



Natural Open Space An Irreplaceable Community Value

Studies throughout the region and country repeatedly document that protected natural open space provide income, taxes, cost savings and jobs for the communities they are found and as a result are a wise investment that pay dividends far beyond their cost.

For example, a study released by the Delaware Valley Regional Planning Commission found that¹ in the 5 southeastern counties of Bucks, Chester, Delaware, Montgomery and Philadelphia, protected open space:

- ✓ Increased the value of homes by \$16.3 billion;
- ✓ Resulted in an additional \$240 million in property and transfer tax revenue for local governments;
- ✓ Saved communities \$133 million for services such as stormwater management that they would otherwise have had to provide;
- ✓ Provided \$577 million in recreational benefits annually; and
- ✓ Helped residents and communities avoid \$795 million in medical costs.



Dark Hollow Park, Bucks County

Protected Open Space Increases the Value of Homes

Homeowners are willing to pay a premium in order to live near natural open space. These increased home values can reach as far as one mile away from protected natural open space.

One study found that homes within 1,500 feet of a park sold for \$1,600 more than properties further away from naturalized areas.² Similarly, the study found that property values go up for homes within 1,500 feet of a wetland by an average of \$37 per acre.³ Pennypack Park in

¹ The Economic Value of Protected Open Space in Southeastern Pennsylvania, Delaware Valley Regional Planning Commission and Greenspace Alliance, November 16, 2010

² Lutzenhiser, M. and N.R. Netusil. "The Effect of Open Spaces on a Home's Sale Price" Contemporary Economic Policy 19.3 (2001): 291-298.

³ Lutzenhiser, M. and N.R. Netusil. "The Effect of Open Spaces on a Home's Sale Price" Contemporary Economic Policy 19.3 (2001): 291-298

Philadelphia is credited with a 38% increase in the value of a nearby property."⁴

In a review of home sales in 5 southeastern counties (Bucks, Chester, Delaware, Montgomery, Philadelphia) during the period of 2005 to 2009, which includes our most recent serious economic downturn in the U.S., open space was found to have increased residential property values by \$16.3 billion.⁵ This positive impact included homes as far as one mile from the open space lands studied. When home prices were being driven downward by the economic down turn of the mid 2000s, the beneficial impact on increased house prices generated from proximity to protected natural open space remained.

In Radnor Township, investment in a 2.4 mile trail that passes behind residential homes and through many areas of naturalized beauty including woodlands and wetlands, is enjoyed by 150,000 users ever year. And those who own homes within a quarter mile of the trail have received an average property value increase of \$69,139.⁶ This project was hotly debated when originally proposed in 2005, but only 5 years after its completion is a treasured piece of township open space.



Radnor Trail, Radnor Township

In Philadelphia it was shown that even improvements to vacant lots with new tree plantings increased the value of surrounding homes by 10 to 30 percent.⁷

Protected Open Space Increases Community and School Tax Revenues

By increasing the market value of homes sold in a community, protected natural open space also increases tax revenues including both annual property taxes collected as well as transfer taxes paid at the time of sale. In Southeastern Pennsylvania, increased tax revenues (both property tax revenues and transfer tax revenues) due to the increased market values resulting from proximity to open space equaled \$240 million a year. This \$240 million a year translates into \$228 million a year in property taxes as well as an estimated \$12.9 million a year in transfer taxes.

Natural Open Space Costs Less To Support than Residential Development

It is often argued that residential development of open space lands will result in greater net revenues for a community when compared to open space purchase and preservation. But research has shown this belief to be erroneous. Residential developments require greater public services and infrastructure that must be provided and supported by the community as compared to open space, and so the net effect is that residential development is more costly for the

⁴ Center for Watershed Protection, Better Site Design: A Handbook for Changing Development Rules in Your Community, August 1998, pg. 134

⁵ The Economic Value of Protected Open Space in Southeastern Pennsylvania, Delaware Valley Regional Planning Commission and Greenspace Alliance, November 16, 2010

⁶ The Economic Value of Protected Open Space in Southeastern Pennsylvania, Delaware Valley Regional Planning Commission and Greenspace Alliance, November 16, 2010

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community than open space purchase and protection. Research on the impacts of residential development versus open space protection in multiple different states found that for every \$1 million in tax revenues a community receives from forests, farms or open space uses they had to spend \$270,000 in support/services; by comparison for every \$1 million in revenues from residential development communities have to expend \$1,160,000 on services to support them.⁸ “The evidence clearly indicates that preserving open space can be a less expensive alternative to development.”⁹

Protected Natural Open Space Prevents Flooding and Flood Damages.

