by conservation lands could provide much needed information to policymakers when considering future public land acquisitions.

The natural amenities supplied by conservation lands and open space also provide benefits to nearby landowners and residents. Previous studies have shown that natural amenities can lead to increased migration to surrounding localities (McGranahan 1999, McGranahan 2008, Deller et al., 2001). Natural areas have also been shown to increase the property values of surrounding home owners. For example, a recent study showed a significant impact on the value of homes located near National Wildlife Refuges in certain areas of the country (Box 3-5 for additional details).

[10] See Chapter 4 in the FY 2010 DOI Economic Contributions report for more information on the economics of invasive species that affect Interior resources.

Box 3-1. Economic Value of Grassland Conservation in the Prairie Pothole Region

The prairie pothole region (PPR), located in the north central United States and south central Canada, is a grassland ecosystem interspersed with wetlands that were created by receding glaciers during the last ice age. This unique ecosystem supports abundant wildlife, including a significant population of waterfowl, garnering it the nickname the "Duck Factory." However, agricultural uses in the area have led to wetland drainage throughout the region over the years. Conservation efforts have been undertaken by government and private interests in recent years in an attempt to maintain habitat for waterfowl production.

USGS researchers and collaborators recently developed estimates for the value of ecosystem services provided by the PPR in North and South Dakota (Gascoigne et al., 2011). The study used benefit transfer techniques to estimate values for three ecosystem services (carbon sequestration, reduced sedimentation, and waterfowl production), and compared these values across different scenarios of future land use change. Land use changes considered include different levels of native prairie conversion and enrollment in the Conservation Reserve Program (CRP) and Wetland Reserve Program (WRP), which provide financial assistance to farmers that voluntarily enroll to provide resource-conserving cover on cropland or maintain wetlands on their property.

The analysis considered four scenarios that simulate different levels of conservation, from aggressive conservation of native prairie to extensive conversion to cropland. The results showed that an aggressive conservation program with protection of native prairie and increased mitigation investment would lead to over $1 billion in net societal benefits over a 20 year period. Carbon sequestration would make up the largest part of this benefit, followed by waterfowl production. Other scenarios indicate that native prairie conversion to cropland would result in a net cost of around $3.4 billion over the 20 year period. These results show the net value that grassland conservation can provide to society from just a select set of ecosystem services. In addition, the analysis provides an example of how economic methods can be used to help decision makers compare different policy alternatives with respect to the net benefits they provide to society.

Northern Pintail Drake in the Prairie Pothole Region of South Dakota (USGS)

Conservation efforts also protect natural assets that support human uses of natural resources. Recreation use is significant at many conservation areas managed by DOI. In 2011, more than 434 million people visited DOI lands. Recreationists receive benefits from these activities beyond their expenditures to participate in the activity. However, recreation and other environmental amenities are not traded in markets, so the tools used to measure the value are referred to as non-market valuation methods. These methods use data from related markets (revealed preference methods) or information from surveys of the public (stated preference methods) to estimate values for environmental goods and services. Some revealed preference methods include travel cost models, hedonic pricing methods, and averting expenditures. Stated preference methods include contingent valuation and conjoint analysis. Benefit transfer techniques are also often used to apply estimates from previous studies to new situations when additional primary research is not feasible.

Methods used to value environmental goods and services

- *Travel cost:* Uses costs of travel and time to estimate values for environmental goods and services.
- *Hedonic pricing*: Imputes values by decomposing market prices into components encompassing environmental and other characteristics (often used for property values or wages).
- *Averting behavior*: Estimates the value of environmental attributes by analyzing expenditures to change behavior to avoid decreased environmental quality.
- *Contingent valuation*: Survey-based method that asks individuals how much they would be willing to pay for environmental goods based on hypothetical scenarios.
- *Conjoint analysis*: Survey-based method that asks individuals to make trade-offs between different alternatives, and uses these responses to value different attributes.
- *Benefit transfer*: Applies an existing value estimate to a new application that is different from the original one (either as a point estimate or a function).

