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Economic Benefits of Land Conservation

*The conservation of natural lands and of working farms and forests can generate financial returns, both to governments and individuals, and create significant cost savings.*

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# Summary

Conserving natural lands, working farms and forests, and the creation of trails and parks are often viewed in terms of their costs. Yet these often generate financial returns, both to governments and individuals, and create significant cost savings to governments in the provision in services. Preservation projects can have a greater economic return than the money initially invested into the project.

This research is not meant to state that conservation is always good and development always bad. Nor is it meant to diminish the importance of the environmental reasons for conservation.

# Introduction

The conservation of natural lands and of working farms and forests can generate financial returns, both to governments and individuals, and create significant cost savings as well.

While this guide focuses on economic benefits, it is not meant to diminish the importance of the environmental and social benefits of land conservation.

Related guides at [ConservationTools.org](http://conservationtools.org) include:

* Environmental Benefits of Conservation
* Economic Benefits of Biodiversity
* Economic Benefits of Parks
* Economic Benefits of Trails
* Economic Benefits of Smart Growth and Costs of Sprawl

This guide presents an inventory of studies that quantify the economic benefits of land conservation and analytical tools for accomplishing the same. They are categorized by their content, recognizing that a number of the studies do not fit perfectly into one category or another. The heading of each section is the title of a study and is hyperlinked to the [ConservationTools.org](http://conservationtools.org) library listing where, in most cases, the study can be viewed or downloaded. For the few items that require purchase, a link to the web page where the item can be ordered is provided. The organization responsible for the study is given, followed by a summary of the key economic findings of the study.

# Outdoor Recreation and Tourism

Outdoor recreation, including hunting, fishing, hiking, wildlife watching and boating is big business. It brings day and overnight visitors to an area and communities reap the economic benefits when visitors buy meals and snacks, stay overnight in hotels, buy specialized equipment, lease land, and pay for travel costs. When a community protects its natural resources, it protects the reason outdoor tourists come to the community.

Tourism is Pennsylvania’s second-largest industry. According to the Pennsylvania Department for Community and Economic Development, Pennsylvania’s travel and tourism industry has a total economic impact of $32.9 billion annually on the state’s economy.  It provides 433,000 travel- and tourism-related jobs and $3.4 billion in state and local tax revenues.

## Pennsylvania’s Wildlife and Wild Places: Our Outdoor Heritage in Peril

*Written by Ben Moyer with funding provided by the Pennsylvania Wild Resource Conservation Fund, Pennsylvania Fish and Boat Commission, Pennsylvania Department of Conservation and Natural Resources and the Pennsylvania Game Commission*

* Wildlife is a multibillion dollar industry in Pennsylvania. Hunting, fishing and wildlife related recreation generates almost $6 billion a year for the state economy.
* The state’s forests and fields support 14 million hunting days and a billion dollars spent on related travel, equipment, lodging and food.
* The state’s rivers, lakes, creeks and ponds support 18 million fishing days, which bring $800 million into the state’s economy
* Wildlife habitat brings Pennsylvanians outside for 19 million days and a billion dollars spent of on wildlife watching and photographing.
* Poorly planned development and unchecked sprawl threaten the land that support wildlife related recreation. Sprawl consumes 350 acres per day and that pace may be accelerating. The sights, sounds, smells and experiences that distinguish rural Pennsylvania and bring Pennsylvanians outside to hunt, fish, and wildlife watch are being lost forever.

## Economic Impact of Pennsylvania’s Heritage Areas, 2008

*Heritage PA*

* State Heritage Areas are large geographic regions or corridors of the Commonwealth that span two or more counties. They contain a multitude of historic, recreational, natural and scenic resources of state and national significance that collectively exemplify the heritage of Pennsylvania. Through regional partnerships and public grassroots planning strategies, these resources are identified, protected, enhanced and promoted to strengthen regional economies through increased tourism, job creation and stimulation of public and private partnerships for new investment opportunities.
* This study details the direct and indirect economic impacts of tourism in of eight of the state’s 12 heritage areas in 2008. Visitors to these 8 heritage areas generated an estimated $255.8 million in direct sales, which supported 4,372 jobs. The total direct, indirect and induced effects of visitor spending were $416.9 million in sales.

## [2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation](http://conservationtools.org/libraries/1/library_items/1225)

*United States Fish and Wildlife Service*

The National Survey of Fishing, Hunting, and Wildlife-Associated Recreation provides the results of interviews with U.S. residents aged 16 and older on their 2011 fishing, hunting, and wildlife watching activities in the United States. It also provides some information on participation in wildlife recreation by those 6 to 15 years of age. In 2011:

* Amongst U.S. residents age 16 and older, 90.1 million people participated in at least one wildlife related recreation activity; 33.1 million fished, 13.7 million hunted, and 71.8 million participated in at least one type of wildlife-watching activity such as observing, feeding, or photographing wildlife. Of the 6-to-15-year-olds U.S. residents, 1.8 million hunted, 8.5 million fished, and 11.7 million wildlife watched. They spent $144.7 billion on their activities, which equated to 1 percent of the Gross Domestic Product.
* Expenditures by sportspersons for fishing and hunting totaled $89.8 billion, which is composed of $32.2 billion in trip-related expenditures, including food, lodging, and transportation; $43.2 billion in equipment; and $14.3 billion in other expenditures which include magazines, membership dues, contributions, land leasing and ownership, and licenses, stamps, tags, and permits.
* Wildlife watchers spent $54.9 billion, which is composed of $17.3 billion in trip-related expenses; $27.2 billion on equipment; and $10.5 billion on magazines and books, membership dues and contributions to conservation or wildlife-related organizations, plantings for the benefit of wildlife, and land leasing and ownership for the purpose of wildlife watching.

For historical data, see the [2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation](http://conservationtools.org/libraries/1/library_items/727) and the [2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation](http://conservationtools.org/libraries/1/library_items/147).

## State and National Economic Impacts of Fishing, Hunting and Wildlife-Related Recreation on U.S. Forest Service-Managed Lands

*Prepared by the American Sportfishing Association for the U.S. Department of Agriculture*

* Between 2000 and 2003, hunters, fishers and wildlife watchers traveling to U.S. Forest Service (USFS) managed lands specifically for those activities spent $1,697.4 million within 50 miles of the USFS unit. These expenditures included travel items (such as food, fuel, and lodging), and non-travel items (including souvenirs, ammunition and other hunting supplies, and entertainment). Hunters had $725.4 million/year in expenditures, anglers annually spent $708.9 million, and wildlife watchers added another $263.1 million in annual retail sales.
* In Pennsylvania, all three activities accounted for $9.5 million in annual retail sales.
* As these expenditures were spent and re-spent by businesses, additional economic impacts were created for state and national economies. Hunting, fishing and wildlife viewing on USFS lands supported 42,342 jobs and $194.0 million in annual federal income tax receipts.

## The Benefits to Business from Hunting and Fishing Excise Taxes

*Southwick Associates and Andrew Loftus Consulting on behalf of the Association of Fish and Wildlife Agencies*

* An excise tax of 10% to 11% on most fishing, hunting, and shooting-sports equipment products is dedicated to the Wildlife and Sport Fish Restoration programs, which are used for the maintenance and enhancement of America’s fish and wildlife populations. Abundant, sustainable fish and wildlife populations yield abundant and diverse hunting and fishing opportunities. Hunters and anglers respond to those opportunities by purchasing more hunting, fishing, and target shooting equipment.
* This tax shows how investing in conservation and rehabilitation projects that benefit game species, as well as nongame species, brings significant economic returns.
* Between 1970 and 2006, excise-tax collections for Wildlife Restoration averaged $251 million per year. Over the same period, hunters and shooters purchased an average of $3.1 billion (wholesale value) in tax-related items per year (all figures are given in 2009 dollars).
* Excise-tax collections and import duties on fishing equipment averaged $110 million annually between 1955 and 2006. During the same period, wholesale purchases of taxable fishing equipment averaged $2.3 billion per year.