In natural forests and meadows, rainwater is absorbed into vegetated soils. The infiltrated water replenishes groundwater, which in turn provides healthy base flow to streams and wetlands, and feeds drinking water aquifers. Soaking this water into the ground also means it does not turn into non-natural stormwater runoff that otherwise contributes to flooding and so the volume of stormwater runoff is reduced. As a result, naturally vegetated areas protect communities from increasing flood damages, the need for flood response services, and the need for flood damage payouts.

In developed areas, rainwater rushes off impervious surfaces such as parking lots, roads, rooftops, hard-packed and chemically treated turf lawns, playing fields, golf courses and unstable farm fields into detention basins and storm systems that dump it, generally untreated or lightly treated, directly into streams, wetlands, lakes, and rivers and onto downstream communities. As development increases, the volume of stormwater increases and flooding worsens. Using manmade structures to try to prevent stormwater runoff and flooding is costly and much less effective than supporting the same action by nature.

By reducing non-natural flooding, natural open space also saves communities money. Responding to a flood requires a variety of emergency service operations and personnel including police and fire departments, local and county municipal services, and cleanup efforts. After a flood, communities must be provided temporary housing, food, and water. There must also be an investment of time and resources in providing ongoing information and assistance to flooded communities. Flooding damages public and private utilities. And investment has to be made in repairing damaged power lines, roads and bridges, gas pipelines, water treatment and storage facilities, and heating and cooling systems which can make the cost of cleanup excessive.

Floods bring serious emotional harm to affected homeowners and communities in crisis. Following a flood disaster, people are engaged in the response and helping one another to cope. Later, feelings of panic, anger, anxiety, disorientation, and despair emerge. The full force of emotions often hit after the floodwaters have receded.



⁸ J.L. Crompton, The Impact of Parks and Open Spaces on Property Values, Dept of Recreation, Park and Tourism Sciences, Winter 2007.

⁹ J.L. Crompton, The Impact of Parks and Open Spaces on Property Values, Dept of Recreation, Park and Tourism Sciences, Winter 2007.

Exhaustion, grief, desperation and depression can then set in. The prolonged stress caused in the wake of a flood can lead to difficulty sleeping, irritability and outbursts of anger, difficulty concentrating, painful emotions, or post traumatic stress disorder. Children can be more deeply affected than adults, experiencing nightmares, fear, anxiety, increased physical pain such as headaches and stomach aches, a decline in their academic performance, difficulty sleeping, even suicidal tendencies.¹⁰

When natural open space is in floodplain and buffer areas along streams it is additionally helpful at preventing and reducing flood damages. While the focus of riparian buffer research, including floodplains lands has often been on the water quality and habitat benefits of buffers, there is expert support for the benefits of buffers for addressing non-natural flood flows and peaks. Dr. Bern Sweeney with the Stroud Water Research Center is on record articulating that streams without buffers have higher peak and volume rates during periods of high flows, i.e. during floods.¹¹ An Army Corp technical document regarding riparian buffers affirmatively states the “widely recognized” value of buffers for, among other things, “reducing flood peaks”.¹² Floodplains vegetated with trees and shrubs can be four times as effective at retarding flood flows as grassy areas.¹³ And in at least one study it was concluded that “adjacent forest vegetation and litter lowered stream water elevations from 9.9 m (32.3 ft) to 5.3 m (17.3 ft.) for a 100-year flood.”¹⁴

“The protection and restoration of forested floodplains reduces the harm and threat of flooding to homes, businesses and communities (1) by ensuring they are not located in these most hazardous of areas that are known to flood and (2) by reducing the peak and breadth of flooding thereby protecting homes that historically have not been located in the path of floods. Protection and restoration of the floodplain also removes the need for emergency services, the costs of rebuilding, and all of the other financial, physical and psychological costs associated with flood damaged communities located in the floodplain.”¹⁵

