The Return on Investment in Parks and Open Space in Massachusetts

THE TRUST *for* PUBLIC LAND

CONSERVING LAND FOR PEOPLE

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The Trust for Public Land

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THE TRUST *for* PUBLIC LAND

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Executive summary

The Trust for Public Land conducted an economic analysis of the return on the Commonwealth's investment in land conservation through a variety of state funding programs and found that every $1 invested in land conservation returned $4 in natural goods and services to the Massachusetts economy. In addition, land conservation funded by the Commonwealth supports key industries that depend on the availability of high-quality protected land and water. Massachusetts has also been successful in leveraging funding support from other sources, expanding the impact of the Commonwealth's investment. A summary of the key findings and the benefits of parks and open space investments by Massachusetts is presented below.

Natural goods and services: Lands conserved in Massachusetts provide valuable natural goods and services such as water quality protection, air pollution removal, and stormwater management. For example, watershed protection surrounding the Quabbin and Wachusett Reservoirs has saved Massachusetts Water Resource Authority ratepayers an estimated $200 million in filtration plant construction and annual operating costs.[1] The Trust for Public Land analyzed lands conserved by Massachusetts and found that every $1 invested in land conservation returns $4 in economic value in natural goods and services.

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Tourism and outdoor recreation: Parks and natural areas are critical to the state and local tourism industries. At least 61 percent of Massachusetts residents participate in outdoor recreation each year. In Massachusetts, outdoor recreation generates $10 billion in annual consumer spending. That spending benefits the state and municipalities through greater sales tax revenues. The tax revenue attributed to outdoor recreation spending equals $739 million annually. Spending on outdoor recreation also helps local businesses that hire Massachusetts residents. Approximately 90,000 jobs in the state are supported by this spending, accounting for $3.5 billion in wages and salaries. Much of that earned income is then spent in local communities, further magnifying the economic impact of outdoor recreation.

1 All numbers reported in the text and tables are rounded to three significant digits unless otherwise noted. Due to rounding some report figures and tables may appear not to sum.

Agriculture, forestry, and commercial fishing: The agriculture, forestry, and commercial fishing industries depend on maintaining farms, forests, and water quality. Agriculture, forestry, commercial fishing, and related processing activity are responsible for $13 billion in output, and 147,000 jobs in Massachusetts.

Economic development: Parks and open space contribute to the high quality of life in Massachusetts. According to Forbes and CNBC, quality of life is the Commonwealth's number one asset for business. In terms of maintaining a talented workforce, the availability of outdoor activities is the second most important factor for recent college graduates deciding whether to stay in the state or move elsewhere. Parks also boost property values and increase municipal revenues. Over $724 million of property value in Boston is attributable to its park system.

Local jobs and economic impact: Investment in existing city and community parks amplifies the economic benefits provided by these spaces through the improvement of their quality and through the creation of additional jobs and local economic activity. The Trust for Public Land analyzed the state's investment in Gateway City parks and found that it will create 492 jobs and $26.5 million in local wages and salaries.[2] That is, every $1 million invested in Gateway City parks creates 13.7 jobs. The Trust for Public land also analyzed the state's investment in public outdoor swimming pools and found that it will create 390 jobs and $24.2 million in local wages and salaries. That is, every $1 million invested in outdoor swimming pools creates 11.8 jobs. The rate of job creation for parks and pools compares favorably with that of other job-creating investments. For example, it is more robust than the rate of jobs generated by spending on pedestrian and bicycle infrastructure (including roads) in cities nationwide, which is 9 jobs created per $1 million invested.

Health: Access to parks and open space increases the physical activity and the health of residents and workers in Massachusetts. This reduces health care costs related to obesity, which amount to $2 billion annually in the state. More than one in five adults in the state do not engage in any physical activity and well over half of residents are overweight or obese. Availability of parks and proximity to them increase the physical activity of children. Researchers have found that as the percentage of park area within a child's neighborhood increases, so does a child's physical activity.

Leverage local and federal funds: By attracting support from other sources, the state maximizes its investment in land conservation. From 1998 to 2011, grant programs in Massachusetts leveraged $118 million in matching funds from federal and local governments, as well as private sources such as land trusts and foundations, for conservation easements (i.e., voluntary conservation agreements with willing landowners) and land purchases. That is, every $1 of state spending on land conservation leveraged $1.23 in additional contributions.

2 A Gateway City is defined as municipality with a population greater than 35,000 and less than 250,000, a median household income below the Commonwealth's average, and a rate of educational attainment of a bachelor's degree or above that is below the Commonwealth's average.

Introduction

The rich history of land conservation in Massachusetts began in 1898 when the legislature established Mount Greylock State Reservation, the first land acquired by the Commonwealth for forest preservation. As of 2012, over 1.25 million acres of land have been permanently conserved.[3]

In addition to numerous ecological and social benefits, parks and natural areas generate significant economic benefits to the communities and people of the Commonwealth in the form of tourism, outdoor recreation, working farms and forests, and natural goods and services. The Commonwealth has recognized the importance of investing in conservation to support these critical benefits. Massachusetts has protected land at an average rate of 9,350 acres per year from 1998 to 2011. Continuing and expanding this investment in conservation will support new jobs, boost spending at local businesses, generate local tax revenues, enhance property values, and increase tourism activity.

Massachusetts has several agencies that administer conservation funding programs and steward and manage state-owned conservation land that generates these types of benefits, including:

- Executive Office of Energy and Environmental Affairs
- Department of Agricultural Resources
- Department of Conservation and Recreation
- Department of Environmental Protection
- Department of Fish and Game

These agencies administer several critical matching grant programs that generate such benefits, as well. The major programs include:

- Agricultural Preservation Restriction Program
- Community Preservation Act[4]
- Conservation Partnership Grant Program
- Drinking Water Supply Protection Program
- Landscape Partnership Program
- Local Acquisitions for Natural Diversity Program (formerly the Self-Help Grant Program)
- Parkland Acquisitions and Renovations for Communities Program (formerly the Urban Self-Help Program)

Executive Office of Energy and Environmental Affairs

The legislature authorizes bond expenditures for environmental programs, including open space acquisition. The legislature authorized a $300 million Open Space Bond Bill in 1996, $112 million of which was for land acquisition. The legislature authorized another Open Space Bond Bill in 2002 for $753 million, $220 million of which was for land acquisition. In 2008, a $1.5 billion environmental bond was passed by the legislature and signed into law by the governor. The 2008 bond contains an annual dedication of $50 million for five years for open space. This revenue is

3 Governor of Massachusetts, "Governor Patrick Announces Conservation of 100,000 Acres of Open Space: Massachusetts Protected Open Space Now Exceeds Developed Land," press release, August 23, 2012, accessed July 19, 2013, http://www.mass.gov/governor/pressoffice/pressreleases/2012/2012823-conservation-of-100000-acres-of-open-space.html.

4 The Department of Revenue manages, collects, and distributes the Community Preservation Act Trust Fund.

divided between departments within the Executive Office of Energy and Environmental Affairs. In March 2013, the governor filed a new environmental bond bill with the legislature, proposing nearly $1 billion for land conservation and several other environmental programs.

Department of Agricultural Resources

The Department of Agricultural Resources houses the Agricultural Preservation Restriction (APR) Program. APR offers to pay farmers the difference between the "fair market value" and the "agricultural value" of their farmland in exchange for a permanent deed restriction, which precludes any use of the property that will have a negative impact on its agricultural viability. The legislature authorizes funding for the APR Program through environmental bond bills, and the governor issues bonds on an annual basis.

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Department of Conservation and Recreation

The Department of Conservation and Recreation (DCR) acquires land through the Division of Water Supply Protection, Division of State Parks and Recreation, the Division of Urban Parks and Recreation, and the Land Protection Planning Program. The legislature authorizes funding for DCR through environmental bond bills, and the governor issues bonds on an annual basis.

Department of Environmental Protection

The Department of Environmental Protection, in conjunction with the Executive Office of Energy and Environmental Affairs, administers the Drinking Water Supply Protection Program (DWSPP). This program provides grant funding to municipalities and other eligible entities for the purpose of acquiring land to protect current or future public drinking water supplies. DWSPP is a reimbursement program. In addition, grant funds cannot exceed 50 percent of the total project cost. Funds are derived from state bond issuances.

Department of Fish and Game

The Department of Fish and Game acquires land through purchases from the Inland Fish and Game Fund as well as funding authorized through the legislature in environmental bond bills. Revenue from hunting, fishing, trapping, and license fees is collected through the Wetlands Stamp Program (1990) for habitat acquisition at a rate of $5 per license.[5]

5 Massachusetts Department of Fish and Game, Division of Fisheries and Wildlife, *Department of Fish and Game & Division of Fisheries and Wildlife Land Acquisitions* FY 2012.

The Community Preservation Act

The Community Preservation Act (CPA) is state enabling legislation allowing cities and towns in Massachusetts to create a local dedicated fund for open space, historic preservation, community housing, and outdoor recreation projects. Communities that adopt CPA also receive funds from the statewide Community Preservation Trust Fund each year to help fund these projects.

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CPA funds are generated through two sources: a voter-approved surcharge of up to 3 percent on local property tax bills, and an annual disbursement from the statewide Community Preservation Trust Fund, which distributes funds each fall to communities that have adopted CPA. The trust fund's revenues are derived from fees collected at the Registry of Deeds and from state budget surplus funds.

Over the 13-year history of the program, communities have received matching disbursements from the statewide Community Preservation Trust Fund ranging from 26 percent to 100 percent of locally raised CPA funds; the average percentage match statewide for the October 2012 disbursement was 37.6 percent. By 2012, 155 cities and towns had passed CPA, 44 percent of the state's communities. Over 17,000 acres of open space have been preserved through CPA.

Conservation Partnership Grant Program

The Conservation Partnership Grant Program was authorized by the legislature in 2002. It is a grant program that provides reimbursements to nonprofit organizations of up to 50 percent of the cost of acquiring land or interest in land for conservation or outdoor recreation purposes. All projects must grant a perpetual conservation restriction (easement) to either the city or town in which the project is located or a state agency, or both. Funds are derived from bond expenditures.

Landscape Partnership Program

Starting in FY 2010, the Massachusetts Executive Office of Energy and Environmental Affairs began offering a new grant opportunity called the Landscape Partnership Program. This program offers competitive grants to municipalities, nonprofit organizations, and agencies to help fund partnership projects that permanently protect a minimum of 500 acres of land. The Landscape Partnership Program seeks to preserve large, unfragmented, high-value conservation landscapes, including working forests and farms; expand state-municipal-private partnerships; increase leveraging of state dollars; enhance stewardship of conservation land; and provide public access opportunities. The program will also fund the development of Natural Resource Protection Zoning in partner municipalities. Conservation activity for this grant program will be available once the program has been implemented.

Local Acquisitions for Natural Diversity Program

The Massachusetts Local Acquisitions for Natural Diversity Program, formerly the Self-Help Grant Program, was established in 1961 to assist municipal conservation commissions in acquiring land for natural resource (wildlife, habitat, trails) and passive outdoor recreation (hiking, fishing, hunting) purposes. Access by the general public is required. This state program pays for the acquisition of land, or a partial interest (such as a conservation restriction), and associated acquisition costs such as appraisal reports and closing costs. Funds are derived from bond expenditures.