# Working Lands

When productive farms and forests are haphazardly consumed by development, the agricultural and forest product industries that depend on these lands are hurt. The workers in these industries are hurt and the people who provide goods and services to these workers are hurt. If enough farmland in an area is converted to non-farm use, the farming communities lose to critical mass necessary to keep local farm-related businesses and hence the whole farm economy alive. Between 1982 and 2007, America lost 23,163,500 acres of farmland to development.

Nationwide, in 2007, farms produced $297 billion in agricultural goods. (2007 Census of Agriculture, United States Department of Agriculture) In 2011, the Pennsylvania Department of Agriculture reports that Pennsylvania farmers annually produce $6.1 billion in agricultural goods. The state’s agricultural industry also supports food processing, marketing, transportation and farm equipment industries, contributing a total of $61 billion to Pennsylvania’s economy.

Working forests are essential to a healthy environment, sustaining wildlife, cleaning our water and air, and mitigating climate change through carbon sequestration. They are also an economic resource, providing renewable natural materials. According to the American Forest & Paper Association, America’s forest products industry supplies about $175 billion worth of goods each year. The Pennsylvania Department of Agriculture reports that each year, Pennsylvania’s forests are responsible for $700 million in exports. Pennsylvania is the top producer in the country of export grade hardwood. In fact, forest products are second only to food as the state’s most exported product.

## Economic Benefits of Farmland Preservation: Evidence from the United States

*Agricultural and Resource Economics, University of Maryland*

* This paper explores how well farmland preservation programs provide the benefits their proponents state they do: food security and local food supply, a viable local agricultural economy, environmental and rural amenities, sound fiscal policy and orderly development.
* Food security and local food supply:
  + Consumers value the ability to purchase local agricultural products. Evidence shows that the sale of local farm goods is important to local economies and some type of public intervention is needed to ensure they are supplied.
* A viable local agricultural economy:
  + Some evidence has been found that farmland preservation programs can benefit the local economy and/or have no negative impacts relative to other economic development opportunities. A 2002 study found that communities that manage land for conservation purposes do not have lower employment growth rates, wage rates, and may have a slightly higher residential growth rate because of the draw of the amenities provided by the lands. Farmland and open space is a basis for tourism in many states.
  + Farmland preservation can signal a commitment to the farming industry that stimulates farm investment rather than waiting to sell out. Farmers are using preservation as a way to maintain a sustainable agricultural economy. A 2007 survey of farmers in four Maryland counties found that, over a five-year period:
    - Sixty six percent of farmers of preserved farms invested in their farm versus 55% of farmers of non-preserved farms. Sixty six percent of farmers of preserved farms attended at least one workshop to enhance their farming skills compared to 38% farmers of non-preserved farms.
    - Forty two percent of farmers said they wanted to use the money they received from preserving their farm for their farm operations. Eighteen percent used the money to finance their farming operations, 35% to reduce debt, 8% saved the money or invested it in their farm, 12% used it to fund their retirement instead of selling their land to do so, and some bought additional land or farming equipment.
  + A 2004 Delaware study found that 33% of farmland preservation participants used the funds to decrease mortgage debt, 15% to purchase additional land, and 15% to purchase farm equipment
  + A critical mass of farms may be necessary to support some sectors of a community’s industry, lending additional importance farmland preservation. For example, New Jersey does not offer the same level of extension services to dairy farmers that other states do because it does not have a critical mass of dairy farmers, and this lack of services can impact input costs and management quality.
* Environmental and rural amenities:
  + Research suggests that people clearly desire farmland preservation programs and express a willingness to pay for the environmental and rural amenities they provide.
  + The preservation of farms may sufficiently raise the property taxes of nearby homes to pay for the preservation of additional farms. This could, at least in the short-term, allow farmland preservation programs to be self-sustaining, though this may not be the case for rural or predominantly agricultural counties.
* Sound fiscal policy and orderly development;
  + The impact of preservation programs on development patterns is unclear. Some evidence shows that farmland preservation alone has limited impacts on concentrating growth, but combined with other policies may be able to direct development away from agricultural areas. The positive amenities generated by preservation may increase the demand for housing near the preserved farms, and create even more development pressure on other farms, especially in areas where there is a short commute to employment centers. An area that should be researched is whether farmland preservation programs shift development to forests.

## Evaluation of Potential Gross Income from Non-Timber Products in a Model Riparian Forest for the Chesapeake Bay Watershed

*Agroforestry Systems*

* The creation of riparian buffers in agricultural landscapes can improve water quality, but also take land out of productive agricultural use. However, using planting and harvesting techniques, such as those employed in indigenous systems of tropical agrogorestry, can create economic, as well as environmental benefits.
* The authors present a model where the harvest of non-timber products (fruits, nuts and ornamentals) can create a gross income of $60,934/ha/year.

## Community Benefits and Costs of Purchase of Agricultural Conservation Easements

*American Farmland Trust for the United States Department of Agriculture, Natural Resources Conservation Service*

* The American Farmland Trust compared the costs of purchasing easements on two farms, one in Deerfield, Massachusetts and one in Berks County, Pennsylvania, to compare the cost and benefits of purchasing an agricultural conservation easement. The largest economic benefits of the easements were the purchases of local goods and services, employment and product sales.
* The benefits of the $44,000 Deerfield easement include:
  + $327,496 of local goods and services are purchased annually and a total local economic impact of the farm operation of $863,315.
  + In addition to the eased property, the farmer also leased 37.6 acres and actively farmed them. Without the eased property, which forms the core of the farm’s operations, it is likely that the other acres would not be used for agriculture. Neighbors benefited from the $10,790 in lease payments.
  + The prevention of $2,139 costs in soil loss due to erosion from residential development.
  + A net annual benefit of $82 in property tax revenue to pay for community services.
* The benefits of the $393,330 Berks easement include:
  + $133,964 spent annually at local businesses for goods and services for the farm.
  + $804/year in recreation benefits.
  + $2,107 in direct sales of farm products.
  + Local residents value their desire to have the farmland as part of their community at $49,466 for a five-year period.

## Forests at Work: A New Model for Local Land Protection

*World Resources Institute: Southern Forests for the Future Incentives Series*

* The economic benefits of working farm preservation include revenues from timber, recreation service, the avoidance of having to artificially replace the ecosystem services naturally provided by the forest, and the avoidance of development costs.
* The location of a preserved working forest can affect the amount of avoided costs of new development and the gain in property taxes from nearby lands that benefit from a protected area established in close proximity.
* Managing for timber, carbon sequestration, recreation and other ecosystem service revenues can, at a minimum, help cover the costs of ongoing management and pay for restoration activities. It could also generate a positive return per dollar spent. This is even more feasible if the working forest is located in newly developing areas, where land values are not as high.
* Utilizing conservation easements rather than fee simple purchases greatly reduces debt service payments and retains at least a modest stream of property tax revenues for the county.

## Why Save Farmland

*American Farmland Trust*

* Preserving farmland and promoting farmland best management practices has benefits both on the world market scale and for local economies. Ensuring food supply and continuing the preeminence of American agricultural products in a rapidly changing world market requires a careful strategy of farmland preservation.
* Agriculture has direct, positive effects on local economies through product sales, job creation, the use of support services and businesses, and the supply of lucrative secondary markets such as food processing.
* Conversion of farmland to residential lots puts a burden on local government budgets. Farmlands pay more in taxes then they require in services, while residential lands require more in services than they pay in taxes.
* Distinctive agricultural landscapes bring tourism dollars into communities.
* Farmland preservation paired with sustainable management practices protects the provision of ecosystem services. Without this protection, governments would have to pay to artificially replace the services naturally provided by the farmland.

# Urban Greenspace

Trees and green spaces in urban areas provide more than aesthetic benefits. Where there are trees, there are reduced energy costs, decreased stormwater treatment costs, increased property values, increased spending at stores, increased employee satisfaction, and lower health care costs through cleaner air and increased recreational opportunities. A healthy urban forest can produce long-term benefits that all residents can share.