Protected Open Space Protects Drinking Water Supplies. Protecting natural landscapes allows rainfall to most efficiently infiltrate, keeping the hydrologic cycle in balance. Southeastern Pennsylvania counties realized “more than \$50 million in annual cost savings from natural water supply services on protected open space.”¹⁶ When vegetated with native trees and shrubs, when covered in a blanket of decaying leaves, needles and wood, the land acts



¹⁰ Accessed June 9, 2008 West Virginia Division of Homeland Security and Emergency Management www.wvdhsem.gov

¹¹ Presentation by Dr. Bern Sweeney, Stroud Water research Center, March 31, 2009, before the Delaware River Basin Commissions Floodplain Regulation Evaluation Subcommittee.

¹² Army Corps of Engineers WRAP, “Technical and Scientific Considerations for Upland and Riparian Buffers Strips in the Section 404 Permit Process”, ERDC-WRAP-01-6, May 2002, citing DeBano and Schmidt 1990; O’Laughlin and Belt 1995”.

¹³ DNREC and Brandywine Conservancy, Conservation Design for Stormwater Management: A Design Approach to Reduce Stormwater Impacts from Land Development and Achieve Multiple Objectives Related to Land Use, September, 1997, p. 2-15; Delaware River Basin Commissions Floodplain Regulation Evaluation Subcommittee Report, May 29, 2009.

¹⁴ Castelle, Johnson, Conolly, “Wetland and Stream Buffer Size Requirements – A Review”, J. Environ. Qual. 23:878-882 (1994);

¹⁵ Delaware River Basin Commissions Floodplain Regulation Evaluation Subcommittee Report, May 29, 2009.

¹⁶ The Economic Value of Protected Open Space in Southeastern Pennsylvania, Delaware Valley Regional Planning Commission and Greenspace Alliance, November 16, 2010

as a sponge. Rainwater can percolate into the soil and filter down to the water table below to re-supply the aquifers that provide our drinking water. Rainwater also provides base flow to our streams, creeks and rivers. The landscape, in this natural state, is alive with life – birds sing in the trees, squirrels dance across the ground, bugs revel in the earth. Our lives are richer and our water flows free and clean.



By contrast, roads, rooftops, compacted soils and other impervious surfaces create a barrier between the rainfall and the natural land forcing the water to run off. The loss of vegetation that comes with development further disrupts the ability of the soil to function naturally as a sponge. The increased runoff alters the hydrologic cycle -- water which once fed aquifers, streams and wetlands, sustaining natural resources during dry periods, is now lost in a mad rush during and after storm events. While running over the land surface,

the water washes toxics, litter, nutrients and sediment into natural water systems, degrading water quality. And heated water washed from hot paved surfaces increases stream temperature. The water table becomes depleted, habitats altered, stream flow and aquatic life are all changed as a result.

Natural Open Space Protects Streams and Rivers from Pollution.

Vegetation removes different types of pollutants associated with stormwater runoff including sediment, phosphorus, nitrogen, and metals.¹⁷ Vegetation will filter out and/or utilize nonpoint sources of pollution such as excess nutrients, sediments, metals and some pesticides.¹⁸ Plants, via their root systems, take up pollutants, especially nitrogen and phosphorus that are essential for plant growth.¹⁹ About 80% of phosphorus in runoff is removed by forested buffers; about 80% of nitrogen is transformed to gases by the anaerobic conditions in leaf litter and surface soil layers, removing it from runoff; pesticides are formed into gases by the anaerobic conditions in leaf litter and surface soil layers, or are taken up as nutrients by plants and trees, removing them from runoff; pesticides are also transformed and biodegraded.²⁰ When located along waterways vegetation root systems anchor soils, thereby preventing erosion and resulting mud pollution in streams and in-stream waters are cooled as a result of plant shading.²¹

¹⁷ Bruce K. Ferguson, Stormwater Infiltration, CRC Press, 1994, p. 38; DNREC and Brandywine Conservancy, Conservation Design for Stormwater Management: A Design Approach to Reduce Stormwater Impacts from Land Development and Achieve Multiple Objectives Related to Land Use, September, 1997, p. 3-6 & 3-7; Pennsylvania Handbook of Best Management Practices for Developing Areas, Prepared by CH2MHILL, Spring 1998, p. 1-25

