CHESAPEAKE BAY
PROGRAM

NORTHEASTERN AREA
State and Private Forestry

Chesapeake Bay Riparian Handbook: A Guide for Establishing and Maintaining Riparian Forest Buffers

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Economics of Riparian Forest Buffers

Introduction

The term ***value***, in the context of riparian forest buffers, can have different meanings for those with different interests.

- To a hydrologist, the value of trees growing along rivers and streams might mean the significance or importance of lowering water temperature, intercepting nutrients and sediment, or stabilizing streambanks. All improve water flow and quality.
- To an ecologist, the value might be associated with the streamside forest habitat for its impact on the diversity of plant and other living resource communities.
- To an environmental engineer, the value of forests along watercourses may be linked to their ability to lower the costs of stormwater management.
- To a forester, the value may be in the harvestable trees.
- To others, there may be no obvious value, and the buffers may even be seen as a nuisance.
- But, for an economist, the term value has a precise definition – it is the price that individuals are willing to pay in order to obtain a good or service. It is measured in units (typically money) that are mathematical and attempts to quantify the worth of goods or services for a market.

However, it is important to note that these values do exist whether or not humans prefer them or are even aware of them.

Characteristics of Economic Value

- Products or services typically have value only if humans value them, directly or indirectly.
- Value is measured in terms of trade-offs, because of scarce resources like money, land, or high environmental quality.
- Typically, money is used as a unit to account value. But, sometimes monetary values cannot be assigned to environmental services.
- Individual values are combined to determine value to society as a whole.

Economic Value

Economic value is comprised of several key elements that fall into two broad groups – use values (to use a resource today, or the option for future use), and non-use or existence values (benefits gained without use today or in the future). When people talk about the economic value of a thing or a place, they are frequently referring to its "intrinsic" value. That is, its value for consumption or use by people, plus its value for non-consumptive use (to look at, or simply because it is there).

For example, the intrinsic value of a stream is linked to the *direct use benefits* of recreational or commercial activities (agricultural irrigation, for cooling or washing industrial processes, or for drinking water). *Indirect use benefits* result when the stream adds to nearby activities (good water quality results in an attractive place to hunt, fish, picnic, or bird watch). *Non-use*

benefits result from good stewardship (conserving the water quality of the stream for one's family, future generations, or simply because its good for the Bay).

Economists attempt to isolate the various value elements to determine what is important to people, to make priority decisions for policy, and to put a price on nature's goods and services in order to estimate the value of protecting a resource or to predict what it might cost to repair it once its been degraded. But, this is a difficult task.

The tools that economists use for this evaluation are crude and cannot count all of the value that nature provides, and they have difficulty dealing with risk and uncertainty. For example, we do not know, with certainty, all the costs if a stream is lost or significantly degraded in quality, or the real value of the current benefits or unknown future benefits.

- What beneficial plant or animal could be lost, and what value could it have to people down the road?
- What will be the cost to fix it?
- What effects will it have on property value or human health to an individual or group of people in a watershed?

These questions are tough, but we can assume that conserving a healthy, viable resource will bring us more value in the long run than the risk and uncertainty of costs to restore or replace the resource. However, even with this limited information, economics can help us make better decisions. To do this, we need to use the best quantitative economic information available to make comparisons between management and policy options and their impacts, consider the non-market values (those that do not have prices, such as a bird or view), and look to anecdotal information and case studies to give examples of possible outcomes.

Economic Benefits Associated with Riparian Forest Buffers

What is the Value of Water Quality and Environmental Benefits?

Clean streams, rivers, and the Bay offer many benefits. Riparian forest buffers help ensure those benefits and avoid costs to repair damaged and degraded natural systems. As a Best Management Practice (BMP), riparian forest buffers typically perform these functions for free.

Stream Stability - Urban retrofits and stormwater management technology is expensive. Studies indicate that urban stream systems may fail to function if the watershed is at 15 percent or greater impervious surface, resulting in "blown-out" streams that silt downstream areas and increase flood potential. Forests help retain stream integrity.

- *Stormwater treatment options that integrate natural systems, such as grass swales and bioretention areas like forest, are less expensive to construct than stormdrain systems and provide better environmental results. In fact, costs of engineered stormwater BMPs range from $500 to $10,000 per acre, and will cost that much again over 20 to 25 years.*
- *After public outcry about degrading streams, Montgomery County, MD, is spending $20,000 to $50,000 per housing lot in some areas to repair damaged streams and restore riparian forests.*
- *In Fairfax County, VA, a local bond issue provided nearly $1.5 million dollars to restore two miles of degraded stream and riparian area—that's more than $750,000 per mile.*

Nutrient Removal - Adequate buffers can reduce costly water treatment.

- *The Interstate Commission for the Potomac River Basin (ICPRB) estimates that urban retrofit of BMPs to remove 20 percent of current nutrient runoff will cost approxi-*

mately $200 per acre, or $643,172,600 for the Bay basin.

- *In the same study, estimated costs of reducing runoff from highly erodible agricultural land are $130 per acre, or $68,758,430 for the basin.*
- *Wastewater treatment facilities in the Washington, DC, area have annual costs of $2 to $10 million per year per facility, which equates to $3 to $5 per pound of nitrogen removed.*
- *Maryland's Tributary Strategies show that, to reach a 40 percent reduction of nutrients by the year 2000, forest buffers and nonstructural controls are significantly more cost effective than engineered approaches. Where forest buffers are estimated to cost $671,000, and nonstructural shore erosion prevention/control $1.6 million per year, comparable structural techniques could cost $3.7 million to $4.3 million per year.*

Pollution Prevention - Air pollution and deposit of airborne pollutants are a multi-billion-dollar problem nationally that affect human health, damage vegetation, and reduce visibility. Trapping and filtering atmospheric pollution is a benefit that trees provide, as well as riparian buffers.

- *In 1991, trees in Chicago removed an estimated 17 tons of carbon monoxide, 98 tons of nitrogen dioxide, and 210 tons of ozone.*
- *Reducing air pollution by 20 percent would cut agriculture losses in half, saving Maryland farmers $20 million.*
- *In Fairfax, VA, open space trees and buffers are estimated to have reduced the cost of traditional air pollution controls by over $4.5 million in 1995.*
- *Energy savings of 10 percent can result by adding as little as 10 percent tree cover to buffers near buildings.*
- *Forest conservation has been estimated to reduce the amount of urban runoff generated from development in Utah by 17 percent.*
- *A single mature tree releases about 100 gallons of clean water vapor per day into the atmosphere and provides the cooling equivalent of nine room air conditioners operating at 8000 BTUs per hour for twelve hours a day.*

Stream Temperature - The absence of streamside trees can have a dramatic effect on aquatic life through increased water temperature. Cold water trout streams were once common in the Mid-Atlantic states, but they have been greatly reduced due to loss of riparian trees.

- *The relationship between stream shade and trout production is firmly linked. Studies have shown that when stream surface shade is reduced to 35 percent, trout populations can drop by as much as 85 percent.*
- *In 1991, Maryland recreational fishers contributed $467 million to the state economy.*

What is the Value of Services Provided by a Wooded Stream Corridor?