## City of Pittsburgh, Pennsylvania Municipal Forest Resource Analysis

*Friends of the Pittsburgh Urban Forest*

* The 2005 City of Pittsburgh Street Tree Inventory data establishes a basis for a complete cost-benefit analysis of Pittsburgh's street tree program using new software developed by the USDA Forest Service called STRATUM, (Street Tree Resource Analysis Tool for Urban Forest Managers).  The analysis provides a dollar value for the environmental work provided by each tree.
* Pittsburgh's 29,641 publicly managed street trees provide cumulative benefits to the community valued at an average of $81 per tree annually, for a gross total value of $2.4 million annually. This is composed of:
  + Street trees provide shading and climate mitigation effects, reducing electricity and gas use by 2,227 MWh and 811,917 therms for a total savings of approximately $1.2 million, with a citywide average of $40.66 per street tree.
  + A 5,303 ton reduction in carbon dioxide, valued at $35,424 per year, for an average net benefit per tree of $1.20.
  + An air quality improvement provided by the street tree population from the removal and avoidance of air pollutants valued at $252,935 per year, with an average net benefit per tree of $8.53.
  + The interception of 41.8 million gallons of stormwater annually, for an average of 1,411 gallons per tree. The total value of this benefit to the city is $334,601 per year, or an average of $11 per tree.
  + Property value increases, aesthetics, and other less tangible improvements are valued at $572,882, for an average of $19.33 per tree.
* When the city’s annual $816,400 in tree-related expenditures are considered, the net annual benefit to the city is $1.6 million, or $53 per tree per year. Pittsburgh receives $2.94 in benefits for every $1 that is spent on its municipal forestry program.

## The Determinants of Neighborhood Transformations in Philadelphia, Identification and Analysis: The New Kensington Pilot Study

*Susan Wachter, The Wharton School, University of Pennsylvania*

* Starting in 1995, the New Kensington neighborhood of Philadelphia, PA was revitalized with street tree plantings, the planting of grass and trees on vacant lots, and the conversion to community gardens or side yards for adjacent homeowners. The goal was to improve the overall appearance and curb appeal of the community, to help stem population loss, attract new residents, and encourage reinvestment
* Improving vacant land led to as much as a 30% increases in the values of surrounding houses. New tree plantings increased the values of surrounding houses by about 10%. In New Kensington, this means a $4 million gain in property value through tree plantings and a $12 million gain through lot improvements.

## Quantifying Urban Forest Structure, Function & Value

*Urban Ecosystems*

* This paper reviews research concerning urban forest structure, function, and value, with emphasis on results from the Chicago Urban Forest Climate Project (CUFCP). During 1991, trees in the Chicago region removed an estimated 5575 metric tons of air pollutants, providing air cleansing worth $9.2 million.
* In Chicago, the $59 million in benefits from its trees in energy savings, air-pollution mitigation, avoided runoff and other benefits far outweigh the $21 million in costs of planting and maintenance (assuming a 30 year time period, 7% discount and 95,000 trees planted).
* Trees increase shade and lower summertime air temperatures. Mature trees reduce neighborhood wind speeds. So, increasing tree cover by 10%, or about 3 trees per building lot, will create an annual estimated savings of $50-$90 per lot.
* The length of time needed to pay back planting and maintenance costs varies with
* the species planted, planting location, and level of care that trees received. In Chicago, this period ranges from 9 to 18 years.

## Shade: Healthy Trees, Healthy Cities, Healthy People

*Georgia Urban Forest Council*

* Businesses that invest in trees realize far reaching and ever growing returns:
  + Trees increase a property’s value between 3 and 7 percent.
  + Shoppers will pay up to 11% more for products purchased in shops along tree-lined streets than they would pay for the same items in shops along treeless streets.
  + Strategically placed trees can reduce summer air conditioning needs by at least 50%.
  + Employers find greater employee productivity, satisfaction and retention at businesses located on properties with trees and other vegetation.
* By luring people outside, trees encourage increased physical activity. Studies suggest that attractive streetscapes and parks that include trees, can lead to an increase in physical activity.
* According to the American Lung Association, asthma costs our healthcare system over $50.1 billion annually and indirect costs from lost productivity add another $5.9 billion (<http://www.lungusa.org/get-involved/advocate/advocacy-documents/senate-EPA-FY2011.pdf>). Urban trees can lower health care costs associated with asthma and other pollution-related health problems by providing cleaner, safer air.
* Since the 1977 Clean Air Act overhaul, Atlanta has never been in compliance with ozone standards (as of this publication’s date of 2005). Cars are the main polluters; each day, Atlantans daily drive more than 100 million miles a day, causing the release of 264 tons of nitrogen oxides.
  + A 60% reduction in Atlanta’s natural tree cover between 1985 and 2005 means fewer air pollutants are filtered. There are fewer trees to cool the city’s temperature, and when pollutants are superheated by increased air temperatures, they become more volatile and more harmful. Preserving and increasing tree cover can mitigate some of the impacts of driving related air pollution.

# Open Space in General

Preservation of parks, forests, farms, stream valleys and trees increases the value of nearby houses, increases tax revenues, supports local businesses, decreases government spending through the natural provision of ecosystem services, decreases the cost of recreation, and creates jobs.

## Return on Environment: The Economic Value of Protected Open Space in Southeastern Pennsylvania

*Delaware Valley Regional Planning Commission and GreenSpace Alliance*

More than just pretty places, the preserved open spaces of southeastern Pennsylvania, (Bucks, Chester, Delaware, Montgomery, and Philadelphia counties), account for millions of dollars each year in savings, earnings, and avoided costs. Preserved open spaces contribute to local economies and property values, create savings on health care and recreation, and perform valuable ecosystem services that naturally improve the air we breathe and the water we drink. In Southeastern Pennsylvania, these economic benefits include:

* $16.3 billion added to the value of housing stock.
* $240 million in property tax revenue generated.
* $133 million in annual cost savings and economic benefits through not having to artificially replace the natural provision of six ecosystem services: water supply ($50.2 million), water filtration ($10.9 million), flood mitigation ($37.5 million), wildlife habitat ($16.9 million), air pollution removal (15.1 million), and the sequestration of carbon in yearly growth of trees on protected open space ($1.9 million).
* Nearly $577 million annually in benefits to residents who participate in recreational activities on protected open space (the value they would be willing to spend in the private market to participate in the recreational activities that they currently enjoy on protected open space.)
* $795 million in avoided medical costs from moderate to strenuous exercise that takes place on protected open space.
* $485 million in savings to businesses from avoiding productivity losses because of the physical activities their employees engage in on protected open space in the region.
* More than 6,900 jobs and $299 million in annual earnings from economic activities associated with protected open space
* $566 million in total annual expenditures associated with protected open space. This is composed of $174 million of spending associated with the management and maintenance of publicly protected open space, $206 million for agricultural sales associated with preserved farmland and $187 million, from tourist activity associated with protected open space.
* 3,100 agricultural jobs associated with protected farmland, which is 45% of the employment related to protected open space.
* $30 million per year in state and local tax revenue from economic activity occurring on or because of protected open space.

## The Impact of Open Space and Potential Local Disamenities on Residential Property Values in Berks County, Pennsylvania

*Richard Ready and Charles Abdalla, Penn State University*

This research project estimated the impact of different land uses on residential property values of 8,090 single family houses in Berks County, Pennsylvania. It was based on sale prices between 1998 and 2002.

* Within 400 meters of a house, open space had the most positive impact on house price, followed by large-lot single family residential land. Commercial, small-lot single family residential, and multi- unit residential were less desirable and the least desirable land use was industrial.
* Between 400 and 1600 meters away from a house, commercial land use had the most positive amenity impact, followed closely by large-lot single family residential housing. For open spaces, only government owned land and land protected by a conservation easement positively impacted residential property values.
* Within 400 meters of the house, open space with conservation easements are viewed less positively than open space without easements. This could be because this category includes agricultural conservation easements, and such land tends to be intensively managed, which may not be desirable to nearby homeowners. Easements are perceived as a positive amenity if the parcel is located between 400 and 1600 meters from the house.