¹⁸ Bruce K. Ferguson, Stormwater Infiltration, CRC Press, 1994, p. 38; DNREC and Brandywine Conservancy, Conservation Design for Stormwater Management: A Design Approach to Reduce Stormwater Impacts from Land Development and Achieve Multiple Objectives Related to Land Use, September, 1997, p. 3-6 & 3-7; Pennsylvania Handbook of Best Management Practices for Developing Areas, Prepared by CH2MHILL, Spring 1998, p. 1-25

¹⁹ DNREC and Brandywine Conservancy, Conservation Design for Stormwater Management: A Design Approach to Reduce Stormwater Impacts from Land Development and Achieve Multiple Objectives Related to Land Use, September, 1997, p. 1-25

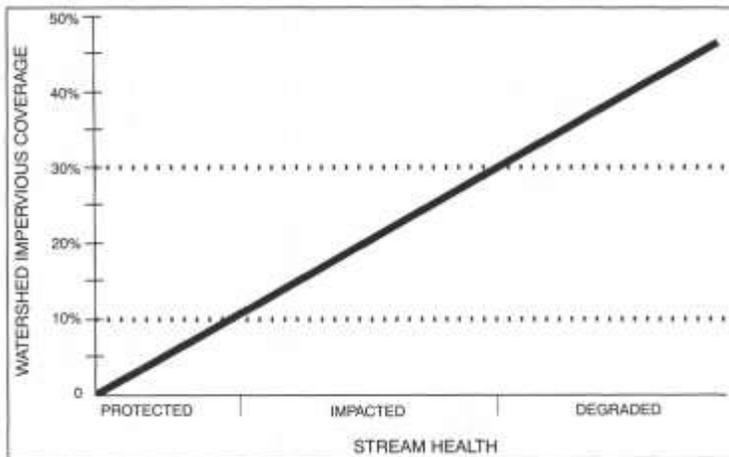
²⁰ David Welsch, Forest Resources Management, USDA Forest Service, "Riparian Forest Buffers: Function and Design for Protection and Enhancement of Water Resources", NA-PR-07-91

²¹ Bruce K. Ferguson, Stormwater Infiltration, CRC Press, 1994, p. 38; DNREC and Brandywine Conservancy, Conservation Design for Stormwater Management: A Design Approach to Reduce Stormwater Impacts from Land Development and Achieve Multiple Objectives Related to Land Use, September, 1997, p. 3-6 & 3-7; Pennsylvania Handbook of Best Management Practices for Developing Areas, Prepared by CH2MHILL, Spring 1998, p. 1-25

Having natural open space in lieu of developed surfaces also successfully prevents pollution before it can even begin. Stormwater from developed landscapes washes a myriad of pollutants from urban/suburban areas into our streams including: sediment, soils, nutrients (such as phosphorus and nitrogen), copper, zinc, and other heavy metals (including lead), fecal coliform, bacteria, hydrocarbons-oils-greases, atmospheric deposition, vehicle emissions, pavement deterioration, tire and brake pad dust, pet waste, chemicals and fertilizers with mixing agents and surfactants used in lawn care, road salts and de-icing chemicals and their agents, household chemicals, organic and inorganic debris and trash. If land is protected as natural open space these pollution inputs are never, from that parcel, formed.



It has been demonstrated that water quality is closely related to how land is developed. Density of development and the percent of impervious surfaces in a completed development site directly impact water quality.²²



Reprinted from "Impervious Surface Coverage, the Emergence of a Key Environmental Indicator", by Chester L. Arnold Jr., and C. James Gibbons, APA Journal, Spring 1996

Protected Open Space Saves Communities Money

Natural open space effectively reduces stormwater runoff that otherwise causes and contributes to flooding and flood damages, protects water supplies, cleanses pollution from air and water, provides wildlife habitat, and effectively captures and stores carbon that otherwise contributes to climate change. It has been calculated that in the 5 counties of Bucks, Chester, Delaware, Montgomery and Philadelphia Counties natural open space saved communities an estimated \$133 million annually that they would have otherwise had to pay to provide their communities these services.²³

²² "Urban Stormwater Runoff: Working for Clean Water", Pa State University and USEPA