Riparian forests are integral to the health of the Bay and its rivers. Their position on the landscape makes them excellent buffers between upland areas and waters that eventually enter the Bay. Scientific studies have shown dramatic reductions of 30 percent to 95 percent in nutrients (nitrogen and phosphorus), sediment, pesticides, and other pollutants in surface and groundwater. Riparian trees provide deep root systems that hold soil in place, thereby stabilizing streambanks and reducing erosion. And, riparian forests offer a tremendous diversity of habitat. Habitat layers provided by trees, shrubs, and grasses make these areas critical to life stages of over half of all native Bay species.

Erosion Control - Erosion and sediment control produces significant costs during development and in maintenance to communities down the road. Buffers mitigate some of these costs for free and add quantifiable and non-quantified benefits.

- *Current state and local requirements for erosion and sediment control (ESC) increase the cost of development. On a typical site,*

costs of ESC average $500 to $1500 per cleared acre. Forest conservation, riparian buffers, and clustering sharply reduce ESC costs and provide services for free.

- *Average costs for subdivision developments include clearing (forest) $4000 per acre, and sediment control $800 per acre. However, forest conservation keeps soil on site, resulting in less time and labor re-grading, stabilizing, and re-landscaping the site.*
- *It costs $10 to $11.5 million annually to dredge and dispose sediments deposited into Baltimore Harbor to keep it navigable. Sediment produced by forestland is the lowest of all land uses.*

Flooding - When floods pass through a forested stream corridor or flood plain, the roughness of the forest and its lush vegetation help to reduce the energy of the water flow, thereby reducing damage to riverbanks and the effects of downstream flooding. Forests reduce the quantity of water for stormwater.

- *Retaining forest area and buffers has reduced stormwater costs in Fairfax County, VA, by $57 million.*
- *Observations made after the 1993 floods in the Midwest showed that where forests were retained in the flood plain or where levees had overgrown with trees, damage to the levee system and the river were less than areas maintained in grass or farmland. Although these benefits are difficult to put a price on, property damage exceeded $50,000 to $250,000/mile.*
- *Similar observations of damage to river banks and adjacent farmlands were recorded following floods in Virginia in 1994-95 where statewide damage totaled more than $10 million.*

Increased Property Values - Frequently seen as a "loss," forests and buffers have been found to increase the value of property, and to provide important environmental and recreational benefits.

- *Property values grow with trees. When surveyed by the Bank of America Mortgage, real estate agents say that homes with treed lots are 20 percent more salable.*
- *In Maryland, the Forest Conservation Act is working. Forest and buffers are being conserved, and developers say that they are receiving 10 to 15 percent premiums for lots adjacent to forest and buffers.*
- *A recent economic study done for areas in southern California states that home prices increase an average of 17 percent because of trees and buffers.*
- *Builders in Amherst, MA, reported that added costs of forest retention on site are always recouped in increased sales prices.*

Recreational Greenways - Linear forests along our rivers attract revenue and are an important recreation resource to communities.

- *Housing prices were 32 percent higher when located next to a greenbelt buffer in Boulder, CO. In one neighborhood, increased property value of $5.4 million attributable to the greenway results in additional annual property tax revenues of over $500,000.*
- *Greenways offer business opportunities. Evidence shows that the quality of life for a community is an increasingly important factor in corporate relocation decisions. Greenways are often cited as an important contributor to quality of life.*
- *According to a 1995 attitude survey, 77 percent of Maryland resident respondents said that it is important to have natural areas close to where they work and live. Almost half said that they would be inclined to move if existing open space in their community were lost.*

Wildlife Habitat - Buffers provide valuable wildlife habitat. Many species use riparian areas at various stages of their life cycles and as travel corridors. Organic matter produced by riparian trees is the foundation of the food web in most stream environments.

- *Each mile of 100-foot buffer on both sides of a stream protects 24 acres of high-quality habitat along shorelines and creeks.*
- *Tourists and residents place a high premium on wildlife watching. A 1994 report says that nearly 60 percent of suburban residents actively engage in wildlife viewing near their homes and are willing to pay premiums for locations in settings that attract wildlife.*
- *In 1989, the Maryland Department of Economic and Employment Development (DEED) estimated the economic importance of the Chesapeake Bay to be $678 billion to the economies of Maryland and Virginia through commercial fishing, marine trade, tourism, port activities, and land values.*
- *Marylanders spent $270 million observing, feeding, and photographing wildlife in 1991 as reported by the U.S. Fish and Wildlife Service.*
- *The Department of Natural Resources of Maryland reports that $133 million was spent in the 1991-1992 hunting season. Hunting-related industries support an estimated 4,600 jobs in the state.*

Timber Production

In 1992, timber products composed the largest portion of the total agricultural crop value in the United States. The total value is listed at $23.8 billion, passing corn and soybeans as the leading agricultural commodity. Figure 12-1 shows the percentage breakdown of the value of agricultural crops and timber in 1992.

Due to the high value of timber products, harvest level changes can dramatically affect local economies. All regions of the United States, including the Chesapeake Bay drainage area, help supply the demand for forest products. Four of the top five states in the United States in terms of volume of hardwood growing stock are in the Bay – (#1) Pennsylvania, (#3) Virginia, (#4) New York, and (#5) West Virginia. In Virginia, $9.8 billion per year is generated by the sale of forest products. In Pennsylvania, the timber industry employs 94,000 people in 2,200 locations with an annual payroll of $2.3 billion. In West Virginia, the business volume from the wood-products industry totals $3.2 billion annu-

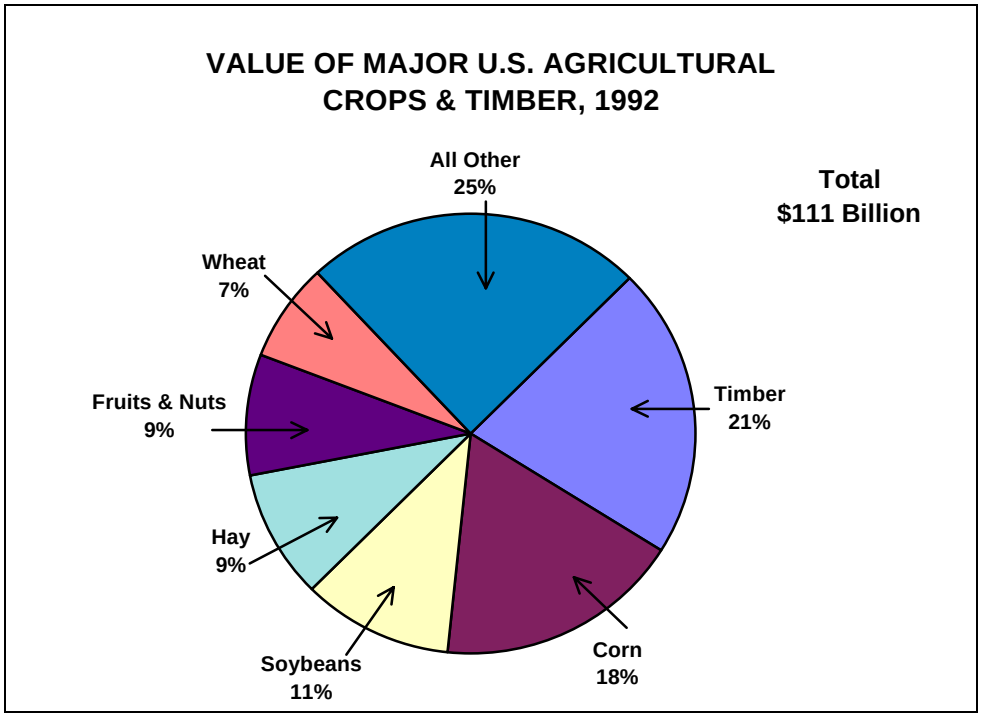

Figure 12 - 1. Timber value estimated from Forest Service Timber Cut/Sold Reports adjusted for value added to local points of delivery. (Source: USDA Economic Research Service Crop Values.)

ally. Table 12-1 is an example of recent stumpage and millage values for Southeastern Pennsylvania. Timber products produced include sawlogs, pulpwood, firewood, posts, and fence rails.