Parkland Acquisitions and Renovations for Communities Program

Parkland Acquisitions and Renovations for Communities (PARC) Program, formerly the Urban Self-Help Program, was established in 1977 to assist cities and towns in acquiring and developing land for park and outdoor recreation purposes. Any town with a population of 35,000 or more year-round residents, or any city regardless of size, that has an authorized park/recreation commission is eligible to participate in the program. Communities that do not meet these population criteria may still qualify under the "small town," "regional," or "statewide" project provisions of the program.

Only projects that are to be developed for suitable outdoor recreation purposes, whether active or passive in nature, shall be considered for funding. Grants are available for the acquisition of land and the construction or renovation of park and outdoor recreation facilities, such as swimming pools, zoos, athletic playfields, playgrounds, and game courts. Access by the general public is required.

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Investment in land conservation

From 1998 to 2011, Massachusetts funded the conservation of 131,000 acres, including lands protected through both conservation easements (i.e., voluntary conservation agreements with willing landowners) and fee simple (i.e., lands purchased outright). During this time an average of 9,350 acres of land were protected annually through state spending, using an average of $31.8 million annually (this is nominal spending that is not in today's dollars). The average expenditure per acre conserved during this period was $3,400. Exhibit 1 breaks out the historical acres and spending conserved by the Commonwealth of Massachusetts.

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Exhibit 1. Historical acres and spending on land conservation

YEAR	ACRES	SPENDING
1998	928	$ 3,660,000
1999	9,270	$ 43,000,000
2000	18,800	$ 33,200,000
2001	17,700	$ 43,800,000
2002	19,400	$ 58,900,000
2003	3,360	$ 12,700,000
2004	3,250	$ 13,600,000
2005	9,370	$ 24,900,000
2006	7,130	$ 35,400,000
2007	6,730	$ 30,200,000
2008	11,600	$ 46,400,000
2009	11,200	$ 43,500,000
2010	6,890	$ 36,200,000
2011	5,260	$ 20,000,000
Total	**131,000**	**$ 445,000,000**
Average	**9,350**	**$ 31,800,000**

Source: Massachusetts Executive Office of Energy and Environmental Affairs.

Natural goods and services

Some of the key economic benefits of land conservation come in the form of natural goods and services. Natural lands and water bodies provide important functions that have significant economic value. Protected parks and natural areas remove air pollutants, protect and enhance water quality, provide fish and game habitat, produce food, manage stormwater, and provide flood control and other necessary functions. The following list qualitatively describes in more detail some of the goods and services provided by different types of ecosystems:

Forests protect water and air quality.

- Forests purify water by stabilizing soils and filtering contaminants. They also regulate the quantity of available water and seasonal flow by capturing and storing water. In fact, forests process nearly two-thirds of the freshwater supply, providing water to about 180 million people across the United States.[6]
- Forests defray the costs of erosion-related damage (e.g., repairing damaged infrastructure and treating contaminated water) because their soil stability reduces erosion and stormwater runoff. Forests improve air quality by absorbing carbon, releasing oxygen, and filtering particulates.[7]

Grasslands and shrublands protect water quality and provide pollination services that are essential to agricultural production.

- Grasslands and shrublands capture water and filter pollutants, minimizing the ability of contaminants to reach water supplies.[8]
- Grasslands and shrublands provide habitat for native pollinators.

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Wetlands reduce flooding, improve water quality, and support biologically diverse habitats.

- A one-acre wetland can typically store about one million gallons of water. Trees and other wetland vegetation help slow the speed of floodwaters. Water storage by wetland vegetation can lower flood heights and reduce the destructive power of floodwaters.[9]
- Wetlands act as a natural filtration system to improve water quality by absorbing excess nutrients from fertilizers, manure, and sewage. In their role as natural purifiers, wetlands reduce water treatment and infrastructure costs.[10]
- Wetland habitats support rich food chains and are home to a range of species, including mussels, fish, and mammals.

6 National Research Council, *Hydrologic Effects of a Changing Forest Landscape* (Washington D.C.: National Academy of Sciences, 2008).

7 Ibid.

8 Ducks Unlimited, "Wetlands and Grassland Habitat: The Benefits of Two Key Waterfowl Habitat Types" (accessed February 11, 2011, http://www.ducks.org conservation/habitat).

9 United States Environmental Protection Agency, *Wetlands: Protecting Life and Property from Flooding* (EPA843-F-06-001, 2006).

10 United States Environmental Protection Agency, *Economic Benefits of Wetlands* (EPA843-F-06-004, 2006).

Agricultural lands can help to improve water and soil quality.

- Conservation tillage reduces the runoff of soil particles attached to nitrate, phosphorus, and herbicides, contributing to improved water quality. Tillage practices can also protect the soil surface from the impact of rain and slow water movement.[11]
- Recent overall declines in soil erosion and improvements in soil quality in the United States are partially attributable to increased soil conservation practices such as crop residue management, land retirement, and conservation tillage.[12]

Open Water

- Water bodies provide flood control and clean drinking water by storing runoff from stormwater, retaining sediment, and recharging groundwater.
- Open water resources provide recreational opportunities and support livelihoods through irrigation for crops and drinking water for livestock.
- Water bodies absorb plant nutrients and are rich in plant varieties that support many species, including migratory birds.

JERRY AND MARCY MONKMAN/ECOPHOTOGRAPHY.COM

11 American Farmland Trust, *The Environmental Benefits of Well Managed Farmland* (DeKalb, Illinois: Center for Agriculture in the Environment, 2005).

12 Ibid.

Highlighting the economic value of natural goods and services

The following section describes the economic value of select natural goods and services provided by conserved lands in Massachusetts.

SARAH PUTNAM

Drinking water protection

The quality of surface drinking water supplies is greatly impacted by land use in their surrounding watersheds. Over 7.7 million state residents, representing 81 percent of the population, receive their drinking water from surface water sources. Natural lands filter contaminants out of stormwater runoff. Protecting these lands also prevents contaminated runoff from developed areas.

As Exhibit 2 shows, 9 percent of the population in Massachusetts or about 897,000 residents served by public water systems were exposed to drinking water with reported violations of clean water protections.

Exhibit 2. Massachusetts water systems, 2011

	GROUND	SURFACE	TOTAL	REPORTED VIOLATIONS	%
Systems	1,580	227	1,810	95	5
Population served	1,850,000	7,720,000	9,570,000	897,000	9

Source: United States Environmental Protection Agency, Fiscal Year 2011 Drinking Water and Ground Water Statistics (EPA816-R-13-003, 2013).

Forests and drinking water

Massachusetts Department of Conservation and Recreation

Nearly 2.5 million Greater Boston residents enjoy the benefits of one of the world's premier, award winning, reservoir water supplies. The Quabbin and Wachusett Reservoirs, managed by the Massachusetts Department of Conservation and Recreation (DCR) for treatment and distribution by the Massachusetts Water Resources Authority (MWRA), are just one of eight large metropolitan surface reservoir supplies in the United States that are exempt from the EPA's filtration requirements set forth by the 1986 Safe Drinking Water Act. An exemplary watershed source protection program is one of the main reasons that MRWA ratepayers saved an estimated $250 million in filtration plant construction costs as well as $4 million in annual operating costs.

CAROLINE RAISLER

Land acquisition is a critical component of this source protection effort. DCR has based its acquisition and watershed management strategies on the understanding that the finest drinking waters in the world are a product of the natural filtering processes of an undisturbed forested landscape. The replication of these natural processes using infrastructure-based treatment and filtration is inferior to, and more expensive than, the incomparable benefits derived from watershed land protection. Over the past two decades, DCR has spent approximately $130 million, provided by the MWRA, to acquire interests in more than 22,000 privately held acres. These purchases targeted the most highly sensitive lands for water quality protection. This ambitious land protection program ensures that the integrity of the natural landscape will be protected in perpetuity from the persistent threats of urbanization that can compromise water quality. As a result, ratepayers have saved hundreds of millions of dollars in capital improvements and annual operating costs associated with filtration.

The beneficial economics of land conservation in guarding a pure, reliable, and safe drinking water supply while holding down burdensome costs in delivering this vital utility to consumers is crystal clear. The math can be complicated, but simply stated the $130 million spent on land acquisition over the last 20 years has resulted in an approved filtration waiver and savings of approximately $200 million ($250 million filtration plant construction plus operating at $4 million per year for 20 years less $130 million in land acquisition costs). That's a lot of green—in both cash and conservation.

Flood control and prevention

Since 2001, flooding has caused $259 million in property damage in the Commonwealth, according to the Hazards and Vulnerability Research Institute.[13] In 2011, tropical storm Irene hit western Massachusetts, causing severe flooding and over $50 million in damages.[14] Conserving land in floodplains helps avoid these costs by preventing development in flood-prone areas. Wetlands and natural areas near rivers and streams also prevent costly property damage by absorbing and storing potentially devastating floodwaters.

The U.S. Army Corps of Engineers calculated that the loss of wetlands in the Charles River watershed near Boston would have caused an average annual flood damage of $17 million. Drawing on its analysis, the corps decided to acquire over 8,100 acres of wetlands in the river basin for flood prevention rather than construct expensive infrastructure such as dikes and dams.[15] Another study found that coastal wetlands in Massachusetts provide $643 million in storm protection services each year on average.[16]

Town of Brewster

The Compact of Cape Cod Conservation Trusts, Inc.

Brewster, as is the case with all 15 Cape Cod towns, is served by the Cape Cod Aquifer, a shallow sand and gravel aquifer that is the cape's sole source of drinking water. Because of the town's highly permeable soil, Brewster's wells are susceptible to contamination from an array of pollution sources, most notably nitrogen loading from residential septic systems. In order to protect its groundwater sources, the Town of Brewster has made the protection of land that safeguards its water supplies its top open space priority (reaffirmed in its 2013 open space plan).

THE COMPACT OF CAPE COD CONSERVATION TRUSTS, INC.

Since 1998, the Town of Brewster, in collaboration with the Brewster Conservation Trust, has protected 245 acres of strategic open space at a total cost of $12.9 million, with the town (through its Land Bank and Community Preservation Act funds) providing $8.36 million and the state awarding grants of $4.54 million. In the fall of 2012, the town authorized the purchase of an additional 82 acres, adjacent to two separate municipal wellfields. Brewster's investment in land conservation has protected water quality, providing substantial cost savings to the community, by avoiding town-wide sewering needs. Compare this result with neighboring Orleans. That town needs to build a $150–$200 million wastewater treatment plant, at a cost of at least $2,600 per year to the average homeowner, to restore degraded coastal waters and provide adequate septic waste management and treatment.

13 Hazards and Vulnerability Research Institute, "The Spatial Hazard Events and Losses Database for the United States, Version 8.0 [Online Database]" (Columbia, SC: University of South Carolina, 2010).

14 David Zielenziger, "Irene's Cost $10 Billion, But Only 60% was Insured" (*International Business Times*, August 31, 2011).

15 United States Environmental Protection Agency, *Wetlands: Protecting Life and Property from Flooding* (EPA843-F-06-001, 2006).