## Return on the Investment From the Land & Water Conservation Fund

*Trust for Public Land*

* The Land and Water Conservation Fund (LWCF) was established by Congress in 1965. It designates a portion of receipts from offshore oil and gas leases into a fund for land conservation and recreation. The Trust for Public Land (TPL) conducted an analysis of the return on the investment of LWCF dollars for federal land acquisition at sixteen locations that received significant LWCF acquisition funds between 1998 and 2009.
* This research, published in 2010, found that every $1 of LWCF funds spent returns almost $4 in economic value. Using $537 million in LWCF funds, 131,000 acres of land were preserved. During the study period, these lands provide $2 billion in water quality protection and supply, flood protection, fish production, habitat provision, storm protection, carbon sequestration, grazing, aesthetics, pollination, dilution of wastewater, and erosion control.
* Additionally, the 10.6 million annual visitors to these areas spend $511 million in the surrounding local communities.

## The Economic Benefits of Land Conservation

*The Trust for Public Land*

This report brings together scientists, economists, and researchers from academia, government, nonprofits, and industry to summarize the best current studies, present new research, and to suggest areas for further inquiry into the economic benefits of land conservation. To show how a strategy of land conservation is integral to economic health, the report:

* Illustrates that parks and open space generate increased property tax revenue and yield a better return on investment than development:
  + The proximate principle states that the market values of properties located near a park or open space) are frequently higher than those of comparable properties located elsewhere. Higher property values lead to higher property taxes. Those revenues can be used to pay debt used to acquire, develop, or renovate the park and once the debt is paid, can provide additional funds to the community.
  + When open space is developed for homes, the taxes of existing residents increase because the cost of providing public services and infrastructure to the new development is usually higher than the tax revenue it generates.
* Reviews the economic benefits of farmland preservation, including maintaining viable local economies and protecting rural and environmental amenities:
  + Land preservation policies do not cause jobs in a community to shift from high to low wage positions. Wage rates are not affected by putting land into non-extractive uses versus multiple uses (including timbering).
  + Preserved farmland can increase the value of nearby houses enough to generate enough extra property tax revenues to enroll additional acres of agricultural land into the preservation programs.
  + While farmland is disappearing from some areas, there is still sufficient land within the country to ensure the nation’s food security. However, farmland preservation helps to ensure sufficient farmland to supply communities with locally grown produce and helps farmers improve their economic well-being.
  + Farmland preservation can signal a commitment to agriculture that stimulates the industry to invest and work to be successful rather than waiting to “sell out.”
  + Farmland preservation can help to ensure a critical mass of farms that may be necessary to protect the viability of a county’s agriculture, depending on the type of farming.
  + Agricultural preservation preserves the open space attributes and rural amenities that attract tourists and new residents to an area
* Shows how forest cover decreases the cost of treating drinking water:
  + For every 10% increase in forest cover in the source area (up to about 60% percent forest cover), treatment and chemical costs decrease by about 20%.
  + About 50 to 55% of the variation in water treatment costs are attributable to the amount of forest cover in the source area.
* Enumerates the economic value of urban trees, which improve air and water quality:
  + Air Quality: Urban trees reduce temperatures and have other microclimate effects, reducing costs energy costs. In Washington D.C., this annually saves residents $2.7 million and in Milwaukee, it annually saves residents $216,0000. They reduce ozone levels. Although the economic benefit of this is unknown, a 1997 study found that the cost of reducing a single part per billion of ozone through electric utility nitrogen oxides limitations is estimated at one-half to three-quarters of a billion dollars annually. Trees remove air pollutants, typically 11 g/square meter of canopy of ozone, particulate matter less than 10 microns, sulfur and nitrogen dioxide, and carbon monoxide. The annual economic value of this pollution removal, per hectare of canopy cover, is estimated $663 in Atlanta, $447 in Boston, $482 in New York, and $527 in Philadelphia.
  + Water quality: When a wooded area is developed, impervious surfaces block the absorption of rain water, and the tree canopy is no longer able to intercept rain before it hits the ground. For natural ground cover, 10% of precipitation runs off lands and into nearby bodies of water. When 75% is impervious surface, 55% of precipitation becomes run off. Parking lots and other paved areas have 98% runoff. Trees can reduce and delay peak flows after a storm, reduce the need for stormwater treatment facilities, and improve water quality. Reducing runoff is likely to save city residents millions per year.
  + Most pollutants enter water bodies from nonpoint sources, including runoff from agricultural lands, urban areas, construction and industrial sites, and failed septic tanks. More than a third of the country’s streams, lakes and estuaries are impaired by water pollution. Damage to streams, lakes, and estuaries from nonpoint source pollution was estimated to be about $7 billion to $9 billion a year in the mid-1980s, and more land has been developed since then.
* Examines the role of parks and open space in attracting businesses and affluent retirees:
  + In recent decades America’s industry has substantially shifted from traditional manufacturing to “smokeless” industries. Many of these smokeless industries are characterized as “footloose”, because they are not tied to material location, and can be more flexible with where they locate or relocate. They are seen as attractive to communities because they bring money into a local economy, but not the pollution often associated with traditional manufacturing industries. These companies often choose to locate in communities that offer a high level of amenities to employees as a means of attracting and retaining top-level workers. Parks, recreation, and open space are top-ranked amenities for a large majority of employees.
  + In a 5-year study of 174 small business owners who relocated to, expanded in, or launched in Colorado, quality of life was their main reason for choosing the area and small-business decision makers ranked the presence of park, recreation, and open space amenities as being most important factor in the measure of quality of life.

## Conservation: An Investment that Pays

*The Trust for Public Land*

This report is a review of the literature dealing with the economic benefits of creating parks, conserving working land, conserving land prone to flooding, and preserving the value of ecosystem benefits. It also discusses the costs of sprawl development. The following show the main benefits described in this paper, and some of the examples used:

Parks and preserved open space boost land values and property taxes:

* In Grand Rapids, Michigan, a study of property sales from the late 1970’s through 2000 in 3 residential neighborhoods near preserved forests showed that lots bordering the preserved forests sold for 19 to 35% more than those a greater distance from the forests. During the same period, in 3 residential neighborhoods near unpreserved forests, there was no increase in property value for those lots bordering the forests in two of the neighborhoods, and a much smaller increase in the third.

Parks boost local economies by attracting residents and businesses:

* Many businesses today are not tied to locating near specific raw materials or transportation modes. Businesses often select locations with high quality of life, such as those with parks, open space and easy outdoor access, to attract highly skilled workers.
* Many communities actively work to attract retirees, especially affluent ones, as they often pay more in local taxes than they use in services (i.e., they don’t use the school system.) A 1998 study of retirees who moved to the Texas Lower Rio Grande Valley found that, amongst 26 reasons to relocate upon retirement, “desire to live in a more recreationally enjoyable area” and “desire to live in a place where recreation opportunities are plentiful” ranked only after “desire to get away from cold weather”.

Good parks encourage economic development:

* In 2007, Philadelphia’s park system provided the city with revenue of $23.3 million, municipal savings of $16 million, resident savings of $1.15 billion, and a collective increase of resident wealth of $729 million. These figures included more than $1.08 billion in what economists call “direct-use value” of parks, including sporting activities, walking, picnicking, and other park visitation.

National parks and refuges benefit surrounding areas:

* In 2006 recreational use of the National Wildlife Refuge System generated almost $1.7 billion in total economic activity, almost four times that year’s $383 million federal appropriation to the refuge system.
* In Kane County, Utah, a comparison of the 4 years following the 1996 creation of nearby Grand Staircase-Escalante National Monument to the 4 years prior to its creation found that unemployment dropped by more than half, per-job earnings increased 13%, property values increased, and hotel-room revenues increased by about 20%.