²³ The Economic Value of Protected Open Space in Southeastern Pennsylvania, Delaware Valley Regional Planning Commission and Greenspace Alliance, November 16, 2010

Open space reduces the volume of stormwater runoff that the community otherwise has to pay to manage. Preservation of tree cover directly translates into reduced stormwater runoff. It has been calculated that "40 percent tree cover could reduce stormwater runoff by 60 percent more than a neighborhood without trees."²⁴

A loss of tree cover over a 15 year period (1985 to 2000) in Bucks, Montgomery, Delaware, and Chester Counties, Pennsylvania and Mercer, Burlington, Camden and Gloucester Counties, New Jersey, reduced the ability of the Delaware watershed region's urban forests to "detain almost 53 million cubic feet of stormwater, a service valued at \$105 million."²⁵ Despite that diminishment, this same region "stored 2.9 billion cubic feet of stormwater in 2000, valued at \$5.9 billion."²⁶

Existing tree cover was found to prevent 65 million cubic feet of stormwater runoff in the Big Timber Creek watershed (New Jersey) saving the community \$3.3 billion in stormwater infrastructure. In the Cobbs Creek watershed (Pennsylvania) existing tree cover prevented 20 million cubic feet of stormwater runoff saving the community \$1 billion in stormwater infrastructure.²⁷

In the Mill Creek watershed (New Jersey) existing tree cover prevented 6.7 million cubic feet of stormwater runoff saving the community \$350 million in stormwater infrastructure. And in the Frankford-Tacony watershed (Pennsylvania) existing tree cover prevented 38 million cubic feet of stormwater runoff saving the community \$2 billion in stormwater infrastructure. This tremendous savings translates into \$176,052,455 per year of benefit/savings for this part of the Delaware River watershed community.²⁸

Further examples of how vegetation has reduced stormwater runoff include:

- ☞ It has been "calculated that tree loss in [an] urban corridor resulted in a 19% increase in runoff from major storms, an estimated 540 million cubic feet of water. Replacing the lost stormwater retention capacity would cost \$1.08 billion."²⁹
- ☞ In the Baltimore-Washington corridor the stormwater retention capacity of forest cover in 1973 was calculated to be worth \$5.7 billion.³⁰

²⁴ Gary Moll, "America's Urban Forests: Growing Concerns", *American Forests*, Autumn 1997

²⁵ American Forests. 2003. "Urban Ecosystem Analysis Delaware Valley Region: Calculating the Value of Nature." March 2003 (The value attributed to these natural systems is based upon what it would have cost the region to construct basins and other solutions for intercepting the runoff.)

²⁶ American Forests. 2003. "Urban Ecosystem Analysis Delaware Valley Region: Calculating the Value of Nature." March 2003 (The value attributed to these natural systems is based upon what it would have cost the region to construct basins and other solutions for intercepting the runoff.)

²⁷ American Forests. 2003. "Urban Ecosystem Analysis Delaware Valley Region: Calculating the Value of Nature." March 2003 (The value attributed to these natural systems is based upon what it would have cost the region to construct basins and other solutions for intercepting the runoff.)

²⁸ American Forests. 2003. "Urban Ecosystem Analysis Delaware Valley Region: Calculating the Value of Nature." March 2003.³⁰ Ibid (These are communities with separate stormwater sewer management systems.)

²⁹ Common Ground, Vol. 10 No. 4, May/June 1999

³⁰ Common Ground, Vol. 10 No. 4, May/June 1999

☐ In Atlanta, Georgia a 20% loss in tree cover in the metropolitan region produced a 4.4 billion cubic foot increase in stormwater runoff; and official estimates are that it would cost at least \$2 billion to build containment facilities capable of storing this excess water.³¹

☐ In Milwaukee, an existing tree canopy of 16% has been found to reduce stormwater flows by up to 22%, saving the City \$15.4 billion in "not having to build additional stormwater retention capacity."³²

☐ In Texas, a tree canopy of 30% reduces stormwater runoff by 28% and saves Austin, TX \$122 million in stormwater control.³³

☐ It has been determined that a 40% canopy tree cover in a metropolitan area with a population of around 2 million, could result in reduced stormwater management costs of more than \$2 billion a year.³⁴

Natural Open Space is Helping Protect Communities from the Damages of Climate Change.