16 Robert Costanza, Octavio Pérez-Maqueo, M. Luisa Martinez, Paul Sutton, Sharolyn J. Anderson, and Kenneth Mulder, "The Value of Coastal Wetlands for Hurricane Protection" (*Ambio* 37, no. 4, 2008, pp. 241-248).

Climate change mitigation (carbon sequestration)

Carbon dioxide (CO_2) is the primary greenhouse gas emitted into the atmosphere through human activities such as energy production, transportation, and industrial processes. Greenhouse gases released into the atmosphere trap heat and lead to a warming of global temperatures. This results in changing weather patterns with more severe and frequent storm activity and greater weather extremes such as periods of extreme drought. The economic impacts include costly storm and flood damage, loss of agriculture and food production, heat-related illnesses and deaths, damage and disruption from increased wildfires, and loss of tourism and recreation activity among others.[17] Carbon "sinks" are natural areas, such as forests, that collect and store carbon; however, by developing these areas, humans are reducing the environment's ability to remove carbon from the atmosphere.[18]

Natural goods and services: Boston's park system

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Boston's 4,750 acres of parkland (of which 52 percent is forested) provide the city and its residents with important natural services, including air pollution removal and stormwater management. These services have significant economic benefits. Trees and shrubs in city parks absorb a variety of air pollutants, including carbon dioxide, ozone, and sulfur dioxide. This service is valued at $553,000 each year.

Parkland also reduced stormwater management costs by capturing precipitation and/or slowing its runoff. Pervious (i.e., unpaved) park areas also allow precipitation to infiltrate and recharge the groundwater. Approximately 77 percent of the city's parkland is pervious. Based on city water treatment costs, The Trust for Public Land estimated that the annual park stormwater retention value for the city is over $8.67 million.

Source: The Trust for Public Land, Center for City Park Excellence, *How Much Value Does the City of Boston Receive from Its Park and Recreation System?* (2008).

17 Thomas R. Karl, Jerry M. Melillo, and Thomas C. Peterson (eds), *Global Climate Change Impacts in the United States* (New York, NY: Cambridge University Press, 2009).

18 United States Environmental Protection Agency, "Overview of Greenhouse Gasses" (accessed July 18, 2013, http://www.epa.gov/climatechange/ghgemissions/gases/co2.html).

Damde Meadows, Hingham, and Broad Meadows, Quincy

Massachusetts Department of Fish and Game, Division of Ecological Restoration

The Massachusetts Division of Ecological Restoration and its partners are interested in the many economic benefits that healthy, restored habitats provide. To estimate the value of carbon sequestration from salt marsh conservation and restoration, the Massachusetts Division of Ecological Restoration commissioned a study examining two recently completed projects—Damde Meadows in Hingham, a property of The Trustees of Reservations, and Broad Meadows in Quincy, conservation land owned by the city. Economists from ICF International compared the preconstruction conditions before restoration with restoration conditions. They estimated that the restored Damde Meadows site is sequestering about 75 metric tons more CO2 equivalent per year and that the Broad Meadows site is sequestering 121 metric tons more CO2 equivalent per year. The annual additional carbon storage provided by both restoration sites combined is equivalent to offsetting the emissions from burning 22,000 gallons of gasoline.

The study evaluated sequestration amounts in terms of the social cost of carbon (SSC).* Unlike market pricing, which assigns value to units of carbon based on what people are paying to offset emissions, the SSC is calculated based on the damages from climate change caused by a unit of greenhouse gas. Compared with its pre-restoration condition, the restored Damde Meadows wetlands alone will avoid up to an additional $92,000 worth of damage from carbon dioxide between 2013 and 2050. The Broad Meadows site will avoid up to an additional $147,000 worth of damage in the same time period.

Social cost of the carbon sequestered from 2013 to 2050 as a result of the restoration project compared with the pre-restoration conditions.

	PRE-RESTORATION		POST-RESTORATION		NET DIFFERENCE IN CARBON STORAGE RATE PRE- AND POST-RESTORATION
Project site	Carbon storage rate	Value of reduction in SCC	Carbon storage rate	Value of reduction in SCC	
Damde Meadows	11.8	$ 14,000	87.9	$ 106,000	+ 76.1
Broad Meadows	24.8	$ 30,000	146.1	$ 177,000	+121.3

Carbon sequestration is but one of the many types of ecosystem service benefits that conservation and ecological restoration projects provide. Others include water purification, storm damage mitigation, and increased recreation.

*Interagency Working Group on Social Cost of Carbon, United States Government, *Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866* (February 2010).

Return on investment in land conservation

The Trust for Public Land conducted an analysis of the return on the Commonwealth's investment in land conservation by comparing the state's investment with the economic value of the natural goods and services provided by conservation lands. Every $1 invested by Massachusetts in land conservation returns $4 in economic value of natural goods and services.

Methodology

To determine the natural goods and services provided by conserved lands, The Trust for Public Land analyzed the ecosystem types found within conserved lands using geographic information system (GIS) analysis. The Trust for Public Land's Conservation Almanac[19] obtained GIS data (i.e., mapped boundaries) of publicly and privately held conservation easements and purchased conservation lands that were protected with state funding. Owing to the complexities of aligning spending records to spatial records, data were not available for a small percentage of parcels of land acquired by the state. The Trust for Public Land collected the best available information, which was provided by Massachusetts Executive Office of Energy and Environmental Affairs. These data represent a subset of total acres protected and spending from 1998 to 2011. The Trust for Public Land analyzed a total of 129,000 acres protected through state funding mechanisms using $412 million in funding (nominal spending, i.e., not adjusted to present value). These projects are sufficiently representative of state land conservation activity (i.e., 99 percent of the acres protected and 93 percent of spending) to estimate the return on investment.

JERRY AND MARCY MONKMAN/ECOPHOTOGRAPHY.COM

19 The Trust for Public Land, Conservation Almanac (accessed July 1, 2013, http://www.conservationalmanac.org).

The Trust for Public Land then determined the underlying ecosystem types using the 2006 National Land Cover Dataset (NLCD 2006), which features a 16-class land cover classification scheme.[20]

From this analysis The Trust for Public Land calculated the number of acres of each of the 13 ecosystem types found within the conservation land. The most commonly acquired land cover type is deciduous forest representing 43 percent of all conserved land. Exhibit 3 breaks out the full results of the land cover analysis.

Exhibit 3. Lands conserved by land cover type

YEAR	ACRES	PERCENT LAND COVER
Deciduous forest	55,600	43 %
Evergreen forest	20,100	16 %
Mixed forest	15,600	12 %
Woody wetland	13,900	11 %
Pasture	9,240	7 %
Cultivated crops	3,710	3 %
Open space	3,240	3 %
Emergent herbaceous wetland	2,000	2 %
Open water	2,000	2 %
Developed	1,530	1 %
Shrub/scrub	1,120	1 %
Grassland	611	< 1 %
Barren	328	< 1 %
Total	**129,000**	

Source: 2006 National Land Cover Dataset (NLCD 2006).

Results

Based on the per-acre economic values (see Appendix), 129,000 acres of conserved land provide $3.17 billion (present value, i.e., the value of past investments in today's dollars) in total economic value from date of purchase (i.e., beginning in 1998) to 2023 (i.e., ten years into the future) in the form of natural goods and services.

The Trust for Public Land used this value to estimate the return on $626 million (present value) invested in 129,000 acres of land conservation by the Commonwealth from 1998 to 2011. The comparison of this investment with the economic value of natural goods and services generated by these lands in the past (i.e., 1998 to 2013) and into the future (i.e., 2014 to 2023) finds that every $1 invested returns $4 in economic value. These goods and services will continue to be provided well beyond 2023, increasing the total return on investment beyond that calculated in this analysis.

20 Joyce A. Fry, George Xian, Suming Jin, Jon A. Dewitz, Collin G. Homer, Limin Yang, Christopher A. Barnes, Nathaniel D. Herold, and James D. Wickham, "Completion of the 2006 National Land Cover Database for the Conterminous United States" (*Photogrammetric Engineering & Remote Sensing* 77, no. 9, 2011, pp. 858-864).

Land conservation supports the economy

In addition to providing natural goods and services, land conservation contributes to the Massachusetts economy in terms of jobs, business growth, taxes, tourism, and other revenue.

Tourism and outdoor recreation industry

Tourism

Parks and natural areas contribute to a thriving tourism and outdoor recreation industry. Over 22.1 million people visited Massachusetts in 2012. Visitors spend an estimated $16.9 billion in the Commonwealth each year and generate $1.1 billion in state and local taxes. The total economic impact of travel was $26.9 billion in 2011. Tourism supported nearly 125,000 jobs, which provided $3.63 billion in wages to Massachusetts residents.[21]

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Outdoor recreation

Outdoor recreation provides an enormous boost to the state's economy. It generates $10 billion in annual consumer spending in Massachusetts by both visitors and residents. That spending benefits the state and local municipalities through greater sales tax revenues. The tax revenue attributed to outdoor recreation spending equals $739 million annually. Spending on outdoor recreation also helps local businesses that hire Massachusetts residents. Approximately 90,000 jobs in the state are supported by this spending, accounting for $3.5 billion in wages and salaries. Much of that earned income is then spent in local communities, further magnifying the economic impact of outdoor recreation. At least 61 percent of Massachusetts residents participate in outdoor recreation each year.[22]

Wildlife-related recreation

Each year the Massachusetts Department of Fish and Game protects thousands of acres that provide critical wildlife habitat. In FY 2012, the department conserved 5,630 acres of wildlife habitat.[23] These lands and other protected natural areas generate important economic benefits by supporting viable populations of fish, game, and other wildlife species. As shown in Exhibit 4, nearly 2.2 million people participated in some form of wildlife-associated recreation in Massachusetts in 2011. This included activities such as fishing, hunting, and birdwatching. Of those participants, 1.8 million (83 percent) engaged in wildlife watching while over a half-million sportspersons hunted or fished during the year (some did both). Across the Commonwealth, participants spent $1.99 billion on trip-related, equipment, and other expenses to engage in these activities. Wildlife-watching expenditures accounted for almost two-thirds of the total spending.[24]

21 Massachusetts Office of Travel and Tourism, *2012 Annual Report* (March 2013).

22 Outdoor Industry Association, *The Outdoor Recreation Economy: Massachusetts* (accessed July 22, 2012, http://www.outdoorindustry.org/images/ore_reports/MA-massachusetts-outdoorrecreationeconomy-oia.pdf).

23 Massachusetts Department of Fish and Game, Division of Fisheries and Wildlife, *Department of Fish and Game & Division of Fisheries and Wildlife Land Acquisitions FY 2012*.

24 United States Fish and Wildlife Service, *2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*.

Exhibit 4. Participation in wildlife-associated recreation in Massachusetts, 2011 (residents and nonresidents)

TYPE OF PARTICIPANT	NUMBER OF PARTICIPANTS	EXPENDITURES		
		TRIP-RELATED	EQUIPMENT AND OTHER	TOTAL
Wildlife watcher	1,830,000	$ 286,000,000	$ 1,000,000,000	$ 1,290,000,000
Sportsperson (hunters and anglers)	538,000	$ 271,000,000	$ 431,000,000	$ 701,000,000
Total	**2,200,000***	**$ 557,000,000**	**$ 1,430,000,000**	**$ 1,990,000,000**

*The total is lower than sum of the participants because some individuals participated in both wildlife watching and hunting and fishing.
Source: United States Fish and Wildlife Service, *2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*.