Conservation is a money saving alternative to some development:

* The large lot size characteristic of sprawl increases costs for water and sewer services. A 2002 study found that, with other factors held constant, an increase in lot size from 0.25 to 1 acre nearly doubles the cost to a developer for installing sewer and water service and each household then paid more for water and sewage services: $392 versus $204 annually.
* By using an environmentally friendly design in a 677-acre development 40 miles northwest of Chicago, developers saved $1 million in infrastructure costs, and preserved 350 acres of open space within the development, including 160 acres of restored prairie, 158 acres of active farmland, 13 acres of wetlands, a 22-acre lake, a village green, and several neighborhood parks.

The ecosystem services delivered by conserved land reduce costs:

* Ultimately, all taxpayers end up bearing the cost to rebuild after a natural disaster. Often, purchasing land for a public park or preventing development through the purchase of a conservation easement may be the most effective way to decrease risk and minimize damage from natural disaster.
* Florida’s wetlands provide storm protection valued at $106,333 per acre per year, New York’s wetlands at $689,700 per acre per year and New Jersey’s saltwater wetlands at $208,973 per acre per year.
* In 1989, the Environmental Protection agency ordered New York City to build a water filtration plant that would have cost between $6 and $8 billion water to construct and $300 million a year to operate. Instead, the city got the EPA’s permission to spend $1.2 billion over the first ten years to restore and protect its watersheds, letting a 2,000-square-mile forest do the work of the water-filtration plant.
* The city of Auburn, Maine saved $30 million in capital costs and an additional $750,000 in annual operating costs by spending $570,000 to acquire and protect land in its watershed.
* In 1974, Arcata, California considered constructing a $25 million sewage treatment plant to meet new federal wastewater standards. Fearful of the need to sprawl outward to pay for the plant and how that would impact the community, Arcata instead converted a coastal brownfield into a marsh to treat wastewater naturally. Today, not only does the Arcata Marsh and Wildlife Sanctuary process the town’s sewage over 154 acres of fresh and saltwater, marshes, tidal mudflats, and grasslands but it sustains 100 plant species, six species of fish, and 300 species of birds and mammals. It also hosts 150,000 human visitors annually and serves as a research site for students, who in turn provide technical support, data collection, and monitoring that the town could not have otherwise afforded.
* When, over the past three decades Houston’s tree cover declined by 16%, the city lost $237 million in stormwater management services and $38 million in annual air pollution removal services.
* In San Antonio, Texas, a 22% decline in tree cover between 1985 and 2001 is estimated to have added $17.7 million in residential energy costs each summer.

Nearby parks promote exercise and reduce health care costs:

* 255,000 Philadelphia residents exercise in that city’s parks with enough frequency to improve their health, resulting in more than $69.4 million in health savings.
* A study of adolescent girls found that those living closer to parks exercised more than those living farther away.

## Livable Places: How Protecting Land Benefits Us All

*Exchange*

Investing in parks and natural areas yields fiscal relief, improved public health, strengthened neighborhoods, environmental protection, and preservation of natural beauty, all of which makes communities more livable. Evidence of this comes from academic research and first-hand experience of community leaders and government officials who have found that open space protection does not “cost” but rather “pays.”

* People prefer to buy homes close to parks, open space and greenery. In Boulder, Colorado, residential property prices decrease by $4.20 for every foot away from the area’s greenbelt. Homes next to the greenbelt were valued 32% higher than those 3,200 feet away. In Oakland, California, a three-mile greenbelt around Lake Merritt, near the city center, adds $41 million to surrounding property values.
* In 2005, farm receipts nationally reached $239 billion and farms generated $74 billion. However 2,880 acres of agricultural land are lost to development each day.
* In San Antonio, Texas, Riverwalk Park was created for $425,000. It is now the most popular attraction of the city’s $3.5 billion tourism industry, even more popular than the Alamo.
* Land preservation can be a cost effective approach to flood prevention. Near Boston, the purchase of more than 8,000 acres of wetlands along the Charles River was an alternative to a $100 million system of dams and levees. After $500 million in flood damage from the Napa River between 1960 and 1998, California spent $160 million to restore the river to its natural, meandering state to prevent further flood damage.
* In New Jersey, a coalition of state and nonprofit partners protected the Sterling Forest from a proposed development with $65 million. If the proposed development had occurred, it would have necessitated the construction of a $160 million water treatment plant.

## Capitalization of Open Spaces into Housing Values and the Residential Property Tax Revenue Impacts of Agricultural Easement Programs

*Agricultural and Resource Economics Review*

* In Calvert and Howard County Maryland, the researchers found that preserved open space increases property values on adjacent residential parcels and asked: how many additional acres of open space could be preserved from this increase in residential land value and consequent generation of higher property tax revenues?
* In Calvert County, the increase in tax revenue generated from a 1% increase in preserved agricultural land (148 acres) from the increased values of the houses within one-mile of the preserved property would be sufficient to purchase an additional 88 acres in the first year and, assuming no real change in housing prices and no change in the property tax rate, 2,640 acres in 30 years.
* In Howard County, this 1% increase in preserved agricultural land (181 acres) could generate sufficient additional tax revenues to purchase 110 acres in one year and 3,300 acres in 30 years.
* In Carroll County property values are not affected by proximity to open space. The authors offer hypotheses as to why this may be, and conclude that more research is necessary.

## Open Space Is a Good Investment, The Financial Argument for Open Space Preservation

*Association of New Jersey Environmental Commissions*

* Municipal investment in open space and farmland is usually less costly than allowing development. Amongst the examples given is Mansfield Township, NJ, where every new residential unit has a net negative fiscal impact of $1,866 per year while preservation of the same land through the county farmland preservation program would result only in a one-time cost of $3,000. Farmland costs $0.27 in services for every $1.00 it generates in taxes as compared to residential land, which requires $1.48 in services for every $1.00 it generates in taxes.
* The savings in the provision of public services may be seen in the long term. In 2003, a study was conducted of a 208-acre natural area that was originally slated to be developed with 39 homes. If that area had been developed, it would have cost the Township $1.9 million over 20 years. It cost $2.7 million to protect. However, after the 20-year loan used to pay the preservation costs is paid, the protected open space, has only minor upkeep costs such as trail maintenance. If it had been developed, it would continue to cost $100,000/year indefinitely.
* Although many municipalities believe that commercial and light industrial development will lower overall tax rates, these types of developments can have unforeseen costs. A 1992 study of the 39 towns in Morris County found that commercial development failed to lower taxes. Reasons for this include courts increasingly ruling in favor of companies that appeal for tax relief, employees moving in and requiring services, and office buildings not changing hands as often as residential buildings, so their taxable value doesn’t come as close to inflation.

## The Shore at Risk: The Threats Facing New Jersey’s Coastal Treasures, and What it Will Take to Address Them

*Environment New Jersey Research & Policy Center*

* The health of the Jersey Shore is in jeopardy, as seen by the declining populations of hard clams and seagrasses, increases in harmful algae blooms and jellyfish, continued problems with bacterial contamination at beaches, and problems with low dissolved oxygen levels in the near-shore waters.
* In addition to the in-depth look at the environmental health of the Jersey Shore, the report includes an examination of the impacts its declining health has on New Jersey’s economy.
* Ecotourism is a significant and growing portion of the Shore economy.
  + There were 7.4 million visits from anglers in 2008
  + In all of New Jersey, wildlife-related recreation accounted for $1.6 billion in spending in 2006.
  + In Cape May, 100,000 birders spend $10 million a year in the local economy.
* New Jersey’s coastal fisheries are already far less productive than they were decades ago, and continued pollution threatens the surviving fisheries. Key fisheries that have disappeared or gone into serious decline include bay scallops and hard clams. New Jersey’s commercial fishery industry had $169 million in revenue in 2008, down 20% since 1994.