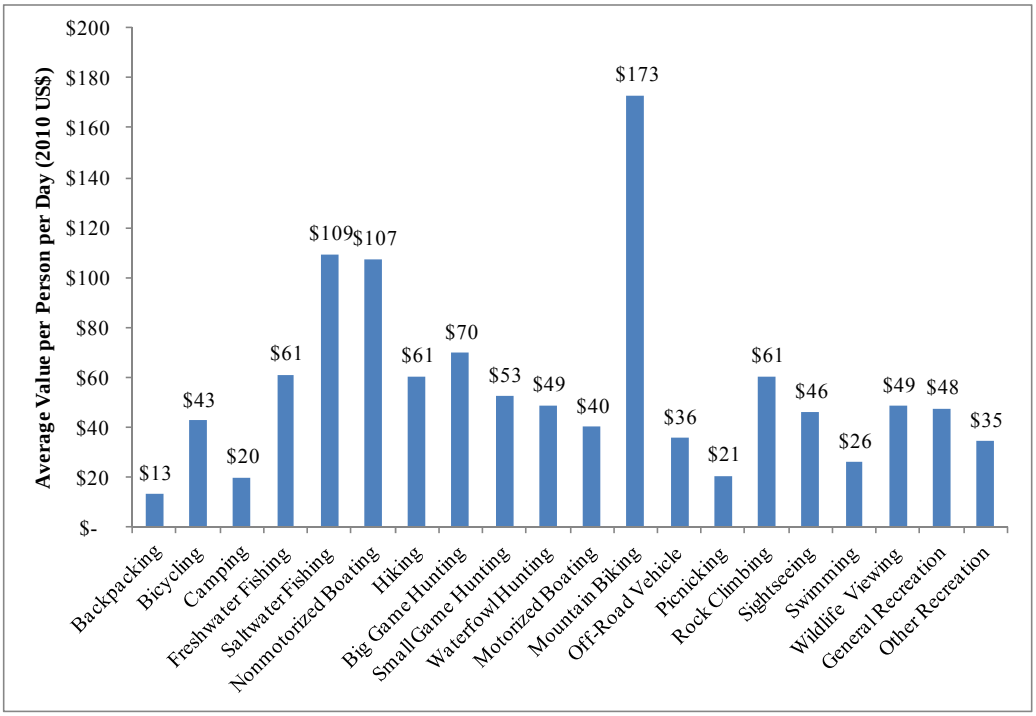
Several reviews of the recreation economic valuation literature have been completed over the years including an on-going effort at Oregon State University. In addition, a new NPS study is currently being finalized that estimates the net economic value of visitation to National Parks (see Box 3-2 for additional details). Figure 3-2 shows mean estimated "use" values for a variety of different recreation activities for studies completed in the United States and Canada between 1958 and 2006 (all values have been converted to 2010 US$). These values range from $13 per person per day for backpacking to $173 per person per day for mountain biking. These values differ from expenditures on recreation activities in that they represent values to individuals over and above expenditures. Many studies have also been conducted to estimate these values for specific recreation sites and recreation uses using a variety of economic analysis techniques (see Box 3-3 for an example related to coral reef recreation).

Box 3-2. Economic Value of National Park Service Visitation

The National Park Service (NPS), together with researchers from the University of Montana, is currently finalizing a study that estimates the economic value of NPS visitation. The net economic value (NEV) of visitation is the monetary value of visitation that exceeds the costs that individuals incur to visit national parks, national monuments, national historic sites, and other units of the National Park system. This study uses data from NPS units where visitor surveys have been conducted to estimate site-specific NEV per visitor trip, and then extends these estimates through meta-analysis to most units of the System (359 of the 397 units currently in the System). These per trip values are then applied to annual visitation data to estimate the total NEV for each unit included in the analysis. A peer-reviewed report with detailed descriptions of the data, methods, and results is expected to be released in 2012.