Grasslands wildlife and recreation

Mass Audubon

Grasslands are especially beneficial for wildlife-associated recreation. Between 1998 and 2011, Massachusetts conserved 611 acres of grasslands. These areas provide unique habitats for a variety of species, including white-tailed deer, red fox, cottontail rabbits, birds, bats, and butterflies. These grassland-dependent species draw wildlife watchers who spend money locally.

SHAWN P. CAREY

Grasslands attract a large number of wildlife observers who spend money on classes and programs and in local communities. Each year over 9,250 people visit Mass Audubon–managed grasslands, participate in programs related to these grasslands, and/or attend grassland-related events and festivals.* The U.S. Fish and Wildlife Service estimates that wildlife-watching participants in Massachusetts spend an average of $28 per day. On an annual basis, visitors to grasslands managed by Mass Audubon spend roughly $259,000 in local communities, or about $1.3 million over a five-year period.

*Personal communication with Kim Peters, Mass Audubon, July 9, 2012.

Motorized recreation

Some protected open space also provides opportunities for motorized recreation, including riding all-terrain vehicles (ATVs) and snowmobiles. As of early 2012 nearly 18,000 ATVs (89 percent belonging to residents) and 13,000 snowmobiles (94 percent belonging to residents) were registered in the state.[25] There are more than 1,100 miles of snowmobile trails across the Commonwealth, according to the Snowmobile Association of Massachusetts. Trails on public lands add to the opportunities for participating in motorized recreation, which means more participants who spend money locally. A 2003 study found that annual expenditures related to snowmobiling trips are over $10.2 million. When combined with other expenditures (e.g., equipment), spending related to snowmobiling represents an injection of $54.8 million into the economy each year.[26]

Agriculture, forestry, and commercial fishing

The agriculture, forestry, and commercial fishing industries depend on maintaining farms, forests, and water quality. Agriculture, forestry, commercial fishing, and related processing activity are responsible for $13 billion in output,[27] and 147,000 jobs in Massachusetts.[28]

Agriculture industry

Land conservation supports the state's agriculture industry by keeping farms in active production while helping farms invest in and expand their operations. Massachusetts has approximately 7,700 farms accounting for 520,000 acres across the state.[29] In 2011, the state's agriculture industry output measured $510 million in revenue (excluding services and forestry).[30] Over 80 percent of farms are family owned and more than 95 percent are "small farms" defined as having annual sales below $250,000. Massachusetts farmland is also the most valuable in the United States with an average value of $12,200 per acre.[31]

Exhibit 5. Top five agriculture commodities, 2011 (by cash receipts)

	FARM RECEIPTS	FARM RECEIPTS - PERCENT OF STATE	FARM RECEIPTS - PERCENT OF U.S.
1. Greenhouse/nursery	$ 158,000,000	30.7	1.0
2. Cranberries	$ 102,000,000	19.8	29.7
3. Dairy products	$ 48,000,000	9.3	0.1
4. Aquaculture	$ 21,900,000	4.2	1.6
5. Apples	$ 20,600,000	4.0	0.9

Source: USDA Economic Research Service, *Massachusetts State Fact Sheet* (2011).

As shown in Exhibit 5, greenhouse and nursery products (flowers, ornamental shrubs) were the top-grossing agricultural commodities with $158 million in sales in 2011. Cranberries were second ($102 million) and accounted for 30 percent of the entire nation's cranberry sales. The top

25 Personal communication with Kathy Lubold, Massachusetts Environmental Police, August 20, 2012.

26 Snowmobile Association of Massachusetts, "Economic Impact: Snowmobiling in Massachusetts" (accessed July 19, 2013, http://www.sledmass.com/economic-impact/).

27 Rigoberto Lopez and Chris Laughton. *The Overlooked Economic Engine: Northeast Agriculture* and supporting report (Farm Credit East, 2012).

28 See Exhibits 6,8, and 9.

29 United States Department of Agriculture, National Agricultural Statistics Service, *New England Agricultural Statistics* (2011).

30 United States Department of Agriculture, Economic Research Service, *2011 State Agriculture Overview: Massachusetts*.

31 U.S. Department of Agriculture, "2007 Census of Agriculture".

livestock product in the state was milk, which generated annual revenue of nearly $48 million.[32] Aquaculture products, which have grown to include more than 15 species of fish and shellfish cultivated for food, research, biomedical, sport, and ornamental purposes, were the fourth-largest-grossing commodity in the state.[33] Rounding out the top five are apples—an iconic staple of the farm industry in Massachusetts and a $20.6 million component of the agriculture sector.

Exhibit 6. Value added by agricultural manufacturing and production to the Massachusetts economy

INDUSTRY	JOBS	ANNUAL PAYROLL	VALUE ADDED
Food manufacturing (2011)	18,700	$ 743,000,000	$ 2,630,000,000
Agricultural production of goods and services (2010)	11,900	Not Available	$ 517,000,000
Textile-related manufacturing (2011)	2,910	$ 142,000,000	$ 296,000,000
Total	**33,600**	**$ 884,000,000**	**$ 3,440,000,000**

Sources: United States Department of Commerce, United States Census Bureau, "2011 County Business Patterns (NAICS)" (accessed August 8, 2013, http://www.census.gov/econ/cbp/); United States Department of Commerce, United States Census Bureau, "Annual Survey of Manufactures: Geographic Area Statistics: Statistics for All Manufacturing by State: 2011 and 2010" (accessed August 8, 2013, http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ASM_2011_31AS101&prodType=table); Rigoberto Lopez and Chris Laughton. The Overlooked Economic Engine: Northeast Agriculture and supporting report (Farm Credit East, 2012).

As Exhibit 6 shows, farming adds $517 million to the state economy and supports strong food and textile manufacturing sectors, which, combined with agriculture's direct contribution, add $3.44 billion to the Commonwealth's economy each year. The economic impact is even more significant when the secondary, or "ripple," effects of this activity are considered. For example, farms support local economies because farmers spend money on local goods and services. Each year over $215 million is spent by farm operators on things like fuel, feed for livestock, seeds, and agricultural services.[34] Furthermore, approximately $32.5 million annually is generated in property taxes from farms across the state.[35]

SUSAN LAPIDES

The economic activity generated by agriculture and agriculture-supported industries supports tens of thousands of jobs in the Commonwealth. Nearly 18,700 jobs are provided by the food manufacturing sector with an additional 2,910 in the textile manufacturing sector. Together they account for nearly $884 million in wages to Massachusetts workers. When jobs provided directly by agriculture are factored in, farming in the Commonwealth helps put 33,600 residents to work each year.

32 United States Department of Agriculture, Economic Research Service, *2011 State Agriculture Overview: Massachusetts*.

33 Massachusetts Department of Agricultural Resources, "Massachusetts Aquaculture Industry" (accessed July 18, 2013, http://www.mass.gov/agr/aquaculture/Industry.htm).

34 United States Department of Agriculture, "2007 Census of Agriculture".

35 American Farmland Trust, *Farms for the Future: Massachusetts' Investments in Farmland Conservation* (Northampton, Massachusetts: American Farmland Trust, 2008).

Tougas Family Farm, Littleton

New England Forestry Foundation

The New England Forestry Foundation has worked in partnership with the Tougas family for over 30 years by leasing a portion of the organization's Rocky Pond Community Forest, a 238-acre property comprised of forest and farmland. The family cultivated a pick-your-own strawberry patch on the property's 35-acre field to compliment the apple orchard and fruit farm. The property originally was owned by Gertrude Falby, who donated the farmland and 132 acres of woodland to the Foundation in 1980.

Land assets of this type, those outside of mission land use, are constantly under the threat of sale for other uses in dire circumstances. The field was particularly vulnerable because it is located near residential housing. In fact, the New England Forestry Foundation was approached by a developer for the parcels. While the New England Forestry Foundation rejected the offer it highlights the field's risk of conversion.

In June 2012, the New England Forestry Foundation placed the field into permanent conservation through the Commonwealth's APR Program, a voluntary initiative intended to offer a nondevelopment alternative to farmers and other owners of "prime" and "state important" agricultural land. To further support the agricultural initiative, the Foundation sold the conserved field to the Tougas family at the agricultural real estate value, a huge discount from the fair market value prior to the APR.

Co-owner and co-manager Andre Tougas said that "with the former New England Forestry Foundation acreage now belonging to the farm, I have invested in planting more apple and cherry trees on the land now that there are no concerns that it will be sold for development."

WHITNEY BEALS

In addition to providing locally grown food, the Tougas Family Farm is also a bustling, local economic engine providing employment for 57 people. A recent weekend brought 22,000 visitors to the farm for a wholesome, recreational family experience.

The Tougases will continue to manage the farmland sustainably and the New England Forestry Foundation will continue to manage the adjoining 203 acres of forestland under Forest Stewardship Council sustainability guidelines for the highest environmental and ecological values. Just as the farm provides local food, the forest provides a source of local, sustainable, forest-based resources for everyday items such as lumber and fuelwood, as well as recreational opportunities for the general public.

Agri-tourism

Land conservation helps support a growing agri-tourism industry. The industry includes a broad set of activities, including farm tours, vacations, bed-and-breakfasts, hiking, cross-country skiing, and hunting and fishing. According to the Massachusetts Department of Agricultural Resources, which maintains a map of agri-tourism destinations, over 400 farm attractions are open to the public.[36] From 2002 to 2007, an 800 percent increase in farm revenue was attributed to agri-tourism in the state, from $663,000 to $5.6 million.[37] The average farm providing agri-tourism and recreational services generates $34,500 from these activities, up 170 percent from $12,800 in 2002.[38]

Exhibit 7. Farmland loss, 1997–2007

CATEGORY	YEAR		
	1997	2002	2007
Farmland (acres)	578,000	519,000	518,000
Average size of farms (acres/farm)	79	85	67
Farmland loss (1997 - 2007)			59,800 acres
Percent loss			10.3 %
Farmland converted to development (1997 - 2007)			12,800 acres
Cropland (acres)	247,000	208,000	187,000
Cropland loss (1997 - 2007)			59,900 acres
Percent loss			24.2 %
Estimated market value of agricultural products sold	$ 484,000,000	$ 384,000,000	$ 490,000,000
Average per farm	$ 66,200	$ 63,300	$ 63,700
Average per acre of farmland	$ 837	$ 741	$ 946

Sources: U.S. Department of Agriculture, 2007 Census of Agriculture; National Agricultural Statistics Service; Farmland Information Center: Massachusetts Statistics Sheet.

The economic cost of farmland loss

Between 1997 and 2007, the Commonwealth lost nearly 60,000 acres of farmland, as shown in Exhibit 7. During this time 12,800 of those acres were permanently lost to development. Perhaps more significantly, Massachusetts lost nearly one-quarter of its cropland in the same ten-year span. On average, the Commonwealth loses 6,000 acres of farmland each year, 1,280 of which being converted to development. According to Losing Ground: Beyond the Footprint, an analysis published by Mass Audubon, the Commonwealth has experienced even greater rates of farmland development.[39] Mass Audubon estimated that 10,000 acres of farmland were developed in the six-year period between 1999 and 2005—a rate of 1,670 acres per year. The loss of farmland is costly. In 2011, the estimated average market value of agricultural products sold was $1,270 per acre of farmland, this does not include the loss of associated secondary economic impacts.[40]

36 Massachusetts Department of Agricultural Resources, "Agri-Tourism Farms" (accessed July 18, 2013, http://www.mass.gov/agr/massgrown/agritourism_farms.htm).