## Land Conservation and Property Taxes in Vermont

*Vermont Land Trust*

* This study looks at the impact of permanent land conservation (through acquisition or through conservation easement) on tax rates in Vermont towns.
* In general, the median municipal tax bill is higher in towns that have the most taxable property, and lower in the towns with the least taxable property value. Towns with the most commercial and industrial taxable property value generally have higher tax bills, although this may be due to the high levels of residential properties needed to support the businesses, as the more year-round residences in a town, the higher the municipal tax bill tends to be.
* This study concludes that more development tends to lead to higher taxes, and on average, tax bills are lower in towns with the most conserved land. The author hypothesizes that this is because open space tends to require few public services, where as more development, (e.g., more people), require more services.

# Wilderness Areas

Wilderness areas, large tracts left relatively untouched by humans, touch the human economy in significant ways. Communities near wilderness areas are attractive places to live and visit, and businesses look to relocate to them because of the amenities they offer to employees and for the opportunity to work in the tourism industry.

## The Impact of Wilderness and Other Wildlands on Local Economies and Regional Development Trends

*USDA Forest Service Proceedings*

* In this paper, wilderness is defined as “both officially designated wilderness areas and other wildland areas” and includes remote areas whose surroundings are similar to that of the wilderness area and those bordered by extractive uses or major population centers.
* Although visitor spending in surrounding communities is the most obvious economic impact of wilderness areas, wilderness contributes to economic development of an area in other ways.
* New residents are attracted by the quality of life provided by proximity to a wilderness area and new businesses are attracted by opportunities to participate in the tourism industry and by amenities and quality of life the wilderness areas can offer to employees. New residents and businesses increase employment and income in the community, as well as provide additional taxes for social services. Rural amenities create a strong sense of place for both long-term and new residents, decreasing motivation to move and creating more stable communities.
* Wilderness areas provide both positive and negative economic impacts. New businesses and residents can change the culture of a community. Increased populations can increase congestion, crime and create housing shortages. The changes will be welcomed by some and bemoaned by others. They should be recognized as part of a growing desire to live near amenities provided by wilderness.
* Recreation-based industries are labor intensive and create a high number of jobs per million-dollars spent. However, many of these jobs are low wage jobs. Service industry jobs offer a wide range of pay levels.
* In the short-term, resource extraction (such as mining, and forestry) may create more jobs than will be created by the designation of land as wilderness or other protected status. In the long-term however, non-resource extraction jobs and improvements to commercial fisheries often lead to an overall positive economic impact to a community.

## Does Wilderness Impoverish Rural Regions?

*International Journal of Wilderness*

* The goals of the Wilderness Act of 1964 include the preservation of wilderness areas (areas where “the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain”) and to afford the public opportunities for solitude and recreation. Thus, the wilderness designation brings these lands into the realm of influencing the quality of life experienced in adjacent and surrounding local communities. A study of 113 rural counties in the American West, 43% containing designated wilderness areas, shows that for the period 1970 to 2000 there is a significant positive correlation between the percent of land in designated wilderness and population, income and employment growth.
* The correlation between designated wilderness area and population, income and employment growth is strongest for counties not adjacent to metropolitan areas.
* While tourism created by wilderness areas can attract job growth in lower paying service sector jobs, growth in higher paying professional service jobs and some natural resource extraction categories was higher in wilderness counties than in non-wilderness counties.
* Wilderness designation promotes, rather than limits growth, and may promote demographic and economic growth at rates that can jeopardize the natural resources.
* The growth of investment income and nonfarm self-employment income are correlated with the presence of wilderness.

# Waterways and Wetlands

The protection of rivers, streams, lakes, bays, and adjacent lands can create jobs, protect fisheries relied upon by the fishing industry, protect food and drinking water sources, protect and create tourism opportunities, enhance property values, decrease local government expenditures and provide recreational opportunities, including those associated with the multi-billion dollar fishing industry. Because so many rely on the services provided by waterways, when they are not protected, governments have to undertake costly projects to restore them or to replace the services they provide.

## Economic Benefits of Wetlands

*United States Environmental Protection Agency*

* Wetlands filter and clean water, decreasing the costs of drinking water filtration. Water flow slows down when it enters a wetland, allowing sediment to settle out of the water. Some pesticides and other pollutants can be broken down by light and bacteria. Plants and microorganisms absorb excess nutrients from sources such as fertilizers, manure, municipal sewage and runoff from urban areas. In South Carolina, it would require a $5 million treatment plant to remove the pollutants filtered by the Congaree Bottomland Hardwood Swamp.
* Flood damages in the U.S. average $2 billion each year. Flood damages have been increased by the draining of wetlands. Wetlands reduce the frequency and intensity of floods by absorbing and storing significant amounts of floodwater. A one-acre wetland can typically store about three-acre feet of water (one acre of land covered by three feet of water), or one million gallons. Coastal wetlands serve as storm surge protectors when hurricanes or tropical storms come ashore. In the Gulf coast area, barrier islands, shoals, marshes, forested wetlands and other features of the coastal landscape can provide a significant and potentially sustainable buffer from wind wave action and storm surge generated by tropical storms and hurricanes.
* Wetlands provide a food, shelter and nursery grounds for marine and freshwater fish. Wetlands support the life cycle of 75% of the fish and shellfish commercially harvested in the U.S., and up to 90% of the recreational fish catch. U.S. consumers spent an estimated $54.4 billion on fishery products in 2000, which supported a $7.2 billion fishery processing business. The American Sportfishing Association estimates recreational fishing has an annual economic impact of $116 billion.
* In 2001, approximately 3 million people hunted migratory birds and 6.5 million, small mammals that are often found in wetlands. They spent more than $2.2 billion.

## Economic Benefit of Conserved Rivers: An Annotated Bibliography

*National Park Service*

* The Economics of River Conservation: An Annotated Bibliography offers an extensive list of studies, papers, and articles on the economic benefits of river conservation, with summaries of their content.

# Cost of Community Services

Cost of community services studies compare the costs and revenue generated by various land use categories, such as residential, commercial, industrial, and farmland/open space. This allows for the evaluation of the fiscal impacts of the various land uses and the impacts of changing from one land use to another. Because open space and farmland tend to raise more revenue than they require to be spent on services, and residential lands tend to require more funds to be spent for services than they raise in revenue, cost of community services studies show the importance of open space and farmland to a community’s fiscal well-being and the importance of having a wide tax-base with a variety of land uses. For more information on this tool, see the [Cost of Community Services Studies](http://conservationtools.org/tools/general/show/15-Cost-of-Community-Services-Studies) guide at ConservationTools.org.

## Cost of Community Services: Shrewsbury Township, York County, PA

*The South Central Assembly for Effective Governance*

* During fiscal year 2000 in Shrewsbury Township, York County, for every $1 of revenue generated by residential property, $1.22 was spent providing services to those lands. For every $1 received from commercial and business land, $0.15 was spent to provide services and for every $1 received from farm/forest/open land uses in the township, $0.17 was spent providing services.

## Conservation Opportunities for Corridor Preservation and Community Development

*Brandywine Conservancy*

* In Chester County, PA, between Route 1 and Route 30, Route 41 passes through or near nine communities that contain extensive prime farmland, headwaters to five significant stream systems, and/or active, vibrant downtowns and villages. These communities have a high development pressure. The Brandywine Conservancy used a cost of community services study to examine how potential development would affect the ability of local governments and school district to provide community services. In these communities, $1.174 was spent for every dollar received from residential land, $.05 spent for every dollar received from commercial land, $.02 spent for every dollar received for industrial land, and $.04 spent for each dollar received for farmland.