Denali National Park (NPS)

Figure 3-2. Average Net Economic Value for Outdoor Recreation Uses (2010 $)



Source: Oregon State University, Recreation Use Values Database (http://recvaluation.forestry.oregonstate.edu)

Box 3-3. Coral Reef Conservation

Coral Reef at Palmyra Atoll National Wildlife Refuge (USFWS)

Some conservation efforts at DOI help to protect coral reefs in the Pacific, the Caribbean, and off the coast of Florida. In addition to the Department's role as the co-chair of the U.S. coral reef task force, which leads U.S. government efforts to preserve and protect coral reef ecosystems, several other bureaus are also involved in coral reef conservation activities. Among other activities, the U.S. Fish and Wildlife Service manages 16 National Wildlife Refuges that help to conserve coral reef ecosystems in the Pacific, Caribbean, and in the Florida Keys (USCRTF 2009). The Environmental Studies Program at the Bureau of Ocean Energy Management (formerly the Minerals Management Service) has conducted monitoring and research on coral reefs in the Floral Garden Banks National Marine Sanctuary, and on corals on man-made off-shore structures. The National Park Service is involved with monitoring, inventory and management of coral reef resources in ten National Park units with coral reef resources in Hawai'i, Guam, American Samoa, the U.S. Virgin Islands, and south Florida. The Office of Insular Affairs conducts a number of programs and administers grants related to coral reefs in U.S.-affiliated insular areas. The U.S. Geological Survey conducts a number of research efforts and mapping projects related to coral reefs (see the USGS Coral Science Plan for more information).

Coral reef resources provide economic value in terms of a number of different ecosystem services. A recent report by Conservation International summarized a number of studies estimating the economic value of several of the ecosystem services provided by coral reefs and related resources including tourism, fisheries, coastal protection, biodiversity, and carbon sequestration (Conservation International 2008). Some of the studies surveyed have attempted to measure the economic value of coral reefs in the United States and its affiliated areas.

Human uses can make up a large component of the economic value of coral reefs. Recreational activities such as snorkeling and SCUBA diving provide value to local users and visitors to the area. For example, one study in the Florida Keys used a travel cost approach to estimate the average per-person economic value for snorkeling trips at $481 (Park et al., 2002).

INVESTING IN CONSERVATION

Evaluating Investments

Given limited budgets for additional land acquisition, it is important to consider the best way to prioritize future investments. Determining the goals to be achieved in land acquisition is a key first step in the prioritization process. Economics can then be used to help inform these prioritization decisions to get the best return on investments.

Currently, many organizations set their priorities for conservation investments by solely assessing the expected benefits (Polasky 2008). However, in order to get the greatest return on investment, it is important to consider *both* benefits and costs of conservation efforts. A number of studies have shown that selecting sites based on return on investment (ROI) calculations can result in greater conservation benefits than when considering benefits or costs alone (Murdoch et al., 2010, Polasky et al., 2001, Ando et al., 1998).

ROI for conservation applications is generally defined as the increase in the conservation objective per unit cost of the conservation action (Murdoch et al., 2007). ROI is measured as the benefits obtained by an investment divided by the costs of the investment. As discussed above, benefits should be measured as the *value* of the investment, not the economic contributions the investment might provide to the community in terms of jobs or economic output. ROI estimates provide additional information beyond simple benefit-ranking systems, giving guidance on differential rates of investment in terms of benefits per dollar.

Identifying a clearly stated conservation objective that can be measured quantitatively is a key first step in evaluating the return on investment. It is possible to specify multiple objectives and devise a weighting system in cases where more than one objective is identified. However, as noted by Murdoch et al., (2007), specifying the objective is not a scientific matter and may be quite contentious. Absent a defined objective, it is impossible to determine the greatest return on investment for a given project.

The measurement of benefits obtained from the conservation actions is often difficult due to lack of appropriate data and monitoring. While traditional economic benefit-cost analysis measures both benefits and costs in monetary terms, several recent applications of conservation ROI analysis use physical measures of benefits (such as species conserved) in their ROI calculations (Murdoch et al., 2007, Newburn et al., 2005). Although the measurement of benefits in monetary terms allows for the comparison across different types of benefits (or multiple benefits), the use of physical measures can be appropriate if a single conservation objective is defined. ROI analysis using physical measures of benefits can be useful in situations where monetization of benefits is very difficult or prohibitively expensive.