37 Heather McCarron, "A Growing Trend – Massachusetts Farms Are Thriving" (*Milford Daily News*, July 24, 2010, accessed July 18, 2013, http://www.milforddailynews.com/news/x1070618329/A-growing-trend-Massachusetts-farms-are-thriving).

38 United States Department of Agriculture, "2007 Census of Agriculture" (accessed July 19, 2013, http://quickstats.nass.usda.gov/).

39 DeNormandie, James. *Losing Ground: Beyond the Footprint, Patterns of Development and Their Impact on the Nature of Massachusetts* (Mass Audubon, 2009).

40 United States Department of Agriculture, Economic Research Service, "Farm Income and Wealth Statistics" (accessed August 4, 2013, http://www.ers.usda.gov/data-products/farm-income-and-wealth-statistics.aspx#.Uf7nlNLksoF).

Massachusetts cranberry industry

Massachusetts is the second-largest producer of cranberries in the nation, second only to Wisconsin. In 2012, the state had 13,000 acres producing 2.12 million barrels of cranberries annually. The value of cranberries used in production topped $103 million.* Cranberry growing not only provides a living for Massachusetts farmers; it also generates income and jobs in related businesses and activities. For example, Ocean Spray Cranberries, Inc., the largest distributor of cranberries, is headquartered in Massachusetts and purchases much of the locally grown cranberry crop. The company employs over 450 people at its corporate office in Lakeville-Middleboro in Massachusetts. An additional 195 employees work at its manufacturing facility in Middleboro, the company's largest plant nationwide.**

*United States Department of Agriculture, National Agricultural Statistics Service: New England Field Office, Massachusetts Cranberries, (accessed July 18, 2013, http://www.mass.usda.gov/Statistics_by_State/New_England_includes/Publications/jancran.pdf).
**Ocean Spray, "About Us," (accessed July 18, 2013, http://www.oceanspray.com/Who-We-Are/Careers/About-Us.aspx).

Forest products industry

Massachusetts is covered by 3.19 million acres of forestland representing nearly 63 percent of the entire state.[41] Timberland (land suitable for commercial timber) is estimated to comprise 2.89 million acres, or 93 percent of all forestland. The majority of commercial timber harvesting is done in the central and western upland regions of the state. These areas are largely responsible for the state's timber harvest that is estimated to be 13.3 million cubic feet of timberlands, or 100 million board feet of timber each year.[42] Forestland conservation supports the Commonwealth's economy through activities related to timber harvesting, production, and manufacturing. However, a total of 106,000 acres of all forestland were lost in the ten-year period between 1998 and 2008.[43]

According to the UMass Amherst Extension Center for Agriculture, forestry ranks seventh in the state in terms of its employment impact. Forests also generate between $232 and $338 million in wood product revenues each year.[44] Forest products are manufactured at 166 manufacturing facilities across the Commonwealth, which include sawmills and paper mills.[45] As Exhibit 8 shows, wood product manufacturing employs 2,340 employees and accounts for an annual payroll of $96.3 million. Total forest-related manufacturing, including paper and furniture in addition to wood products, contributes $1.67 billion to the state's economy each year and employs 14,800 with an annual payroll of $744 million. By other estimates, forest-based employment is as high as 24,000 in the state.[46]

41 Avril L de la Crétaz, Lena S. Fletcher, Paul E. Gregory, William R. VanDoren, and Paul K Barten, *An Assessment of the Forest Resources of Massachusetts* (University of Massachusetts Amherst, Department of Natural Resources and Conservation, and Massachusetts Department of Conservation and Recreation, prepared for the USDA Forest Service, 2010).

42 Massachusetts Executive Office of Energy and Environmental Affairs, *2011 Land Protection Report* (Spring 2012).

43 Avril L de la Crétaz, Lena S. Fletcher, Paul E. Gregory, William R. VanDoren, and Paul K Barten, *An Assessment of the Forest Resources of Massachusetts* (University of Massachusetts Amherst, Department of Natural Resources and Conservation, and Massachusetts Department of Conservation and Recreation, prepared for the USDA Forest Service, 2010).

44 University of Massachusetts, Center for Agriculture, Research & Education, "Valuing the Forest for the Trees" (accessed July 18, 2013, http://ag.umass.edu/news-events/highlights/valuing-forest-trees).

45 American Forest and Paper Association, *Forest & Paper Industry at a Glance: Massachusetts* (2011).

46 University of Massachusetts, Center for Agriculture, Research & Education, "Valuing the Forest for the Trees" (accessed July 18, 2013, http://ag.umass.edu/news-events/highlights/valuing-forest-trees).

Exhibit 8. Value added by forestry-related manufacturing to the Massachusetts economy

INDUSTRY	EMPLOYEES	ANNUAL PAYROLL	VALUE ADDED
Paper manufacturing	8,820	$ 475,000,000	$ 1,090,000,000
Furniture manufacturing	3,690	$ 173,000,000	$ 398,000,000
Wood product manufacturing	2,340	$ 96,300,000	$ 187,000,000
Total	**14,800**	**$ 744,000,000**	**$ 1,670,000,000**

Sources: United States Department of Commerce, United States Census Bureau, "2011 County Business Patterns (NAICS)" (accessed August 8, 2013, http://www.census.gov/econ/cbp/); United States Department of Commerce, United States Census Bureau, "Annual Survey of Manufactures: Geographic Area Statistics: Statistics for All Manufacturing by State: 2011 and 2010" (accessed August 8, 2013, http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ASM_2011_31AS101&prodType=table).

Specialty forest products

Maple syrup products and Christmas trees are two specialty forest products found in Massachusetts that benefit from the protection of working lands. Over 280 farms grow Christmas trees, which account for 3,160 acres across the state. In 2007, nearly 75,900 trees were harvested—an average of 24 trees per acre. Sales of Christmas trees topped $2.78 million.[47] This means that an average acre of Christmas trees generates about $900 in revenue. The Massachusetts Christmas Tree Association lists nearly 100 tree growers in the state.[48] The seasonal selling of trees is a significant source of income for many of these farmers and landowners.

Maple syrup production is also supported by the protection of forestland. In 2011, 62,000 gallons of maple syrup were sold for a combined total of $3.53 million. This was the highest sales output in the past five years and more than double the output of the previous year. In 2007, 292 operations were tapping maple trees for a total of 253,000 taps. According to the Massachusetts Maple Producers Association, the industry employs 1,000 workers, and about 60,000 tourists spend more than $1.5 million during the "sugaring" season at maple farms and nearby restaurants and lodging businesses.[49]

47 United States Department of Agriculture, "2007 Census of Agriculture".

48 Massachusetts Christmas Tree Association, "Tree Farms" (accessed July 18, 2013, http://www.christmas-trees.org/retailers-county.htm).

49 Massachusetts Maple Producers Association, "Maple Syrup and the Massachusetts Economy" (accessed on July 18, 2013, http://www.massmaple.org/economics.php).

Commercial fishing industry

Protecting fish habitat and water quality contributes to the important commercial fisheries industry and closely related economic sectors. In 2011, Massachusetts had the highest commercial landings in New England, totaling $565 million. As shown in Exhibit 9, the sales impact of the industry was $7.75 billion, also the highest in New England. Massachusetts generated the largest impact in New England across three other categories, generating 98,400 jobs, and $3.09 billion in value added impacts. The retail sector generated the greatest employment impacts, supporting 59,700 jobs.[50]

Exhibit 9. Economic impacts of the Massachusetts seafood industry

SUBSECTOR	SALES	VALUE ADDED	JOBS
Commercial harvesters	$ 1,030,000,000	$ 480,000,000	13,300
Seafood processors and dealers	$ 980,000,000	$ 480,000,000	7,590
Importers	$ 4,050,000,000	$ 1,230,000,000	14,700
Seafood wholesalers and distributors	$ 500,000,000	$ 220,000,000	3,100
Retail sectors	$ 1,200,000,000	$ 670,000,000	59,700
Total	**$ 7,750,000,000**	**$ 3,090,000,000**	**98,400**

Source: United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, *Fisheries Economics of the U.S. 2011: New England*.

Economic development

Quality of life

Conservation has major implications for the health of the state's economy beyond the industries directly impacted. Protecting natural resources improves the quality of life for the residents of Massachusetts by providing places to roam, play, and learn and by maintaining the scenic beauty of the state. Quality of life has a major impact on the ability of the Commonwealth to attract well-educated and talented workers and new businesses. Land conservation helps the state maintain a quality-of-life advantage in an increasingly competitive national and global economic climate.

The most sought-after workers in today's economy look at more than just a paycheck when picking places of employment. One survey of high-tech workers showed that a job's attractiveness increases by 33 percent in a community with a high quality of life.[51] Another survey found that the availability of outdoor activities is the second most important factor after job availability for recent college graduates when deciding whether to stay or leave Massachusetts.[52] A 2003 quality of life survey undertaken for The Massachusetts Institute (MassINC)[53] also found that access to beaches, oceans, and mountains is one of the state's three most desirable features. Over half of respondents also said that the loss of open space, including loss of farmlands and parks, posed a threat to quality of life.[54]

50 United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, *Fisheries Economics of the U.S. 2011: New England*.

51 American Planning Association, *How Cities Use Parks for Economic Development* (2002).

52 Mount Auburn Associates and Yellow Wood Associates, *Parks and Beaches: Common Cents for the Common Wealth* (The Trust for Public Land, 2007).

53 The Massachusetts Institute for a New Commonwealth.

54 Larry Hugick and Jenny Armeni, *The Pursuit of Happiness: A Survey on the Quality of Life in Massachusetts* (MassInc, 2004).

Quality of life is the Commonwealth's top-ranked asset for businesses, according to Forbes Magazine. In 2011, Forbes listed Massachusetts as the state with the highest quality of life in the country in its Best States for Business and Careers rankings. The state earned this ranking, in part, through its culture and recreation opportunities. The state did not score in the top ten of any other category, which indicates how important quality of life is to business growth and economic development.[55] In a similar ranking by CNBC, the Commonwealth ranked in the top ten of all states in quality of life based on criteria that included air and water quality.[56] Businesses recognize the importance of quality of life in attracting skilled employees. According to CNBC, air and water quality and perceived livability are the second most important consideration for locating a business after cost of doing business.

Real estate development and property values

Open space preservation in Massachusetts also supports economic development by stimulating real estate development (and redevelopment) while boosting property values and thereby increasing municipal tax revenues. Studies have shown that the value of property adjacent to either public or privately owned open space is measurably higher than that of comparable properties without this amenity. The value is even greater when the adjacent open land is permanently protected.[57] An academic study that examined the amenity value of proximity to Great Meadows National Wildlife Refuge, located 20 miles west of Boston, found that a property located 200 meters (about 650 feet) closer to the refuge increases the sale price of the average property by almost $2,000.[58] Another study found that an average home in Lynnfield, Massachusetts is worth $34,600 more if located near open space, an increase of 6.7 percent in property value. This increase in value generates an additional $415 in town property taxes per house annually.[59] Local trails are also a highly desirable amenity among homebuyers. Homes near the Minuteman Bikeway and Nashua River Rail Trail in Massachusetts sell in 21 days on average, or 45 percent faster than other comparable homes, and sell closer to their list price.[60]

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55 Kurt Badenhausen, "The Best States for Business and Careers" (*Forbes*, November 22, 2011, accessed July 17, 2013, http://www.forbes.com/special-report/2011/best-states-11_land.html).