## Farmland Information Center Fact Sheet: Cost of Community Services

*American Farmland Trust*

* Cost of community services studies can be used to address the following three claims: Open lands, including working farms and forests, should be developed to their “highest and best use”; when agricultural land is assessed at its farming or ranching value instead of its potential value as residential or commercial development, it receives an unfair tax break; and residential development lowers property taxes by increasing the tax base. Although working and open space lands may generate less revenue than residential, commercial or industrial property, they require less public infrastructure and fewer community services. A summary of several Cost of Community Services studies from 21 states shows that on average, the median cost, per dollar of revenue raised, to provide public services for commercial and industrial lands was $0.28, for working and open space lands was $0.36, and for residential lands was $1.15.

# Ecosystem Services

Ecosystems provide multiple services that benefit people. These include:

* Provisioning services -- the products obtained from an ecosystem such as food, fresh water, biological raw materials (i.e. timber, fiber, biomass fuel, and ornamental resources)
* Regulating services -- the benefits obtained from an ecosystem’s control of natural processes (such as maintenance of air quality, climate regulation, water purification, pest mitigation and flood control)
* Cultural services -- the nonmaterial benefits obtained from ecosystems (such as recreational opportunities and educational and inspirational values)
* Support services -- the natural processes that maintain the other ecosystem services, (such as nutrient and water cycling, habitat and primary production.) [Definition from the World Resources Institute: <http://pdf.wri.org/esr_definitions_of_ecosystem_services.pdf>]

Well planned and maintained preservation of land protects these ecosystem services and prevents governments from having to artificially replace them at high costs.

## The Economic Benefits of Natural Goods and Services: A Report for the Piedmont Environmental Council

*Aaron Paul, Yale School of Forestry and Environmental Studies*

Virginia’s natural resources provide approximately $21.8 billion/year in ecosystem services. Of this, state and federal public lands provide $5.1 billion and the more than 700,000 acres of private land under conservation easement provide $520 million. The following provides a breakdown of these benefits:

* Water Quality: Forests, pastures and wetlands absorb excess nutrient runoff, toxins and sediments from transportation corridors, agricultural enterprises, and industrial sources, protecting drinking water supplies and marine resources and saving municipalities from making major capital expenditures in chemical or mechanical water treatment.
  + Total annual benefits: $5,200,000,000
* Water Supply: Forests and wetlands slow runoff, minimize evaporation, and allow for high rates of ground water restoration. This process moderates flow during periods of drought and flood to provide a relatively consistent supply of water for consumption, electricity generation, industrial uses, and recreation compared to what would exist in their absence.
  + Total annual benefits: $980,000,000
* Pollination: Farmers rely on both native pollinators and honeybees to pollinate crops. This study used an estimation of the proportion of pollination services provided by native insects for fifty-one fruits, nuts, field crops, and vegetables and the value of the crops produced because of it.
  + Total annual benefits: $27,000,000
* Recreation: Forty-five percent of all overnight trips to Virginia include outdoor recreation, which results in $8 billion spent within the state. State and national parks are the largest draw, making up 48% of outdoor recreation visits.
  + Total annual benefits: $8,000,000,000
* Forest Products: Virginia’s annual forest production amounts to 500 million cubic feet, of which saw logs comprise 45%, pulpwood 40%, and veneer logs, mulch, and other post-industrial products comprising the remainder.
  + Total annual benefits: $1,800,000,000
* Farm Products: In 2007, 30,500 Virginia farms harvested 3.2 million acres of cropland or pasture.
  + Total annual benefits: $2,300,000,000
* Disturbance Prevention: Beaches and coastal wetlands protect coastal properties and infrastructure by absorbing storm surges, mitigating flooding and minimizing erosion.
  + Total annual benefits: $1,900,000,000
* Habitat: Because of the difficulty in calculating the economic benefit of habitat, this study only estimated the contribution of wetlands to Virginia’s marine resource harvest.
  + Total annual benefits: $450,000,000
* Carbon Sequestration: Virginia forests sequester a total of 42.8 million tons of CO2 equivalent annually. Sequestration rates of grass coverage and transitional parcels are only one third of one percent of that provided by forests. The value of carbon sequestered was calculated using a three-year average of prices on the European Union Emissions Trading Scheme
  + Total annual benefits: $1,100,000,000

## Ecosystem Services in Cecil County’s Green Infrastructure: Technical Report for the Cecil County Green Infrastructure Plan

*The Conservation Fund*

* In Cecil County, Maryland, 16 ecosystem services provided by forests and wetlands provide services valued at $2.1 billion a year. That amount is equivalent to two-thirds of the county’s total economic output of $3.3 billion. These ecosystem services do not include services from bodies of water, such as the Chesapeake Bay.
* Large, contiguous blocks of forests and wetlands are most likely to contain fully functioning ecosystems, and therefore are more likely to provide valuable ecosystem services. This shows that preservation of these contiguous blocks is a vital investment.

## Protecting the Source

*The Trust for Public Land*

* Healthy, functioning watersheds slow surface runoff and increase water infiltration into the soil. Healthy watersheds naturally filter pollutants, decrease soil erosion, and moderate water quantity by decreasing flooding and recharging groundwater reserves. The result is cleaner water downstream.
* The loss of natural lands to development, along with a constantly expanding diversity of water contaminants and higher pollutant loads, have made water treatment more difficult and more expensive.
* A 2002 survey of 27 water suppliers conducted by the Trust for Public Land and the American Water Works Association found that, for every 10% increase in forest cover in a drinking water’s source area, treatment and chemical costs decreased by approximately 20%.
* This report presents a series of best practices on source protection and gives case studies of communities that have effectively linked land protection, water protection and water treatment cost savings.

## The Value of Green Infrastructure

*Center for Neighborhood Technology and American Rivers*

* Green infrastructure is a network of decentralized stormwater management practices such as preservation of undeveloped areas near a water source, green roofs, tree planting, rain gardens and permeable pavement that can capture and infiltrate rain where it falls, reducing stormwater runoff and improving the health of surrounding waterways.  The practices provide multiple environmental, economic and social benefits, including less polluted stormwater and increased property values. This paper gives an overview of the methods used to measure the benefits of green infrastructure on water (reduced storm water runoff, improved water quality, reduced water treatment needs, decreased flooding), energy savings, improved air quality, climate change mitigation, urban heat island mitigation, improved community livability and improved habitat. It provides multiple case studies to demonstrate green infrastructure’s economic benefits. For example:
  + The Milwaukee Metropolitan Sewerage District (MMSD) purchases undeveloped properties in areas expected to have major growth in the next 20 years and natural areas along streams, shorelines and wetlands. The purchased acreage is estimated to hold over 1.3 billion gallons of stormwater at a cost of $0.017 per gallon. One of MMSD’s flood management facilities holds 315 million gallons at a cost of $0.31 per gallon.
  + In Philadelphia, PA, officials learned that managing runoff through green infrastructure from 50% of the city’s impervious services would provide a net benefit of $2.8 billion, a net benefit 2,333% higher than managing it with a 30-foot tunnel, the traditional grey infrastructure option, which would provide a net benefit of $122 million.

## Valuing New Jersey’s Natural Capital

*New Jersey Department of Environmental Protection*

* This report summarizes the results of a two-year study that quantified the value of New Jersey’s natural resources. It gives the annual dollar value (in 2004 dollars) and present value, the amount of money that would need to be invested now at a 3% interest rate to generate an equal level of annual monetary benefits.
* The total value of New Jersey’s natural capital is about $20 billion per year (present value $680 billion), plus or minus $9 billion per year (present value $300 billion).
* The annual value of the services provided by New Jersey’s natural capital is conservatively estimated at between $8.6 billion (present value $288 billion) and $19.8 billion (present value $660 billion).
* The annual value of the goods provided by New Jersey’s natural capital is estimated at between $2.8 billion (present value $93 billion) and $9.7 billion (present value $322 billion).
* Additionally, wildlife-related tourism is estimated to annually generate about $3 billion of gross economic activity in New Jersey.