Box 3-4. Conservation Banking

Conservation banking is a market-based approach to conservation of species and habitat used by FWS. A conservation bank is a parcel of land that has been restored or preserved as habitat for a specific species or suite of species and is then protected, managed, and monitored in perpetuity. The bank sponsor then sells their credits to those who need to mitigate or otherwise offset unavoidable impacts to the same species the bank protects. In some cases a bank sponsor reserves the credits for their own future projects rather than selling them to others; these banks are known as single user banks. Once credits are sold or otherwise traded, they are retired and when all credits are sold, the bank is closed and site remains as a perpetual preserve that is monitored and managed through funds from the endowment.

Conservation banking has proven to be a useful tool for accomplishing compensatory mitigation for impacts to federal and state protected species. Treating mitigation as a marketable good creates competition and takes advantage of economies of scale through aggregated offsets. FWS-certified banks are tracked in the Regulatory In-lieu Fee and Bank Information Tracking System (RIBITS) (http://geo.usace.army.mil/ribits/index.html).

On example of conservation banking is the Florida Panther Conservation Bank (FPCB), a privately owned 1,930-acre site located in Hendry County, Florida. The bank, established in 2008, is approximately 4.5 miles north of Big Cypress National Preserve and lies within Priority One (Primary Zone) Panther Habitat. The FWS uses a panther habitat suitability ranking system based in part on methods in publications by Swanson et al., (2005) and Kautz et al., (2006), adjusted by FWS to consolidate similar types of habitats and include the Comprehensive Everglades Restoration Plan water treatment and retention areas located in the panther's range. Through this methodology, FWS awarded FPCB 15,541.4 Florida panther conservation credits. During its first 4 years in operation FPCB sold about 74% of its credits (in 29 credit transactions) to state and local government agencies, developers and others in need of compensatory mitigation for the panther. Credits (Panther Habitat Units) currently sell sold for $750 to $1,500. FWS has approved a second bank and a third bank in the planning stages

Florida Panther (USFWS)

Incorporating costs into prioritization of conservation investments can result in significantly different decisions than if benefits are considered alone. For example, land costs can vary significantly from one area to another and may affect priority rankings. As noted by Polasky (2008), socioeconomic factors such as the rate of land conversion are also important in determining threats that affect expected benefits. Armsworth et al., (2006) also showed how land market dynamics can impact the effectiveness of conservation investments. Market feedbacks after conservation land purchases can lead to increased land prices in the surrounding area. When these high prices are a result of greater development demand, purchasers must make trade-offs between high cost/high threat parcels and low cost/low threat parcels. However, when prices vary based on changes in supply, conservation funds can be used to purchase lands in low cost/high threat locations, stretching limited budget dollars further. Conservation purchases can

also result in development being displaced into other local areas, potentially placing areas with higher conservation value in danger. Development can also increase in an area if the presence of conservation lands makes the area more attractive to other buyers seeking to capitalize on amenity values (Armsworth et al., 2006).

Targeting Investments

Conservation investments can be targeted to consider a number of different factors or to achieve different outcomes. The factors considered in targeting investments may depend on the objectives of the conservation program. Investments could be targeted based on conservation benefits achieved, such as environmental benefits or human use benefits. Categories of environmental benefits that are often considered in conservation projects include ecosystem services, natural amenities, and production of fish and wildlife. Targeting could also be focused on human uses. For example, prioritization of areas for land acquisition could take into account recreational or cultural uses. Location is another factor that could influence conservation investment. Certain areas could be targeted if current protected areas are fragmented by privately owned lands. Land prices in different locations could also influence land acquisition decisions for future conservation investments.

Targeted conservation investments in urban areas can provide high returns because of the large number of individuals that might value and use these areas. Box 3-6 provides information on conservation investments in the Anacostia watershed.

Options for Land Acquisition

As discussed earlier in this chapter, land acquisition is one of the primary ways that entities engage in conservation efforts. Therefore land acquisition costs are often the primary driver of the costs of conservation efforts. Management efforts that consider market factors that affect land prices, and consider different options for land acquisition during the planning process can help achieve conservation benefits at a lower overall cost.