Crop Alternatives and Specialty Forest Products - Trees and other alternative products grown in the streamside forest can bring big rewards.

- ***Aromatics*** - *Essential oils are concentrated in plant leaves, flowers, seeds, bark, and roots. Examples of trees cultivated for their oils include cedar, sweet birch, and sassafras. These oils are used for scenting soaps, polishes, deodorants, and personal care products. They are at the core of a $10 billion a year flavoring and cosmetic industry. Cedar oil is especially profitable at 25 metric tons produced per year at about $9.50 per pound (1978 price).*
- ***Cooking Wood: smoke wood and flavor wood*** - *Woods such as alder, apple, and cherry are used as flavor enhancers in grill cooking either in homes or restaurants. Annual gross sales in cooking wood are estimated at $18 million to $20 million. Unfortunately, profit margins are thin with a retail price of $3 to $3.50 for a 5-pound bag, but a profit of only $0.06 to $0.08 per bag.*
- ***Nuts*** - *Nut trees are an excellent alternative crop that can be raised in the riparian corridor. They include acorns, black walnuts, butternuts, pecans, and hickory nuts. Black walnut meat can bring $6 a pound or more, while uncracked nuts range from $0.75 to $1.25 per pound.*
- ***Wildlife Recreation*** - *The management of forests for recreation and wildlife-based enterprises has good potential benefits to private landowners. Both consumptive and non-consumptive uses can be developed, from access for hunting and fishing to photography and informal field education of school children. In Maryland, deer and bird hunting fees to private landowners range from $3 to $5 per acre per year, and up to $80 per hunter per day for waterfowl hunting access.*
- ***Weaving and Dying Materials*** - *A great variety of native materials that grow in or near woodlands and buffers can be used for weaving, decorating, and dyeing. While few are used on a commercial scale, many products can be used to produce a cottage indus-*

Table 12 - 1
Southeastern Pennsylvania Average Prices of Selected Species, September 1996
International ¼ Inch Rule

SPECIES	STUMPAGE PRICES Thousand board-feet	MILL PRICES Thousand board-feet
northern red oak	$419	$579
white oak	$314	$551
mixed oak	$324	$517
black cherry	$248	$800
white ash	$386	$406
hard maple	$235	$625
soft maple	$149	$300
yellow-poplar	$210	$383
miscellaneous hardwoods	$142	$300
pine - hemlock	$109	$270

try, such as weaving and basket making. Species that offer good material include bark from alder, brown ash, birch, hickory, poplar, and willow. Also popular are native vines from bittersweet, honeysuckle, and Virginia creeper.

- ***Shiitake Mushrooms*** *- The shiitake has been popular for centuries in Japan, where it is known as the forest mushroom. It originally grew wild on the shii tree, which is closely related to the oak. During the last 20 years, hundreds of shiitake growers have begun cultivating the mushroom in the United States. Since the 1940's, worldwide demand for shiitake mushrooms has placed its market volume second only to that of the common white mushroom. Its market potential is great because of its unusually high nutritional value and the fact that it can be grown in every part of the country. Shiitakes are grown using oak logs, particularly white oak, that have been thinned from woodlots. Retail prices are about $9-$12 a pound.*

- ***Decorative Cones*** *- A wide variety of cones are used in floral, wreath, and potpourri products. They are used in gift and fragrance items, as ornaments and table decorations, and in a variety of small niche products, such as jewelry, grave blankets, and bird feeders. Cones can be dipped in wax and used as fire starters and decorations, or crushed and molded into Presto-log shapes for fire starters. Cones from hemlock, loblolly pine, white pine, red pine, and spruce are all marketable. Landowners can make $7-$24 per bushel, depending on the species.*

- ***Ginseng*** *- Ginseng is a wild forest herb that was first discovered in China 5,000 years ago. Ginseng is used as a medicinal plant – mainly the root. Ginseng acts as an antidepressant, increases resistance to disease, and improves both physical and mental performance. American wild ginseng is so much sought after that much of it has disappeared. It sells for as much as $360 per dried pound, and over $70 million worth of ginseng root, both wild and cultivated, is now exported annually.*

Other examples of special products are listed in Table 12-2.

Costs Associated with Riparian Forest Buffers

The Costs of Establishment and Management

The Natural Resources Conservation Service defines a riparian forest buffer strip as an area of trees and shrubs, at least 50 feet wide, located between cropland and watercourses. The riparian buffer is effective in controlling erosion and attached nutrients, reducing instream sediment loads during flooding, reducing nutrients in overland and subsurface flow, moderating stream temperatures, and providing habitat.

One tool that can be used for establishment planning is the riparian forest buffer specification developed in 1990 by the USDA Forest Service. That specification, as described in this manual, outlines three distinct zones. Zone 1 is nearest the streambank, has a recommended fixed 15-foot width, and is a no management zone to achieve streambank stabilization. Zone 2 is recommended to be at least 60-feet wide and is geared to nutrient removal. Zone 3 is hoped to be 20-feet wide and consists of dense grasses and forbs to convert concentrated water flow to uniform sheet flow. With this basic outline we can begin to plan establishment costs, and then, estimate maintenance cost for a 10-year period. The costs shown in Table 12-3 are derived from USDA Forest Service, Stewardship Incentive Program (SIP) cost-share rate structure guidance for SIP Practice 6 - Riparian and Wetland Protection and Improvement for Various States within the Northeastern Area. All costs shown are the price of practices installed and include labor.

Table 12 - 2

Special Forest Products of the Northeastern United States

(Adapted from Inside Agroforestry, Winter 1996 Issue)

Specialty Products	Examples	Use
Food	Shiitake and matsuki mushrooms	food, medicinals
	Black locust and plum honey	food, candy
	Walnuts, acorns, pecans, and Pinyon pine nuts	food, dyes
	Blueberries, huckleberries, and other berries	food, dyes
	Maple, birch, and boxelder sap	syrups, candy
Specialty Items	Cedar and pine oils	aromatics, crafts
	Poplar, willow, and switchgrass biomass plantings	fuel, paper
	Cedar, poplar, and willow residues	mulches, animal bedding, litter products
	Walnut crotches, wormy chestnut, diamond willow, and cedar veneer	wood, decorations and carvings
Decoratives	Club fern, Spanish moss, and other mosses	decorations, craft projects
	Wild grape, kudzu, vine maple, and other vines	crafts
Medicinals	Ginseng	longevity, general strengthening, teas, herbs
	Goldenseal	eyewash, laxative, tonic hemorrhagic
Herbs	Slippery elm bark	food flavoring, laxative
	Elder flowers	food flavoring, eye and skin health