## The Value of the World’s Ecosystem Services and Natural Capital

*Nature*

The authors estimated the economic value of 17 ecosystem services for 16 biomes, based on published studies and a few original calculations. For the entire biosphere, the value (most of which is outside the market) is estimated to be between $16–54 trillion/year (1997 U.S. dollars) per year, with an average of $33 trillion/year. Because of the nature of the uncertainties, this must be considered a minimum estimate. The 17 ecosystem services considered were:

* Gas regulation (regulation of atmospheric chemical composition),
* Climate regulation,
* Disturbance regulation (i.e., storm protection, flood control and draught recovery),
* Water supply (water storage and retention),
* Erosion control and sediment retention,
* Soil formation,
* Nutrient cycling (i.e., nitrogen fixation, N, P and other elemental or nutrient cycles),
* Waste treatment,
* Pollination,
* Biological control (i.e. predator control of prey species),
* Refugia (i.e. nurseries, habitat for migratory species, regional habitats for locally harvested species, overwintering grounds),
* Food production (i.e. production of fish, game, crops, nuts and fruits by hunting, gathering, subsistence farming or fishing)
* Raw materials (i.e. lumber, fuel, fodder)
* Genetic resources (i.e., pharmaceuticals, products for materials science, genes for resistance to plant pathogens and crop pests, ornamental species (pets and horticultural varieties of plants)).
* Recreation
* Cultural (aesthetic, artistic, educational, spiritual, and/or scientific values of ecosystems.)

## Ecosystem Service Valuation and Watershed Resources: An Annotated Literature Review

*The Water Challenge Program*

* This annotated bibliography presents a review of literature on ecosystem service valuation. It includes national and international studies regarding the theoretical thinking behind the valuation of ecosystem services, the empirical valuation of ecosystem services and ecosystem service valuation in areas such as the measurement of the multifunctional attributes of agriculture.

Millennium Ecosystem Assessment

* The Millennium Ecosystem Assessment (MA) was called for by the United Nations Secretary-General Kofi Annan in 2000. Initiated in 2001, the objective of the MA was to assess the consequences of ecosystem change for human wellbeing and the scientific basis for action needed to enhance the conservation and sustainable use of those systems and their contribution to human wellbeing. Their findings, contained in five technical volumes and six synthesis reports, provide a state-of-the-art scientific appraisal of the condition and trends in the world’s ecosystems, the services they provide, and the options to restore, conserve or enhance the sustainable use of ecosystems. Included in this in-depth resource are analyses of how changes to ecosystems have, and will have, both positive and negative impacts on economic development.

# Journals

## Review of Environmental Economics and Policy

*Association of Environmental and Resource Economists*

* The Review of Environmental Economics and Policy aims to fill the gap between traditional academic journals and the general interest press by providing a widely accessible, yet scholarly source for the latest thinking on environmental economics and related policy. It is designed for broad appeal to economists and others in academia, government, the private sector, and the advocacy world who share a common interest in environmental and natural resource policy. Articles in the Review are edited to be broadly accessible; rather than focusing on technical and methodological aspects of research, articles tend to focus on the broad lessons that can be learned for environmental and resource economics or for public policy.

## Ecological Economics

*The United States Society for Ecological Economics and Ecological Economics*

* Ecological economics is the science of sustainability. The United States Society for Ecological Economics provides a venue for intellectual exchange and collaboration on issues related to the theory, policy, and implementation of sustainability and sustainable development. The society consists of a strong, interdisciplinary group of academics and practitioners who seek to develop solutions to our most pressing economic, social, and environmental problems, and who care about the well-being of this planet. The society publishes *Ecological Economics,* a journal concerned with extending and integrating the study and management of “nature's household” (ecology) and “humankind's household” (economics). This integration is necessary because conceptual and professional isolation have led to economic and environmental policies which are mutually destructive rather than reinforcing in the long term. The journal is transdisciplinary in spirit and methodologically open.

# Toolkits

## The Wildlife Habitat Benefits Estimation Toolkit

*Defenders of Wildlife*

* The Wildlife Habitat Benefits Estimation Toolkit is a set of easy-to-use spreadsheet-based valuation models, tables and databases directed at land use and wildlife planners and others interested in estimating the economic benefits associated with wildlife and habitat conservation in specific geographic regions. The toolkit comprises models that generate estimates of:
  + Changes in property values that result from increases or decreases in nearby open space.
  + Net economic benefit per activity day for participation in wildlife-associated recreation activities (fishing, hunting, wildlife-watching);
  + Visitation numbers for wildlife-associated recreation for an existing wildlife refuge or state game management area (or changes in visitation from the expansion/reduction of the acreage of that land)
  + The annual value of the ecosystem services provided by terrestrial and aquatic habitat or wetlands.
* The toolkit includes a literature review of the impacts of land conservation on economic competitiveness of a community. It also provides a set of reports that contain literature reviews and present the methods applied in the development of the estimation model and valuation tables, detailed user manuals that include a series of application examples, and several presentations that provide an overview of the toolkit.

## Green Values® National Stormwater Management Calculator

*Center for Neighborhood Technology*

* Center for Neighborhood Technology’s Green Values Calculator™ is a tool for quickly comparing the performance, costs, and some benefits of green infrastructure practices to those of conventional stormwater management practices. The calculator takes users through a step-by-step process of determining the average precipitation at a site, choosing a stormwater runoff volume reduction goal, defining the impervious areas of the site under a conventional development scheme and then choosing from a range of green infrastructure best management practices to find the combination that meets the runoff volume reduction goal in a cost-effective way.
* It includes the ability to calculate the costs of stormwater management before and after undeveloped land is converted to another use.
* The calculator provides construction, annual maintenance and lifecycle cost comparisons to manage a specified volume of stormwater for green infrastructure and conventional scenarios. The calculator also estimates some of the non-hydrologic benefits of using green infrastructure.

## Environmental Valuation Reference Inventory

*Environment Canada*

* The Environmental Valuation Reference InventoryTM (EVRITM) is a searchable storehouse of empirical studies on the economic value of environmental benefits and human health effects. It has been developed as a tool to help policy analysts use the benefits transfer approach. Using the EVRI to do a benefits transfer is an alternative to doing new valuation research.

## i-Tree

*United States Department of Agriculture Forest Service*

* i-Tree is a state-of-the-art, peer-reviewed software suite from the USDA Forest Service that provides urban forestry analysis and benefits assessment tools. It's an easy-to-use, computer-based program that allows communities to conduct and analyze a street tree inventory and evaluate current benefits, costs, and management needs.
* Communities can analyze the economic benefits of their urban forests with Streets (formerly STRATUM), a street tree management and analysis tool for urban forest managers, which quantifies the dollar value of the urban forest’s annual environmental and aesthetic benefits: energy conservation, air quality improvement, CO2 reduction, stormwater control, and increased property value.

## National Tree Benefit Calculator

*Casey Trees and Davey Tree Expert Co.*

* The Tree Benefit Calculator allows users to estimate the annual economic and environmental value of individual street trees using inputs of a tree’s location, species and size.
* The Tree Benefit Calculator is intended to be simple and accessible and this tool should be considered a starting point for understanding trees’ value in the community, rather than a scientific accounting of precise values. This tool is based on i-Tree’s street tree assessment tool called STREETS. For more detailed information on urban and community forest assessments, visit the [i-Tree website](http://www.itreetools.org).

A Bibliography of Economic Valuation Literature

*Defenders of Wildlife: Conservation Economics Program*

* Defenders of Wildlife maintains a "living" bibliography of economic valuation studies, papers, and journal articles to serve as a resource for researchers and policy makers, and their staff to remain current with the latest theoretical and applied economic analyses. This 41-page document provides an extensive list of resources.

# Library

## Related Library Categories at ConservationTools.org

Economic Benefits

## Featured Library Items at ConservationTools.org

# Related Guides

* Environmental Benefits of Conservation
* Economic Benefits of Biodiversity
* Economic Benefits of Parks
* Economic Benefits of Trails
* Economic Benefits of Smart Growth and Costs of Sprawl

# Experts

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Richman performed the research for this guide.

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