Global climate change is a major threat to our region, nation, and earth. A recent report entitled "Confronting Climate Change in the U.S. Northeast" and an associated New Jersey specific Executive Summary found that under one conservative emissions scenario, by the end of the century, New Jersey is expected to lose virtually all of its snow cover; that "the frequency and severity of heavy rainfall events is expected to rise"; and that the frequency of short term drought (one to three months) is projected to increase.³⁵

In addition, global climate change is expected to dramatically increase the number of days over 100 degrees communities in our region experience. In the coming decades, communities nearby Philadelphia will begin to experience in the range of 10 days to 30 days that are over 100°.³⁶

Scientists have determined that carbon dioxide, a major greenhouse gas, contributes significantly to global climate change.³⁷ Trees are an important part of the solution. Trees store carbon in their leaves, stems, branches, and roots.³⁸ Other plants, dead plant material, and the organic matter found on the forest floor and in forest soils also store carbon.³⁹ Protecting our forests natural open space areas also helps protect us from global climate change.

³¹ Center for Watershed Protection, Better Site Design: A Handbook for Changing Development Rules in Your Community, August, 1998, p. 155 citing American Forest and US Water News in 1997; Gary Moll, "America's Urban Forests: Growing Concerns", American Forests, Autumn 1997

³² Lynn McDonald, "Global Problems, Local Solutions, Measuring the Value of the Urban Forest", American Forests, Autumn 1996.

³³ Cheryl Kollin, "Designing with Nature and Showing the Benefits", Land Development, National Association of Home Builders, Winter, 1997

³⁴ Gary Moll, "America's Urban Forests: Growing Concerns", American Forests, Autumn 1997

³⁵ Union of Concerned Scientists, *New Jersey, Confront climate change in the U.S. Northeast*, 2007, a summary based on *Confronting Climate Change in the U.S. Northeast: Science, Impacts and Solutions*, by the Northeast Climate Impacts Assessment, 2007.

³⁶ Union of Concerned Scientists, *New Jersey, Confront climate change in the U.S. Northeast*, 2007, a summary based on *Confronting Climate Change in the U.S. Northeast: Science, Impacts and Solutions*, by the Northeast Climate Impacts Assessment, 2007.

³⁷ *The Economic Value of New Jersey State Parks and Forests*, NJDEP Division of Science, Research and Technology, June 2004 pg. 14

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The social costs of emitting carbon (calculated as damage avoided) ranges from \$21 per ton⁴⁰ currently to about \$34 per ton,⁴¹ to \$80 per ton by the year 2040. It has been calculated, using the conservative figure of \$21 per ton, that the trees supported by protected open space in 5 southeastern counties has helped us avoid \$61.4 million in the costs of responding to climate change damage.⁴²

Protected Open Space Provides Residents Free Recreation that Would Otherwise Cost Millions.

Protected open space supports a wide variety of recreational opportunities to our communities that would otherwise cost us substantial amounts of money both individually and collectively. Walking, running, biking, and other forms of exercise are just a few ways open space helps us to better enjoy our lives.⁴³ The protected open space in Bucks, Chester, Delaware, Montgomery, and Philadelphia Counties of Southeastern Pennsylvania provided residents an estimated \$577 million each year in recreational fun, value, and monies saved. And in so doing, it is estimated that these same areas helped residents and communities avoid \$795 million in medical costs by supporting recreation that helped lower the incidence of cardiovascular disease, as well as reduce diabetes, depression, obesity, and some forms of cancer.⁴⁴



Protected Open Space Generates Economic Activity for the Communities Where it is Found

Protected open space in Southeastern Pennsylvania communities supported operational investments of \$566 million, contributed an estimated 6,900 jobs, supported \$299 million in salaries paid and supported an additional \$30 million in state and local taxes per year.⁴⁵

⁴⁰ The Economic Value of Protected Open Space in Southeastern Pennsylvania, Delaware Valley Regional Planning Commission and Greenspace Alliance, November 16, 2010

⁴¹ *The Economic Value of New Jersey State Parks and Forests*, NJDEP Division of Science, Research and Technology, June 2004 pg. 14

⁴² The Economic Value of Protected Open Space in Southeastern Pennsylvania, Delaware Valley Regional Planning Commission and Greenspace Alliance, November 16, 2010

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