56 CNBC, "America's Top States for Business 2011: A CNBC Special Report" (accessed July 18, 2013, http://www.cnbc.com/id/41666600/).

57 United States Department of Agriculture, Forest Service, Cooperating Across Boundaries: Partnerships to Conserve Open Space in Rural America (2006).

58 Brad C. Neumann, Kevin J. Boyle, and Kathleen P. Bell, "Property Price Effects of a National Wildlife Refuge: Great Meadows National Wildlife Refuge in Massachusetts" (*Land Use Policy* 26, no. 4, 2009, pp. 1011-1019).

59 Amber Donnelly, "Measuring the Value of Open Space: A Hedonic Study" (Bachelor's thesis, College of the Holy Cross, Worcester, MA, 2005).

60 Craig Della Penna, *Home Sales near Two Massachusetts Rail Trails* (Northampton, MA: The Murphys Realtors, Inc., 2006).

Urban parks provide especially substantial economic benefits. Property owners in Boston benefit from the investment in parks as proximity to parks directly accounts for $724 million in property value in the city. Boston itself receives $8.26 million in property taxes just from the increase in property value attributed to its park and recreation system. An additional $1.92 million in tax revenue is generated from the increased tourism value from the system.[61]

Fiscal health

In addition to increasing property tax revenue through increased property values and generating new sales tax revenue from visitors, land conservation saves Commonwealth communities money through avoided costs on expensive infrastructure and other municipal services required by residentially developed areas such as schools, police and fire protection, and others. Studies have consistently shown that open space and working lands contribute more in taxes than they require in municipal services. Residential land, however, contributes less in taxes than it receives in municipal services, representing a net loss to local governments. The national median across 151 communities over 25 years is that for every $1 paid in local taxes, working lands and open space require $0.35 in services while the average home requires $1.16 in services.[62]

Studies of ten Massachusetts communities undertaken by the American Farmland Trust confirm these findings: Open space and working farms and forests require on average only $0.43 in services for every $1 in tax revenue generated by those lands. Residential land, meanwhile, requires $1.10 in services for every $1 generated in tax revenue.[63]

JERRY AND MARCY MONKMAN/ECOPHOTOGRAPHY.COM

61 The Trust for Public Land, *How Much Value Does the City of Boston Receive from Its Park and Recreation System?* (2008).
62 American Farmland Trust, *Cost of Community Services Fact Sheet* (Northampton, MA: Farmland Information Center, 2010).
63 Ibid.

Gateway City Park in Fitchburg

The Trustees of Reservations

Fitchburg is making a cleaned and restored North Nashua River a focal point of social and economic revitalization. Among a number of sites identified as possible green space was a derelict five-acre parcel along the river on the city's west end, in what was historically a mill district. This parcel was the site of a woolen mill that burned down in the mid-1980s and had since been abandoned. In 2008, the site was approved for development as industrial storage space, which would have resulted in large buildings backed to the river and the majority of the five acres being paved.

The Trustees of Reservations began working with city, the Nashua River Watershed Association, the North County Land Trust, and other community organizations to create an alternative, green future for this site. In 2009, the Commonwealth announced a new conservation program—the Gateway City Parks Program—that would ultimately provide roughly $1.6 million to acquire the land and design and construct a park. With the support of state funding, The Trustees of Reservations was able to acquire the land from the development company, permanently protecting the land through conservation restriction, securing additional trail easements with neighboring owners, and conveying the parcel to the city for design and construction as a public park.

Gateway Park opened in September 2011 as the newest riverfront park in an emerging greenway and includes features such as scenic views of the water, walking paths, benches, a natural amphitheater, a community garden, and picnic areas. The park's completion marked the culmination of three years of collaborative effort on the part of over a dozen public and private groups, including the City of Fitchburg, the Massachusetts Executive Office of Energy and Environmental Affairs, the Fitchburg Greenway Committee, The Trustees of Reservations, North County Land Trust, Nashua River Watershed Association, and WDC Construction, Inc.

Since the inception of the Gateway Park project, the River Street area has seen encouraging redevelopment activity. The River Street corridor was finally approved as a 40R Smart Growth overlay district by the City Council, after a previous attempt at passing this innovative zoning change was voted down. The 40R designation bases development densities on building space, not land area. It also provides incentives for renovation. Studies in other areas of the city have suggested that increasing allowable densities could generate as much as $4 million in additional annual tax revenue for the city.* Other activity includes the redevelopment of a mill building across the river from the park. The Riverside Commons project is a mixed-use development with 187 residential units and over 16,000 square feet of commercial space. The assessed value of the property tripled from roughly $1 million to $3 million with the change of use from industrial to commercial/residential. Furthermore, upon completion of park construction, the developers were able to secure over $17.2 million in private financing despite challenging market and lending conditions. While the park is not directly responsible for these activities, its value is clearly recognized—touted on the Riverside Commons website homepage as the "new nature park" and "river walk."

* Urban Land Institute and MassDevelopment, *Revitalizing John Fitch Highway*, (2011).

Economic impact of investing in local parks

Investment in existing city and community parks amplifies the economic benefits provided by these spaces through the improvement of their quality and through the creation of additional jobs and local economic activity. High-quality parks can have measurably greater economic impacts than their lower-quality counterparts, which can have negative economic impacts. Investing in the maintenance and improvement of parks also puts local people to work directly and through the economic activity that is generated as the money spent on parks ripples throughout the local economy.

Real estate development and property values

People and businesses want to locate next to high-quality parks. In general, the higher the quality of a park, the greater the demand is for property near that park. That demand translates directly into higher property values and greater municipal property tax revenues. Research conducted by The Trust for Public Land's Center for City Park Excellence has found that "excellent" parks tend to add 15 percent to the value of a nearby property. Problematic parks, however, can subtract 5 percent of a home's value.[64] A study of capital spending for park improvements in New York City found a considerable increase in the economic impact of parks after improvements were made. These changes included an increase in asking rents in buildings surrounding the park, a lower single-family turnover ratio, and an increase in the sale price of single-family homes.[65] These types of impacts mean that improving local parks is a significant economic development tool.

Local jobs and economic impact

The Trust for Public Land conducted an analysis of the local economic and employment impacts of the Commonwealth's investments in improving Gateway City parks and outdoor swimming pools across Massachusetts.[66]

Park improvements in Gateway Cities

The state-designated Gateway Cities represent the Commonwealth's older industrial communities that once served as regional economic epicenters but have declined in recent years. The shift away from traditional manufacturing to knowledge-based industries has left these communities in need of revitalization. State investment in maintaining and improving local parks in these communities has been an effective strategy in stimulating local economic activity and creating local jobs.

Data were collected on how much the state has invested and will continue to invest in park improvements in each of the 24 communities from 2009 to 2015. Spending amounts for each city were broken out by the type of spending. A total of eight spending categories were examined, each of which corresponds to a specific industry. Exhibit 10 provides the breakdown of spending in the various types of park improvements.

64 The Trust for Public Land, *Measuring the Economic Value of a City Park System* (2009).

65 Ernst & Young, *Analysis of Secondary Economic Impacts Resulting from Park Expenditures* (New York, NY: New Yorkers for Parks, 2003).

66 The Commonwealth defines a Gateway Municipality as a "municipality with a population greater than 35,000 and less than 250,000, a median household income below the commonwealth's average and a rate of educational attainment of a bachelor's degree or above that is below the commonwealth's average." Mass. Gen. Laws ch. 23A, § 3A.

Exhibit 10. Types of park improvement investments

PARK IMPROVEMENT CATEGORY	SPENDING	PERCENTAGE
Park and recreational open space improvement construction	$ 23,700,000	66 %
Landscape architecture and planning services	$ 7,770,000	22 %
Stadium construction	$ 3,250,000	9 %
Fitness and recreational sports centers	$ 455,000	1 %
Remediation services	$ 290,000	1 %
Water supply and irrigation systems	$ 200,000	1 %
Surveying and mapping services	$ 129,000	< 1 %
Environmental consulting services	$ 61,700	< 1 %
Total	**$ 35,900,000**	

Source: Massachusetts Executive Office of Energy and Environmental Affairs.

Massachusetts has invested or will invest $35.9 million in park improvements in Gateway Cities. The Trust for Public Land examined the economic impact of this investment using a regional input-output model that uses industry and location-specific multipliers to calculate the total economic impact of spending in each city.

Three types of impacts are associated with investment in parks:

- Direct: These impacts include the dollar amount invested in parks and the jobs created directly by this spending. For example, when an investment is made to create a pavilion in a park, a local lumber company receives a portion of those funds as revenue from the sale of construction materials. Direct jobs include the share of jobs at the lumber company supported by that spending.
- Indirect: As a result of state investments in parks, sales and jobs are generated in the businesses that supply goods and services related to park improvement projects. Indirect effects are the changes in sales, jobs, and income within "backward-linked" industries in the region. In the pavilion example above, each business providing goods and services to that lumber company benefits indirectly from park investments.
- Induced: The spending of wages on a variety of goods and services throughout the economy (e.g., retail) by workers holding directly or indirectly created jobs generates additional "induced" impacts. These are the changes in sales, jobs, and income in the region resulting from household spending of income earned either directly or indirectly from state spending on parks. The induced impacts of the pavilion example include a share of the retail spending by workers at the lumber company and by employees at the businesses providing goods and services to the lumber company. This spending creates additional "induced" jobs at these retail locations.

The Trust for Public Land used IMPLAN, a leading regional input-output model, to calculate the direct, indirect, and induced impacts created from investments in parks. The model takes into account interindustry relationships in local, regional, and national economies. Since not all economic activity that is generated happens in the city (or the county or state), the model also considers "leakages" that represent goods and services imported from outside the area of study. Investments in parks were modeled at the county level to minimize the impact of leakage.

Exhibit 11. Impact of park investments

	EMPLOYMENT	LABOR INCOME	VALUE ADDED	OUTPUT
Direct	317	$ 18,200,000	$ 19,600,000	$ 35,900,000
Indirect	68	$ 3,610,000	$ 5,600,000	$ 9,040,000
Induced	107	$ 4,690,000	$ 8,840,000	$ 13,900,000
Total	**492**	**$ 26,500,000**	**$ 34,100,000**	**$ 58,800,000**

Employment: The annual average of monthly jobs, which can be either full time or part time.
Labor Income: All forms of employment income, including employee wages and benefits and proprietor income.
Value Added: The difference between total output and the cost of inputs.
Output: The value of industry production.