Table 12 - 3
Riparian Forest Buffer Installation Estimated Costs

COMPONENT	MATERIALS	UNIT	ESTIMATED COST
	ESTABLISHMENT		
Preparation	**Light site prep**		
	- mow, disking	acre	$12.00
Planting	**Tree Seedlings**		
	8x8 spacing; 430 trees/acre	acre	$495.00
	(Hardwoods - $1.15/seedling)		
	12-18' seedling with labor included		----------
Subtotal			**$507.00**
	MAINTENANCE		
Reinforcement	Seedlings 50/acre	acre	$58.00
Planting	Year 2 after establishment		----------
			$58.00
TOTAL COST	Planting and Establishment	acre	**$565.00**
	OPTIONAL COSTS		
Establishment			
	Shelters ($5.00/tree Installed)	acre	$2150.00
	Fencing (1 acre=282 linear feet)	acre	$564.00
Maintenance			
	Competition control		
	- Herbicide treatment	acre	$54.00
	- mowing	acre	$12.00

** Labor cost included in estimates could be saved with help by volunteers for establishment.

Economic Impacts of Riparian Forest Buffers

The cost impacts of riparian buffers are site specific and determined by a variety of factors. Such considerations as dominant-land use, landowner objectives, and opportunity costs or foregone production, dictate the total cost that retaining or restoring riparian forest will impose. Following are three hypothetical scenarios that are intended to illustrate economic impacts for "typical" situations in the Chesapeake Bay Watershed - a coastal plain agricultural field, a forestry site, and a tract of new subdivision development near an urban center. Thanks goes to Dr. Ian Hardie, University of Maryland; John Long and Patty Engler, NRCS, and Scott Crafton, Virginia Chesapeake Bay Local Assistance Department for their assistance and review of these scenarios.

SCENARIO # 1: AGRICULTURAL FIELD

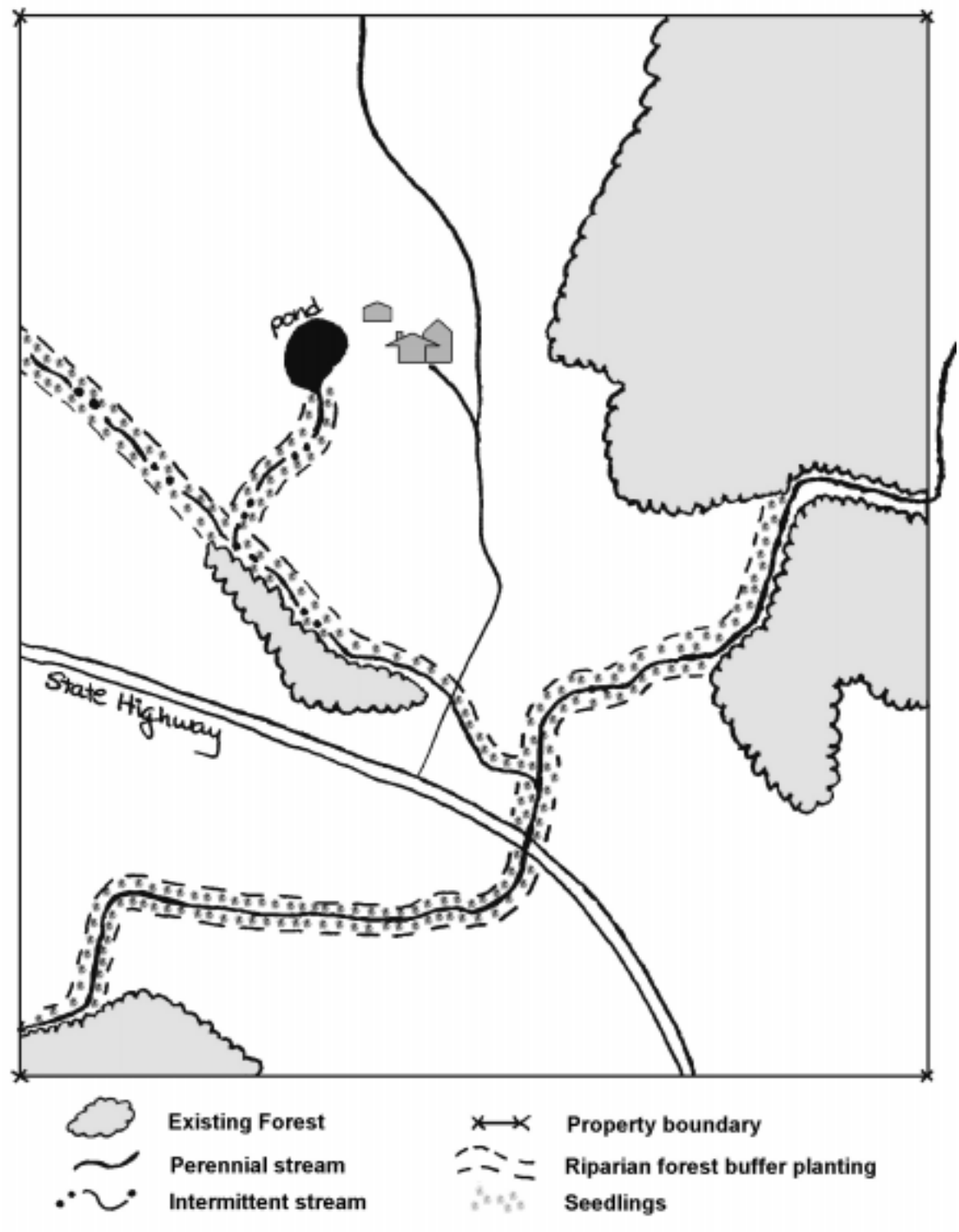

Figure 12 - 2. Agricultural Field: Riparian Forest Buffer Establishment.

This example occurs in the Coastal Plain area of Maryland and is a hypothetical farm. The costs of riparian forest buffers on agricultural lands include buffer establishment, maintenance, and the opportunity cost of installing a buffer – foregone income from lost production in the riparian area.

Scenario:

A 140-acre farm field located on the Eastern Shore of Maryland. The landowner manages the field in a two-crop (corn, soybeans), 2-year rotation. The field has 1307 feet of perennial and intermittent streams running through it. The farmer has agreed to establish a 50-foot wide forest buffer on both sides of the stream on the advice of his NRCS District Conservationist. The result will be a 3-acre riparian buffer.

Assumptions:

- Yield over the entire field. In many cases the area adjacent to a stream or river is considered marginal land because of erosion or drought-prone soils, steep or rolling slopes, poor drainage, and low soil fertility. However, in some cases this area is influenced by the flood plain and can be highly productive. Therefore, we assume a consistent yield.
- No existing buffer. The buffer to be established is calculated for both sides of stream at 50'.
- Land Capability Class - IIe or IIIe (few to moderate limitations).
- Production costs represent variable and fixed costs.

Income to the Farmer:

This amount represents the cost to the producer in lost crop income. Installing a forest buffer changes the land use for a long period of time. Therefore, total net income is the net present value of crop income for 20 years with a discount rate of 4 percent, the length of time before one may see a return from the new timber resource. Net income above variable and fixed costs is 1996 Crop Budgets of $84.00 per acre and assumes crop price/yields for corn ($3.60/100) and soybeans ($7.85/35) from MD Cooperative Extension Service.