The price of land can affect individuals' willingness to sell land or easements for conservation purposes. In the past, high land prices have placed pressure on owners of natural lands in many areas, creating a strong incentive for them to sell their land for development purposes. While relatively low land prices can create an opportunity to invest in land for conservation purposes, such investments must be balanced by the stream of anticipated benefits.

Market values of land can influence which areas are feasible for purchase and how many areas can be acquired in a given year based on funding levels. Land prices are generally determined by the current and potential future uses of the land. Market values of agricultural lands are linked to characteristics that affect productivity such as soil quality, slope, and access to water sources. In many areas, potential development prospects in the near-term can have a positive influence on land process. Distance from urban centers, uses of neighboring parcels, and development restrictions can all influence future land uses and land prices. These factors can vary across geographic areas.

Conservation easements are another way for private landholders, conservation organizations, and government agencies to maintain lands for conservation in perpetuity. Conservation easements are legally enforceable agreements between a landowner and a government or land trust that restrict

development and commercial and industrial uses on the property, while the landowner maintains ownership. The National Land Trust Census Report estimated that a total of 47 million acres were conserved by local, state and national land trusts in 2010 (Land Trust Alliance 2011). While the majority of Interior land acquisitions are fee simple (the government has full ownership of the property), some recent LWCF transactions have used conservation easements to protect land that remains private property. As of 2010, the FWS had 4.2 million acres under agreement, easement or lease (USFWS Division of Realty 2010).

A portion of the land held by FWS under conservation easements is managed as habitat conservation banks, which use the easements to protect habitat and realize conservation objectives. Conservation banks are a market-based approach to protect habitat for conservation purposes using conservation easements, and allowing for the transfer of credits to achieve mitigation or conservation goals while improving efficiency. Box 3-4 provides additional details about conservation banking efforts at FWS.

The consideration of market factors that affect land acquisition costs and different options for maintaining conservation lands can help managers to achieve the same conservation benefits at a lower cost. The use of this information along with estimates of the value of conservation benefits can help to prioritize future conservation investments.

Incentives may be able to help bring about land use patterns that achieve habitat objectives at lower cost. Incentives may also induce innovations in the production of habitat, in the techniques employed in managing land for commercial uses that allow habitat objectives to be met at lower cost, and in other measures that help protect and recover species. Land management techniques that make habitat conservation and other uses more compatible hold particular promise for reducing the costs of meeting conservation goals. Economists would typically focus on two principal objectives when considering the use of incentive mechanisms in the endangered species program: inducing private landowners to participate voluntarily in habitat conservation efforts, and reducing the economic costs of species and habitat conservation.

Box 3-5. Effect of National Wildlife Refuges on Home Values

Open space and natural areas provide amenities that are of value to nearby residents and visitors to the surrounding localities. One way these values are revealed is through increased property values of nearby homes.

Eastern Neck National Wildlife Refuge (USFWS)

A recent study examined how proximity to National Wildlife Refuges (NWRs) affects nearby home values (Taylor et al., 2011). Using confidential micro-level U.S. Census data, hedonic property valuation models were estimated to isolate the effect NWRs had on nearby home values, after controlling for other characteristics that affect the value of housing. The study's focus was on NWRs located in urban areas or the urban fringe within the continental United States because NWRs are more likely to have an effect if they are located in housing markets where open space is relatively scarce.

The analysis consistently found that properties within 0.5 miles of a NWR and 8 miles of an urban center were found to have a value differential of 4–5% in the Northeast, 7–9% in the Southeast, and 3–6% in the California/Nevada region. These impacts can also be represented in terms of "capitalized value," or the total impact on property values of the homes surrounding a NWR. Using the average impact for each region, the average capitalized value per NWR was estimated to be $8.7 million in the Northeast, $8.7 million in the Southeast, and $7.6 million in the California/Nevada region. The estimated capitalized values give an approximation of the enhanced property tax base that localities enjoy as a result of the NWRs. This is only one aspect of the value created through investments in conservation through the NWR system.