By analyzing the multiplier effects (i.e., how the impacts of spending ripple throughout the economy) while accounting for leakages, IMPLAN calculates the economic impact of the state's spending on parks in Gateway Cities in terms of economic output, jobs, and wages. As shown in Exhibit 11, the state's direct investment of $35.9 million in Gateway City parks creates a total of 492 jobs and $26.5 million in labor income. That is, every $1 million invested in Gateway City parks creates 13.7 jobs. This rate of job creation is higher than the rate created by spending on pedestrian and bicycle infrastructure (e.g., roads and trails). A study of 11 cities across the country found that, on average, nine jobs are created per $1 million invested.[67]

Outdoor swimming pool investments

Massachusetts has invested or will invest $33 million in outdoor swimming pool improvements in 23 cities across the Commonwealth. The state has or will invest in two categories of outdoor swimming pool improvements: $31.6 million in outdoor swimming pool construction (96 percent) and $1.4 million in remediation services (4 percent). The Trust for Public Land calculated the direct, indirect, and induced impacts created from investments in outdoor swimming pools using the regional input-output model IMPLAN.

As shown in Exhibit 12, the state's direct investment of $33.0 million in outdoor swimming pools created a total of 390 jobs and $24.2 million in labor income. That is, every $1 million invested in outdoor swimming pools creates 11.8 jobs. This rate of job creation is also more robust than the rate created by spending on pedestrian and bicycle infrastructure in cities nationwide (nine jobs created per $1 million invested), even though it is slightly lower than Gateway City park improvements, discussed above.[68]

Exhibit 12. Impact of outdoor swimming pool investments

	EMPLOYMENT	LABOR INCOME	VALUE ADDED	OUTPUT
Direct	261	$ 17,300,000	$ 18,800,000	$ 33,000,000
Indirect	49	$ 3,080,000	$ 4,650,000	$ 7,400,000
Induced	81	$ 3,830,000	$ 7,070,000	$ 11,000,000
Total	**390**	**$ 24,200,000**	**$ 30,500,000**	**$ 51,400,000**

Employment: The annual average of monthly jobs, which can be either full time or part time.
Labor Income: All forms of employment income, including employee wages and benefits and proprietor income.
Value Added: The difference between total output and the cost of inputs.
Output: The value of industry production.

67 Heidi Garrett-Peltier, *Pedestrian and Bicycle Infrastructure: A National Study of Employment Impacts* (Political Economy Research Institute, University of Massachusetts, Amherst, 2011).

68 Ibid.

Human health benefits

In addition to ensuring clean air, clean drinking water, and local food sources, land conservation promotes a physically active lifestyle. Studies have linked access to parks and open space to increased physical activity and better health, which translates into fewer missed days of work, higher productivity at work, and fewer visits to the doctor. The Trust for America's Health reports 23.5 percent of adults are physically inactive in Massachusetts.[69] Just over half of adult females and 68 percent of adult males are overweight or obese.[70] Access to places for physical activity along with informational outreach has been shown to produce a 48 percent increase in the frequency of physical activity.[71] Availability to parks and proximity to them increase the physical activity of children. Researchers have found that as the percentage of park area within a child's neighborhood increases, so does a child's physical activity.[72] While the health benefits are impressive on their own merit, they also translate into improved economic health.

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The costs of obesity are substantial and include direct medical expenses and the reduced productivity of obese workers. Studies have shown that the very obese lose one month of productive work per year without considering the extra sick days taken. This costs employers an average of $3,790 per very obese male worker and $3,040 per very obese female worker each year.[73] Higher rates of obesity also mean higher medical costs. Obese people have medical costs $1,430 higher than those of normal weight on average. Health care costs related to obesity add up to over $2 billion each year in Massachusetts.[74]

69 Trust for America's Health, "Key Health Data about Massachusetts" (accessed July 19, 2013, http://www.healthyamericans.org/states/?stateid=MA#section=1,year=2012,code=diabetes).

70 The Henry J. Kaiser Family Foundation, "Massachusetts: Overweight and Obesity Rates for Adults by Gender" (accessed July 18, 2013, http://kff.org/other/state-indicator/adult-overweightobesity-rate-by-gender/?state=MA).

71 Emily B. Kahn, Leigh T. Ramsey, Ross C. Brownson, Gregory W. Heath, Elizabeth H. Howze, Kenneth E. Powell, Elaine J. Stone, Mummy W. Rajab, Phaedra Corso, and the Task Force on Community Preventive Services, "The Effectiveness of Interventions to Increase Physical Activity: A Systematic Review" (*American Journal of Preventive Medicine* 22, no. 45, 2002, pp. 73-107).

72 James Roemmich, Leonard Epstein, Samina Raja, Li Yin, Jodie Robinson, and Dana Winiewic, "Association of Access to Parks and Recreational Facilities with the Physical Activity of Young Children" (*Preventive Medicine* 43, no. 6, 2006, pp. 437-441); James Roemmich, Leonard Epstein, Samina Raja, and Li Yin, "The Neighborhood and Home Environments: Disparate Effects on Physical Activity and Sedentary Behaviors in Youth," (*Annals of Behavioral Medicine*, 33, no. 1, 2007, pp. 29-38).

73 Sharon Begley, "As America's Waistline Expands, Costs Soar" (*Reuters*, April 30, 2012, accessed July 18, 2013, http://www/reuters.com/article/2012/04/30/us-obesity-idUSBRE83T0C820120430).

74 Centers for Disease Control and Prevention, "Adult Obesity" (*Vital Signs*, August 2010).

Windrush Farm, North Andover and Boxford, Massachusetts

The Trust for Public Land

The Trust for Public Land partnered with Windrush Farm Therapeutic Equitation, Inc. (WFTE), the Towns of North Andover and Boxford, and Essex County Greenbelt Association (Greenbelt) to conserve the 195-acre Windrush Farm and longtime WFTE headquarters. A combination of town and state funding, private foundations, and 468 individual donors contributed to the overall purchase price.

WINDRUSH FARM THERAPEUTIC EQUITATION, INC.

From 2011-2012, WFTE served a total of 1,490 individuals, including 431 children and adults with disabilities, including veterans of war, with equine-assisted therapies. During this time more than 440 volunteers donated nearly 29,000 hours. Based on the Independent Sector's estimate of the value of volunteer time in Massachusetts in 2011, $27.43 per hour, these volunteers donated $795,000 in value to the community.*

Founded in 1964 by Marjorie Kittredge, WFTE is the pioneer of more than 780 programs of its kind supported by the Professional Association of Therapeutic Horsemanship. WFTE plans to expand the number and variety of amenities to include the general public, such as community gardens, walking trails, outdoor classrooms, and summer programs.

Windrush Farm contains state-recognized critical wildlife habitat supporting rare and endangered species. Its protection creates a nearly 1,800-acre contiguous block of conservation land and connects to an extensive trail network including the Bay Circuit Trail and trails in Boxford State Forest. Conserving Windrush Farm also protects the Ipswich River watershed, providing drinking water to more than 330,000 residents in 15 Massachusetts communities.

WINDRUSH FARM THERAPEUTIC EQUITATION, INC.

*Independent Sector, "Value of a Volunteer Hour, by State: 2011" (accessed July 17, 2013, http://www.independentsector.org/volunteer_time).

Leveraged federal, private, and local funding

The Commonwealth's investment in conservation leverages funding from local, private, nonprofit, and federal sources. By attracting support from other sources, the state does not have to bear the entire cost burden of a project and therefore maximizes its investment. By leveraging funds, more local projects are able to be sponsored, creating additional economic benefits.

From 1998 to 2011, grant programs in Massachusetts leveraged $118 million in matching funds from federal, private, and local sources for conservation easements and land purchases.[75] That is, every $1 of state spending on land conservation was matched by $1.23 in federal, private, and local contributions.

Black Brook Farm

The Nature Conservancy

In 2007, Edward Parks noticed developments springing up around his farm in Middleborough. Mr. Parks feared that developers would mar the open land around his Black Brook Farm with housing subdivisions. The residential development plans that threatened the area could introduce septic effluent, lawn fertilizers, and street runoff into local waterways. The pollutants could impact water quality and the local ecosystem's long-term viability.

DAVID MCGOWAN

The stream that flows through Mr. Parks's property, Black Brook, delivers 17 million gallons of water into the Assawompset Ponds Complex at peak flow. These ponds form the state's largest natural water body and supply 200,000 people in 11 towns with drinking water, including New Bedford, Taunton, Bridgewater, Freetown, Lakeville, and Middleborough.

Black Brook Farm was conserved using a combination of funding sources that leveraged state investment. The Massachusetts Department of Fish and Game used open space bond funds to purchase 230 acres from Mr. Parks, creating a new Wildlife Management Area. Another 210 acres were placed under a permanent conservation easement using a Water Supply Protection grant that was equally matched with $800,000 in private and municipal funds.

The Black Brook Farm project not only protects major drinking water supply, it also conserves vital wildlife habitat. A healthy Black Brook watershed ensures that New England's largest herring population will find clean water in its Assawompset Ponds spawning grounds. Protection of Black Brook and the Assawompset Ponds Complex will also help freshwater mussels, nesting bald eagles, and the bridle shiner—a globally rare minnow.

75 Massachusetts grant programs include Conservation Partnership Grant Program, Drinking Water Supply Protection Grant Program, Local Acquisitions for Natural Diversity (LAND) Grant Program, and Parkland Acquisitions and Renovations for Communities (PARC) Grant Program.

Conclusion

The Commonwealth's investments in land conservation are critical to creating and protecting the places and amenities that make the Commonwealth a great place to live and work. Parks and open space contribute to a high quality of life while simultaneously stimulating economic activity across the state. This study found that every $1 invested in land conservation by Massachusetts returns $4 in economic value of natural goods and services. In addition to that return on investment, residents, communities, and local governments benefit from new jobs. State investment in park improvements in Gateway Cities and outdoor swimming pools in cities across Massachusetts will create a total of 882 jobs, or 11.8 to 13.7 jobs for every $1 million invested.

Drawing on existing research, this study also demonstrates that conservation lands contribute to the economic well-being of the state by attracting visitors who spend money in local communities; supporting local farmers, forest products workers, and fishermen acting as a catalyst for rural and urban economic development; and leading to major savings in health care costs. Finally, because the state has been so effective in leveraging additional funds, every dollar invested is maximized in terms of the economic benefits it generates for the people, communities, and businesses of Massachusetts.

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Appendix: methodology

The natural goods and services provided by the distinct ecosystem types found within the conserved lands of Massachusetts, and their monetary values, were determined using the benefits transfer methodology. That is, The Trust for Public Land conducted a thorough literature review of the types of goods and services provided by the 13 ecosystem types identified in conserved lands using recent, relevant, and scientifically sound sources. The Trust for Public Land then used the economic values of the different ecosystem types identified in that literature to estimate a per-acre economic value of the goods and services provided. Benefits transfer methodology is a common approach in environmental economics because it is a practical alternative to time-intensive and data-intensive original research.

The Trust for Public Land followed the steps below in conducting the benefits transfer:[76]

- Step 1. Define the policy context. This definition should include various characteristics of the program site, what information is needed, and in what units.
- Step 2. Locate and gather original research outcomes. Conduct a thorough literature review, and obtain copies of potentially relevant studies.
- Step 3. Screen the original research studies for relevance. How well does the original research context correspond to the policy context? What is the quality of the original research?
- Step 4. Select a point estimate or average of a range of point estimates. Convert each to dollars per acre.
- Step 5. Transfer the point estimate or average value estimate. Aggregate the point estimate or average value estimate by multiplying it by the total number of acres, providing a total value for the good or service at the program site.