Figures are shown in dollars per acre.	*Dollars/acre*
Net Income	**$1,141.00**

Cost of Buffer Establishment and Maintenance:

Installing a forest buffer involves site preparation, tree planting, and some second year reinforcement planting. Additional maintenance is sometimes employed to reduce competition and promote tree growth. Refer to preceding cost sheet for itemized costs.

Cost of Forest Buffer	**$565.00**
Total Cost of Riparian Forest Buffer to the Landowner	**$1,706.00**

Incentive Programs that Reduce Costs of Forest Buffers to Landowners

State and federal programs exist which cost-share best management practices (BMP) and the establishment of riparian forest buffers on agricultural lands. These programs can frequently be combined, or "piggy-backed," into a financial assistance package. An examination of programs and incentives available for buffers in the Bay states appears later in this chapter. Below are examples of program combinations for each state and the bottom-line cost over a 20-year period to the private landowner if these programs are used. These figures are net present values for direct comparison to landowner costs.

Maryland:

- Conservation Reserve Program (CRP)
  - 50% cost-share reduces buffer installation cost (one time) $283.00
  - Annual rental payments - $81/acre (15 years) $901.00
  - Riparian Forest Buffer 20% incentive and $5 maintenance (15 years) $235.00
- MD Buffer Incentive Program - $300/acre (one time) $300.00

THE COST TO A MARYLAND LANDOWNER PER ACRE *$0.00*

The Maryland landowner makes $13.00 per acre

Virginia:

- CRP package $1,419.00
- Woodland Buffer Filter Area - $100/acre (one time) $100.00

THE COST TO A VIRGINIA LANDOWNER PER ACRE *$187.00*

The Virginia landowner loses income per acre over a 20-year period

Pennsylvania:

- CRP package $1,419.00
- Streambank Fencing Program
  (if >12-foot buffer, then fencing provided for free) ----------

THE COST TO A PENNSYLVANIA LANDOWNER PER ACRE *$287.00*

The Pennsylvania landowner loses income per acre over a 20-year period.

DISCUSSION:

- State and federal conservation programs can reduce or eliminate landowner costs for restoring riparian buffers on their land. This scenario shows that cost-share and incentive programs can lead to break even or better over a 20-year period. However, crop income opportunity is still lost as time continues.

- Riparian forests can provide additional and diversified economic returns to the agricultural producer. For example, timber that is selectively harvested can still provide annual equivalent of $8.00/acre (red oak - 60-year rotation) to $34.00/acre (loblolly pine – 35-year rotation). Also, allowing hunting access can return $3.00-$5.00 in lease fees per acre every year.

SCENARIO # 2: FOREST SITE

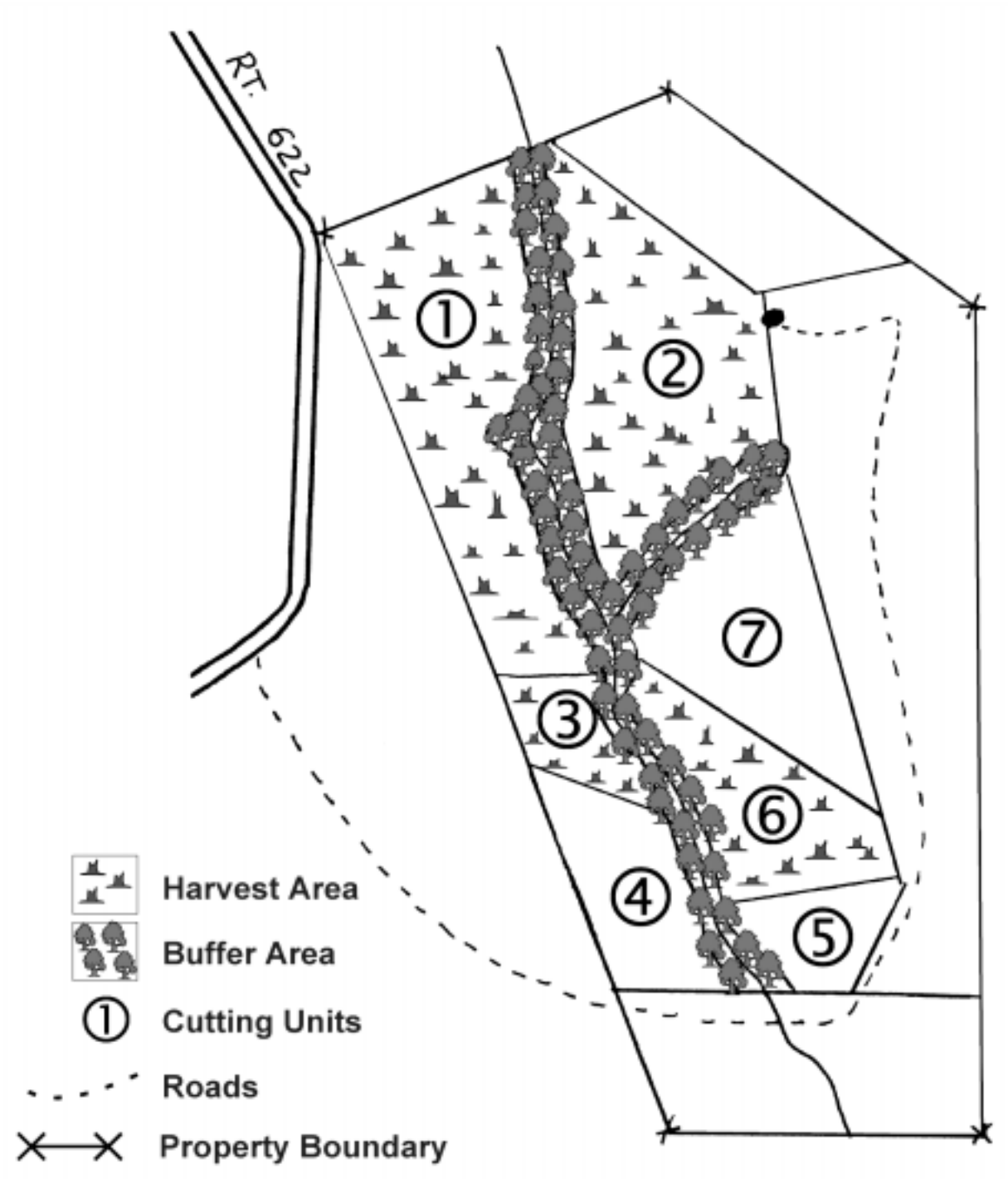

Figure 12 - 3. Forest: Streamside Management Zone Designation.

This example occurs in the Coastal Plains area of Virginia's western shore. It was selected because it is based on an actual situation encountered by a leading forest products company in the region working with a private landowner. The costs, or in this case the foregone income, to retain the forest buffer are from the private landowner perspective.

Scenario:

A 54-acre land parcel in private non-industrial land ownership located in the Middle Neck region of Virginia. It is a mixed pine/hardwood site with 3920 feet of perennial stream running through the area scheduled for timber harvesting. A local ordinance requires a 50-foot wide buffer or streamside management zone to protect water quality. The result is a 4.5 acre total area impacted by retaining the buffer.