Box 3-6. Anacostia River Restoration

Washington, DC's Anacostia River—also known as the "forgotten river"— runs through some of the nation's poorest neighborhoods. The river was once a place where church members were baptized, children swam, and families picnicked. Over the years, it became a dumping ground for trash, toxics, and sewage, lined by highways and train tracks that cut off public access. A concerned citizen formed the Anacostia Watershed Society in 1989 to draw attention to the river. In the 1990s, this led to a growing partnership of local residents, interest groups, and multiple agencies, devoting millions of dollars, time, and technical expertise to restore and reclaim the watershed. In 2010, the U.S. Army Corps of Engineers and local partners released a restoration vision, identifying over 3,000 restoration projects to improve river health. In 2011, D.C. broke ground on one of the biggest investments yet—a $2.6 billion Clean Rivers Project that will eliminate nearly all combined sewer overflows to the Anacostia.

Last year, the Obama Administration identified the Anacostia River Watershed as a priority under the America's Great Outdoors initiative and the Urban Waters Federal Partnership. Both efforts seek to reconnect Americans to the outdoors and revitalize urban waterways in underserved communities. NPS is coordinating implementation by 11 federal agencies on over 50 projects, including installing rain gardens, restoring habitat, monitoring water quality, building trails, engaging youth, and cleaning up contaminants.

The NPS is largest federal landowner in the Anacostia watershed and the NPS has numerous projects underway to enhance the watershed. Last year, NPS hired roughly 300 youth and worked with 6,000 volunteers in the Anacostia East Park to rebuild eroded trails and to educate other youth about the local environment. NPS is also working with DC and Maryland to create the Anacostia Riverwalk Trail. When completed, 48 miles of trail will connect 16 waterfront neighborhoods to the park and the river. Residents and visitors will be able to walk and bike to the Fish Wharf, baseball stadium, Kingman Island, and National Arboretum, increasing visitation, jobs, and economic revitalization to local neighborhoods.

Other DOI bureaus are also active partners in revitalizing the Anacostia. USGS measures DC water quality, helping locate leaking sewers and observing and predicting tidal storm surges. They also created a geospatial mapping tool that includes data layers identifying each of the 50 federal projects, as well as demographic information to help guide future restoration efforts where the need is greatest. FWS tracks the impact of contaminants on fish in the river and helped transform one of the dirtiest urban streams in one of the poorest parts of D.C. The $2.7 million Watts Branch restoration project implemented by FWS and other partners now prevents 1,500 tons of sediment from entering the tidal river. By reducing erosion, partners are improving both water quality and habitat for eel, shad, and striped bass, along with herons, hawks, and owls.

Evaluating the economic benefits from restoring and enhancing urban habitat, greenspace, and river access is challenging—most environmental goods and services are not bought and sold in the market. However extensive research indicates that people value improvements to environmental quality and are willing to pay for such improvements, as may be reflected in increased property values (e.g., Lewis et al., 2008) or increased recreation use (e.g., Kinnell et al., 2006). Research also demonstrates that these environmental investments not only improve property values and boost local economies, but also improve public health (McInnis and Shinogle, 2009) and may provide an increased sense of community (EPA).

Before and after— 2011 FWS restoration on the Anacostia (FWS).

CONCLUSIONS

Land conservation plays an important role in DOI's mission. Investments in land conservation can include land acquisition as well as science research and other conservation management activities. These investments provide value to society in terms of species and habitat protection, maintenance of working landscapes, the provision of ecosystem services, and human use benefits.

The measurement of benefits from conservation investments can provide important information to policymakers for future decisions. Economic techniques allow the benefits and costs of conservation investments to be represented in monetary terms, enabling comparison across locations or projects in a common metric. Absent the ability to quantify benefits in monetary terms, physical measures of benefits (e.g., number of species conserved) can be substituted, where either measure of benefit can be used to calculate a return on investment. Such calculations can provide valuable information to evaluate, target and prioritize land acquisition decisions or other conservation activities.

Incentives, a key component of both development and conservation, are often best understood and evaluated through economics, which together with the other ecological and social sciences can improve our understanding of conservation implementation options.

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