The Trust for Public Land considered a broad set of natural goods and services based on the availability of high-quality sources. The Trust for Public Land did not examine each and every natural good and service. The Trust for Public Land expects that an analysis of additional natural goods and services would reveal further positive benefits, and therefore our numbers are likely to underestimate the "true" economic value and return on investment examined in this study.

Based on existing research, The Trust for Public Land determined the natural goods and services provided and estimated their values for each land cover type, as shown in Exhibit A.

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76 Randall S. Rosenberger and John B. Loomis, "Benefit Transfer," (In *A Primer on Nonmarket Valuation*, Patricia Champ, Kevin Boyle, and Thomas Brown, eds. Norwell, MA: Kluwer Academic Publishers, 445–482).

Exhibit A. Estimated annual per-acre value of natural goods and services by land cover type

LAND COVER*	ECOSYSTEM SERVICES	ANNUAL VALUE PER ACRE**
Deciduous forest	Stormwater management; water quality protection; carbon storage; carbon sequestration; air pollution removal; and soil retention	$ 1,220
Evergreen forest	Stormwater management; water quality protection; carbon storage; carbon sequestration; air pollution removal; and soil retention	$ 1,180
Mixed forest	Stormwater management; water quality protection; carbon storage; carbon sequestration; air pollution removal; and soil retention	$ 1,200
Woody wetland	All	$ 2,570
Pasture	Wildlife habitat; carbon sequestration; pollination services; erosion control; and production of livestock	$ 58
Cultivated crops	Agricultural goods; pollination; carbon sequestration; and erosion control	$ 167
Open space (e.g., parks)	Air pollution removal; carbon sequestration; carbon storage; and stormwater management	$ 464
Emergent herbaceous wetland	All	$ 2,570
Open water	All	$ 239
Developed	Air pollution removal; carbon sequestration; carbon storage; and stormwater management	$ 464
Shrub/scrub	Stormwater management; water quality protection; carbon storage; carbon sequestration; air pollution removal; and wildlife habitat	$ 434
Grassland	Pollination; wildlife habitat; carbon sequestration; erosion control; and nitrous oxide reduction	$ 31
Barren (e.g., rocky outcrop)	None	-

* In order from the most commonly conserved to the least commonly conserved.
** All values are reported in 2013 dollars.

Forests (deciduous, evergreen, and mixed)

The Trust for Public Land analyzed six natural services provided by Massachusetts forests: stormwater management, water quality protection, carbon storage, carbon sequestration, air pollution removal, and soil retention. The annual per-acre value of these services is $1,220 for deciduous forest, $1,180 for evergreen forest, and $1,200 for mixed forest.

Forests decrease the amount of stormwater runoff that reaches local waters by capturing and storing rainfall and infiltrating rainwater into the soil. It also slows the rate of runoff, which helps reduce flooding. The value of this service is calculated based on the avoided cost, or savings, from not having to construct stormwater storage infrastructure because of forest cover. The Trust for Public Land transferred the value from a recent study that calculated this value for similar forest types in a geography parable to Massachusetts.[77]

77 New Jersey Department of Environmental Protection, Division of Science, Research & Technology, *The Economic Value of New Jersey State Parks and Forests* (2004).

Forestland protects the quality of drinking water for many Massachusetts residents. The Trust for Public Land analyzed the avoided cost of drinking water treatment facilities and infrastructure because of forest cover in the Quabbin Reservoir Watershed, which provides drinking water to the Greater Boston area. The Trust for Public Land then calculated the annual benefit from this cost savings from each acre of forest in the watershed and applied it to forestland in Massachusetts, which protects numerous drinking water sources in the state.

Forest trees also store and sequester carbon. Storage refers to how much carbon is present or "stored" in trees at present while sequestration is how much carbon is removed from the atmosphere each year. The Trust for Public Land determined the average volume of carbon stored by the average acre of forestland in Massachusetts using the U.S. Forest Service–developed Carbon OnLine Estimator (COLE), which draws from the Forest Service's Forest Inventory and Analysis Data.

Carbon sequestration rates for deciduous forests in the state were obtained from a study that examining forests in the state published in an academic journal.[78] Evergreen forest carbon sequestration rates were transferred from a published volume of research on forests and carbon mitigation.[79] The carbon sequestration rate of mixed forest was calculated as the average of the rates of the two aforementioned forest types. The average global market price of carbon was used as the dollar value of carbon to calculate an annual per-acre value for carbon storage and sequestration by forests in the state.

In addition to removing carbon from the atmosphere, forests provide clean air by removing other harmful air pollutants. The Trust for Public Land considered the removal value of four major air pollutants: ozone, nitrogen dioxide, particulate matter, and sulfur dioxide. The volume of pollutants removed from the air on an annual per-acre basis was derived from a U.S. Forest Service analysis of "community" forests in Massachusetts. Pollution-removal dollar values on a per-volume basis were obtained for each of the air pollutants from the U.S. Forest Service's UFORE computer model. These dollar amounts represent the national median externality value of each air pollutant (the estimated costs of pollution to society that are not reflected in the market price of goods and services that produced the pollution).[80]

Soil retention is another key service provided by forests as forestland prevents soil from being eroded away. The USDA-supported Conservation Reserve Enhancement Program (CREP), an incentive program for farmers seeking to maintain the ecological functions of streams, provides an implicit measure of the value of soil erosion control because forests perform the same function as farmland enrolled in CREP.[81] The Trust for Public Land transferred the average per-acre value from the New York and Vermont CREP programs because Massachusetts does not currently have an active program and these two states have similar forest types and are the only adjacent states with the program.

78 Michael L. Goulden, J. William Munger, Song-Miao Fan, Bruce C. Daube, and Steven C. Wofsy, "Exchange of Carbon Dioxide by a Deciduous Forest: Response to Interannual Climate Variability" (*Science* 271, no. 5255, 1996, pp. 1576–1578).

79 R. Neil Sampson, Dwight Hair, and American Forestry Association, "Forest Management Opportunities for Mitigation of Carbon Emissions" (*Forests and Global Change*, vol. 2. Washington, DC: American Forests, 1996).

80 David J. Nowak and Eric J. Greenfield, *Urban and Community Forests of New England* (USDA Forest Service General Technical Report NRS-38, 2008).

81 New Jersey Department of Environmental Protection, Division of Science, Research & Technology, *The Economic Value of New Jersey State Parks and Forests* (2004).

Pasture/hay

The Trust for Public Land estimated the annual value of wildlife habitat, carbon sequestration, pollination services, erosion control, and the production of livestock goods to be $58 per acre of pasture or hay.

The NRCS Grassland Reserve Program (GRP) provides a proxy measure of the value of pastureland for wildlife habitat. The program provides landowners financial incentives to conserve their land for wildlife habitat. The Trust for Public Land used the statewide average of 2012 GRP rates to calculate an annual per-acre value.

Carbon sequestration rates were obtained for grasslands in the United States, and the market price of carbon was applied to determine an annual per-acre value.[82] The Trust for Public Land used the rental rate paid for pastureland in Massachusetts as an implicit value for the production of food and goods from livestock.[83] The value for pollination services and erosion control was transferred from cultivated crops because pasture/hay land provides similar levels of services.

Cultivated crops

Massachusetts receives $167 per acre in annual value for each acre of cropland for agricultural goods, pollination services, carbon sequestration, and erosion control. The rent paid by farm operators for cropland in 2012 was used as the value of cropland for food production. Rent represents the most accurate value of land compared with values associated with production and income, which reflect a variety of other forces and inputs. Annual per-acre rent data were obtained from the 2012 U.S. Department of Agriculture's National Agricultural Statistics Service Massachusetts Survey. The value of pollination services was transferred from a prominent national study that examined the change in agricultural production without natural pollination.[84]

Cropland also sequesters carbon. The value of this service was inputted from an analysis of agricultural land in the New England region.[85] The erosion control value of land with cultivated crops was included in the per-acre value from an analysis published in an academic journal.

Developed open space (i.e., parks)

The Trust for Public Land analyzed the value of air pollution removal, carbon sequestration, carbon storage, and stormwater management provided by parks in Massachusetts. Open space near developed areas is typically parkland or characteristically similar to parks. The annual per-acre value of these services is $464.

The per-acre value of air pollution, carbon sequestration, and carbon storage by park trees was derived from a recent U.S. Forest Service analysis of urban and community forests in Massachusetts. The stormwater management value was transferred from a U.S. Forest Service analysis of street trees in Worcester, Massachusetts.

82 Osvaldo E. Sala and José M. Paruelo, "Ecosystem Services in Grassland," (In *Nature's Services: Societal Dependence on Natural Ecosystems*, Gretchen C. Daily (ed.) Washington, DC: Island Press, 1997, 237–252).

83 United States Department of Agriculture, National Agricultural Statistics Service, *New England Agricultural Statistics*, 2011.

84 Edward Southwick and Lawrence Southwick Jr., "Estimating the Economic Value of Honey-Bees (Hymenoptera: Apidae) as Agricultural Pollinators in the United States" (*Journal of Economic Entomology* 85, no. 3, 1992, pp. 621–633).

85 Maine Department of Environmental Protection, Agriculture and Forestry Technical Working Group Meeting, *Maine Greenhouse Gas Action Plan Development Process: Agriculture and Forestry Greenhouse Gas Baseline and Reduction Options* (drafted for review May 27, 2004 and revised June 3, 2004).

Wetlands

The Trust for Public Land estimated the value of wetlands in Massachusetts to be $2,570 per acre per year for all of the goods and services they provide. This value is based on penalties assessed by the Massachusetts Department of Environmental Protection to landowners and entities that destroy or alter wetlands without authorization. The penalties represent the value placed by the state on wetlands and therefore serve as a proxy for the economic value of the goods and services provided by wetlands.

Open water

The annual value of open (surface) water of $239 per acre for all ecosystem services was obtained from a published study that calculated a region-specific ecosystem service value for a variety of ecosystem types found on U.S. National Wildlife Refuges.

Developed: low, medium, high

The Trust for Public Land applied the developed, open space value (see above) to low-, medium-, and high-developed land cover types because these are likely small urban or community parcels that have or will be developed into parks. This is a reasonable assumption given the nature of state land acquisitions and the resolution of the land cover GIS dataset being too coarse to determine a small amount of parkland in a largely urban or developed environment.

Shrub/scrub

The annual value of shrub/scrub land is estimated to be $434 per acre for stormwater management, water quality protection, carbon storage, carbon sequestration, air pollution removal, and habitat. Values were averaged from the mixed-forest and grassland land cover types because of the characteristics of shrub/scrub ecosystems in Massachusetts.

Grassland

Grassland provides an annual economic value of $31 per acre in pollination services, wildlife habitat, carbon sequestration, erosion control, and nitrous oxide (a greenhouse gas) reduction. Values were transferred from the pasture/hay calculation (see above) for pollination services, wildlife habitat, carbon sequestration, and erosion control because of the similar levels of services provided by both land cover types. The economic value of the annual removal of nitrous oxide was obtained from a published journal article.

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