Income from Timber Production:

Income figures are shown per acre. Reforestation is optional in this region because natural regeneration occurs well on these sites. The reforestation cost is included to show potential costs to the landowner, and it assumes that they may choose selected species management.

- Gross Timber Income (per acre) $1,268.00
- Production Costs to Landowner (per acre)
  Harvest - payment to logger (estimate of labor, equipment maintenance, hauling, insurance, FOB).....-634.00
  Reforestation - species enhancement/management (optional) .....-200.00
- **Net Income to Landowner..... $434.00**

Cost of a Buffer to the Landowner

The figures in Table 12-4 show the income potential of the entire 54-acre land parcel and the impact of lost income for using alternative harvesting techniques within the 4.5-acre forest buffer. The preferred management approach is to clearcut the entire parcel. Each alternative harvesting technique reflects the adjusted Total Return, the exact dollar change (loss) and percentage change in return to the landowner. Total returns were calculated at $634.00 per acre to reflect the impact of the buffer on the timber sale only.

Table 12 - 4
Cost of Buffer to Landowner Using Various Management Regimes

Harvesting Alternatives	Total Return	Change	% Change
1. Total clearcut of the entire parcel	$34,250		
2. Partial Cut - All sawtimber in Buffer (>50% basal area)	$33,991	($259)	-1.00%
3. Partial Cut - High quality in sawtimber in Buffer (< or = 50% basal area)	$31,602	($2,648)	-7.70%
4. No Harvest in Buffer	$28,531	($5,719)	-16.70%

Program Opportunities – Reforestation and Buffer Implementation

For private landowners, state and federal programs exist which cost-share reforestation, best management practices (BMP), and establishment of riparian forest buffers. These programs can frequently be combined, or "piggy-backed," into a financial assistance package. An examination of programs and incentives available for buffers in the Bay states appears later in this chapter. Below are examples of program combinations for each state that reduce the costs of buffers on private lands and the total net income if these programs are used.

Federal Programs:

- Stewardship Incentive Program: 65% cost-share (includes riparian zone enhancement)
- Conservation Reserve Program: 50% cost-share (new added incentive for riparian areas)
- Environmental Quality Incentives Program: 75% cost-share (includes riparian forest buffers)
- Public Law 96-451: 10 percent investment tax credit up to $10,000 for reforestation

Virginia:

- Water Quality Law: The state's voluntary BMP guidelines recommend a 50-foot wide buffer on which 50 percent of the basal area in the buffer can be harvested.
- Woodland Erosion Stabilization: Cost-share provided to establish permanent vegetation on eroding areas of forestry sites, but grass and legumes are commonly used.

- A combination of federal programs would reduce reforestation costs by $170.00 per acre.
  - SIP cost-share (65 percent) = $150.00
  - Federal Tax incentive = $20.00 per year for 7 years

This would raise Net Income per acre to $604.00

Maryland:

- Forest Harvest Guidelines: A minimum 50-foot wide no-cut buffer is required for perennial streams. If Buffer Management Plan is implemented, selective harvesting is allowed.
- Buffer Incentive Program: $300 per acre of buffer one-time payment.
- Woodland Incentive Program: Cost-share 50 percent private forest management activities.
- Reforestation/Timber Stand Improvement Tax Deduction: Small forestry operation can deduct from adjusted gross income double cost of reforestation activities, including buffers.

- A combination of federal and state programs would eliminate cost of reforestation.
  - With Buffer Management Plan - 60 percent basal area harvestable = $380.00
  - SIP cost-share (65 percent) = $150.00
  - MD BIP ($300/acre)= $300.00

This would raise Net Income per acre to $830.00

Pennsylvania:

- Voluntary Guidelines: There are no mandatory requirements in the riparian zone on private forestland, although a 50-foot buffer is recommended.
- A combination of federal programs would reduce reforestation cost to $170.00 per acre

This would raise Net Income per acre to $604.00

DISCUSSION:

- Added incentives such as preferential tax treatment of riparian areas and conservation easements that allow selective harvest of streamside timber would reduce costs further.

- Allowing forest management within the riparian forest buffer or Streamside Management Zones is an effective way to protect water quality and provide economic return to private landowners. Forestry activities are a compatible land use with environmental protection and open space retention. It keeps the land economically viable and provides multiple benefits.

SCENARIO #3: SUBDIVISION DEVELOPMENT SITE

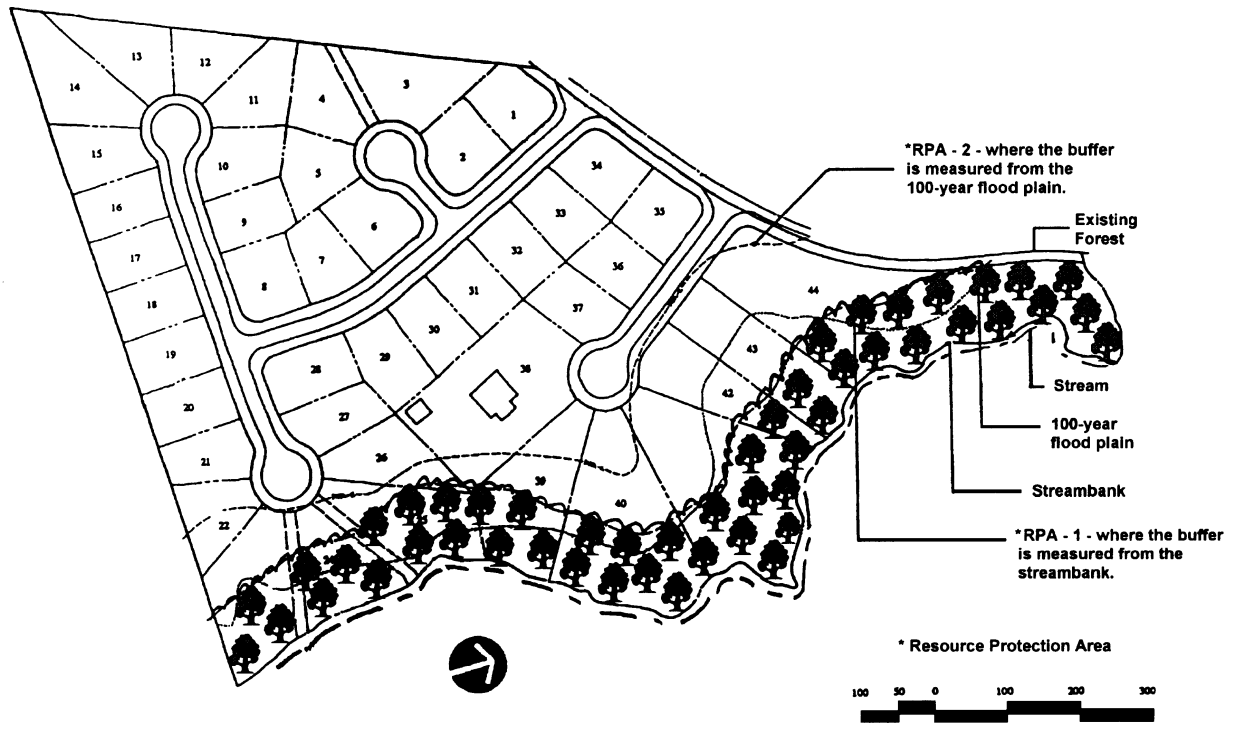

Figure 12 - 4. Development: Riparian Forest Buffer Retention/Establishment.

This example occurs in the Tidewater area of Virginia and is therefore subject to Chesapeake Bay Preservation Act (CBPA) regulations. It was selected because of CBPA's recognition of riparian buffer areas as important to conserve during the development process, and its flexible guidelines to protect the resource while allowing development. The guidelines stress that development is expected to minimize land

disturbance and impervious cover while preserving indigenous (native) vegetation to the degree possible, consistent with an approved project plan. The CBPA criteria tend to affect how a project is planned and need not result in increased project costs.

Although hypothetical, this scenario is based on an actual project included in a "Study of the Cost of Complying with the Chesapeake Bay Preservation Act Regulations" prepared by Chesapeake Bay Local Assistance Department of Virginia. Circumstances vary from site-to-site that can impact costs such as steep slopes, erosion control devices, and stormwater management requirements. This scenario illustrates the impact of preserving a 50-foot buffer adjacent to a perennial stream only.

Scenario:

A single family small subdivision in the Virginia Chesapeake Bay Preservation Area with a Resource Protection Area (a bordering stream) on the project site. The 17.6-acre subdivision contains 44 platted lots according to current zoning, and it is subject to Designation and Management Regulations.

Zoning Allowances:

- Minimum lot size ..... 9000 sq.ft.
- Current Number of Platted Buildable Lots ..... 44 Lots
- Finished Lot Price $61,000
- **Total Sale Value** $2,684,000

Cost Impact of Retaining 50-Foot Wide Buffer

The previous illustration shows retaining the riparian buffer on the project site.

- 50-foot buffer Possible Result - 1 lost lot $61,000

Additional Elements and Cost Estimates for CBPA and Buffer

These elements are shown to illustrate the range of planning, engineering, and facilities that could be included to meet the performance criteria of CBPA. Most are already required by state erosion and sediment control laws. However, the integration of buffers and other natural systems can actually reduce development costs and add value to the site.

- Site Plan, Erosion Control Plan (already required) $0.00
- Water Quality Stormwater Plan (engineering time) $650.00
- Installation and maintenance of erosion control devices (already required) $0.00
- Installation of on-site stormwater controls (excluded on this site) $0.00
- Minimize land disturbance and natural vegetation removal $0.00
  (could show a net savings)
- Review fees (could be $0) $0.00

TOTAL COST TO DEVELOPER $61,650.00

Implementing 50-foot wide buffer results in:
1 lot lost @ $61,000 each = $61,000 + $650 (added costs)

Total Per-lot Cost $61,000÷43 lots = ... $1,434.00

Buffer Cost as a Percentage of Total Value $61,650 ÷ $2,684,000.00 = ...-2.3%

DISCUSSION:

- The impact of the costs in this example reflects the application of buffer requirements to a subdivision that was platted prior to implementation of CBPA regulatory requirements, and therefore, did not account for those requirements in the planning and layout of the lots. Consultants suggest that an alternative plat plan, that accounted for CBPA rules such as the buffer requirement, might still accommodate 44 lots. Local subdivision rules, allowing for clustering, or zoning rules, allowing for density compensation for buffers (i.e. allowing the same number of slightly smaller lots to be platted than would be allowed if no buffers were implemented), could eliminate the risk of lost lots.

- Market research indicates that the value of lots where buffers are present is often 5% or higher than the value of lots where no buffers are present. That would result in a $3,050.00 premium for each lot sold adjacent to the buffer.

Comparison of Trees, Row Crops, and Pasture on Land with Class IIIe Capability

Item	Row Crops	Pasture	Trees
Cash Flow	Annual	Annual	Revenues and expenses occur periodically
Income Tax Treatment	Ordinarily taxable income	Ordinary taxable income	Amortization and investment credit on reforestation costs
Supply/Demand Outlook	Oversupply of most crops; low prices	Oversupply of beef; fluctuating prices	USDA predicted shortage of high quality timber; price increasing
Market	Usually must sell at current price; relatively perishable product		Multiple products can be held for good markets
Financial Returns from Investment	At current prices, rates of return are below interest earned on saving account and may be negative		Better than long-term Certificate of Deposit
Soil Conservation Protection from Erosion	Requires expensive maintenance	Moderate maintenance	Excellent: builds soil
Drought	High risk of loss of investment	Moderate risk, percent loss of vegetative cover	Low risk, once established
Management	Annual intensive time and labor	Moderate time requirement	Very low time requirement
Investment Length	One year	1 to 10 years	Usually longer than 15 years prior to thinning

Source: USDA Soil Conservation Service and USDA Forest Service, Northeastern Area, State and Private Forestry. Forest Management: A Viable Alternative on Marginal Croplands Eligible for the Conservation Reserve Program, Fiscal Year 1991.

Finance Tools and Economic Incentives

Because so much of the protection of riparian areas relies on voluntary participation, a central element of riparian forest buffer conservation and restoration involves economic incentives to landowners and developers. The financial benefit a landowner receives can have a significant impact on his or her willingness to protect and restore riparian buffers. Incentives programs are delivered through a host of agents such as Natural Resources Conservation Service (NRCS), Farm Service Agency (FSA), the USDA Forest Service, state and local natural resource agencies, private industry, and citizen groups, and are designed to provide technical and financial assistance directly to landowners and communities. In developed areas, zoning, land use, and stormwater provisions may provide opportunities for greater use of riparian forest buffers. In October 1996, the Riparian Forest Buffer Panel recommended to the Chesapeake Executive Council to enhance incentives and *"Develop and promote an adequate array of incentives for landowners and developers to encourage voluntary riparian buffer retention and restoration."* This is an overview of several financial tools and incentive programs that exist in the Chesapeake Bay states. A complete analysis of state and federal stream protection programs and identified gaps appears in Section XIV of this handbook.

Recognized Cost-Share Programs

Although productivity is often a priority for those whose livelihood depends on the land, a balance needs to be struck between productivity and natural resource protection. For stream protection on agricultural land, site-specific management and integration of a range of conservation practices are the rule. There are many best management practices (BMPs) that can be applied to farms to protect water quality, and financial support is available to help landowners offset costs to install such practices. Table 12-5 is a list of some federal cost-share programs that are frequently used to encourage riparian forest conservation and restoration and can be combined with state programs to increase incentives and reduce costs to landowners.

Maryland has the Buffer Incentive Program, Woodland Incentive Program, and Maryland Agriculture Water Quality Cost-share Program.

Table 12 - 5
Recognized Cost-Share Programs

Program	Agency	Eligibility
Conservation Reserve Program	NRCS	HEL land, wetlands, wildlife forested riparian areas. 50% cost-share, annual payments up to $50,000 for 10-15 years, 20% incentive for trees and continuous sign-up.
Forestry Incentives Program	NRCS/ USFS	Up to 65% cost-share for tree planting and prep. Area must be 10-100 acres.
Stewardship Incentive Program	USFS	Private forests 1-1000 acres. Up to 65% cost-share for SIP practices including riparian & wetland protection and improvement. Maintain for 10 years.
Environmental Quality Incentives Program	NRCS	Agricultural land, including forests. Up to 75% cost-share for riparian forest buffers and related practices. Must sign long-term agreement.
Wetlands Reserve Program	NRCS	Riparian areas can be restored. Up to 75% cost-share of restoration activity. Maintain for at least 10 years.

Virginia has the Woodland Buffer Filter Area and Loafing Lot Management System. Pennsylvania has the Streambank Fencing Program.

Tax Incentives & Credits

Tax incentives and credits are frequently identified as a desirable approach to encourage resource conservation. Property and income tax relief can be a powerful tool to balance maintaining economic viability of resource-land use and the protection of valuable water resources. The Riparian Forest Buffer Panel saw this and recommended to the Chesapeake Executive Council that tax strategies be examined as an incentive to landowners to conserve and restore riparian areas.

The Bay states of Maryland, Pennsylvania, and Virginia have some type of preferential tax assessment program for land kept in resource use or open space, such as prime agricultural land or private woodlots. These programs reduce the assessed value of the land, resulting in lower property taxes, but often lack any definition for riparian area protection. On the other hand, federal income tax credits exist and can include reforestation efforts in riparian areas. Table 12-6 has examples of tax incentive programs in the Bay states. Call the state forestry or agriculture agency for more information about the programs and eligibility of your land.

Table 12 - 6
Tax Incentive Programs

	PROGRAM	DESCRIPTION
FEDERAL:		
	Public Law 96-451	Provides federal income tax incentives to reduce reforestation costs. The law permits up to $10,000 of capitalized reforestation costs each year to be eligible for an investment tax credit and 7-year amortization.
MARYLAND:		
	Reforestation/Timber Stand Improvement Tax Deduction Program	Allows landowners of small forestry operations to deduct from their adjusted gross income double the costs of reforestation.
	Forest Conservation and Management Program	Provides special tax assessments on forestland, if landowner agrees to adhere to a forest stewardship plan.
	Agricultural Use Assessment	Provides a preferential assessment on the value of land in agricultural use. Woodlots can also receive an agricultural assessment.
VIRGINIA:		
	Use-Value Assessment	Counties provide preferential assessments on agricultural and forestlands.
PENNSYLVANIA:		
	Farmland and Forest Land Assessment Act (Clean and Green Act)	County can grant a preferential assessment for 10 or more contiguous acres of land devoted to agriculture, forest reserve, or open space.

Conservation Easements

Many landowners find that placing their land in an easement is a smart financial strategy for themselves and their families. It is also a way to contribute to protecting their local environment. Conservation easements are a "market-based" approach to land conservation. They offer landowners who sell certain rights to their property a high portion of fair market value as compensation, can yield significant tax savings to those who donate land, and allow them to retain private ownership.

A conservation easement is a voluntary legal agreement between a willing property owner and a qualified party, such as a land trust, public agency, or conservation organization. Each easement is individual and is tailored to the particular property and the interests of the owner. The specific rights a property owner forgoes when granting a conservation easement are spelled out in an easement document. The owner and prospective easement holder identify the areas that the owner wants to protect and the rights and restrictions on use that are necessary to meet those goals – deciding together what can and cannot be done to the property.

To understand the easement concept, think of owning land as holding a bundle of rights. The landowner may sell or give away the whole bundle, or just one or two of those rights. These include the right to construct buildings, to subdivide the land, to restrict access, or to harvest timber. If the goal is to preserve a natural area, for example, an easement may prohibit construction and activities that would destroy the protected area. On the other hand, many easements do not require public access and even the most restrictive easement usually allows continued farming and forestry.

A conservation easement can be written so that it lasts forever. This is known as a perpetual easement. Where state laws allow, an easement can be written for a specific period of years, and it is known as a term easement. Only gifts of perpetual easements, however, can qualify a donor for income and estate tax benefits. And, the easement runs with the land – that is, the original owner and all future owners are bound by its restrictions. It is recorded at the county or town records office so that future owners will learn about the easement when they obtain title reports.

Conservation easements can reduce a property owner's income tax. According to Internal Revenue Code Section 170(h) a donated conservation easement is a tax-deductible charitable gift, provided that it is perpetual and is donated "exclusively for conservation purposes" to a qualified conservation organization or public agency. Conservation purposes are defined by the IRS as the:

- preservation of land areas for outdoor recreation by, or the education of, the general public;
- protection of relatively natural habitats of fish, wildlife, plants, or similar ecosystems;
- preservation of open space – including farmland and forestland – for scenic enjoyment or pursuant to an adopted-governmental policy. In either case, such open space preservation must yield a significant public benefit; and
- preservation of historically important land areas or buildings.

Conservation easements can reduce a property owner's estate taxes. If the owner grants a perpetual easement before his or her death, the property must be valued in the estate at its lowered, restricted value. To the extent that the restricted value is lower than the unrestricted value, the value of the estate is reduced, and thus subject to less taxes. Also, if owners donate the land into an easement during their lifetime, they also realize income tax savings. If owners do not want to restrict the property during their life, they can still specify the conservation easement in their will and receive the same reduced tax results.

Conservation easements can reduce an owner's property tax. If a conservation easement reduces the development potential of the property, it may reduce the level of assessment

and the amount of the owner's property taxes. State law and local assessments may influence or determine actual property tax relief to easement grantors.

Unfortunately, the application of conservation easements to the protection of riparian forest zones is not frequently used. State land protection programs, perhaps coupled with federal programs, may provide for riparian area protection and restoration easements in the future. For more information on current programs to protect your land through conservation easement and how to receive tax benefits, contact your state agricultural, forestry agency, or local land trust.

References

Brabec, E. 1992. Trees make cents. Scenic America Technical Information Series, Volume 1, No. 1. Annapolis MD. 8p.

Brabec, E. 1992. On the value of open spaces. Scenic America Technical Information Series, Volume 1, No. 2. Annapolis MD. 8p.

Chesapeake Bay Local Assistance Department. 1992. Study of the costs of complying with the Chesapeake Bay preservation act regulations. Richmond, VA. 42p.

Chesapeake Bay Foundation. 1996. A dollars and sense partnership: economic development and environmental protection. Annapolis, MD. 21p.

Cooksey, R.A. and A. Todd. 1996. Conserving the forests of the Chesapeake: the status and trends, and importance of forests for the Bay's sustainable future. Tech. Paper-03-96. Radnor, PA. USDA Forest Service, Northeastern Area. 35p.

Lipton, D.W., K. Wellman, I.C. Sheifer, and R.F. Weiher. 1995. Economic valuation of natural resources - a handbook for coastal resource policymakers. NOAA Coastal, Ocean Program Decision Analysis Series No.5. NOAA Coastal Ocean Office, Silver Spring, MD. 131p.

McPherson, E.G., D. Nowak, and R.A. Rowntree. 1994. Chicago's urban forest ecosystem: results of the Chicago urban forest climate project. Gen. Tech. Report NE-186. Radnor, PA. USDA Forest Service, Northeastern Forest Experiment Station. 201p.

Thomas, M.G. and D.R. Schumann. 1993. Income opportunities in special forest products - self-help suggestions for rural entrepreneurs. Ag. Info. Bulletin-666. Washington, D.C. USDA Forest Service. 206p.

USDA Forest Service. 1991. Forest management - a viable alternative on marginal croplands eligible for the conservation reserve program. Tech. Transfer Brochure. USDA Forest Service, Northeastern Area and Soil Conservation Service. 12p.