RIPARIAN FOREST BUFFERS:

Restoring and Managing a Vital Chesapeake Resource

Conference Proceedings

October 5-6, 1994

Ellicott City, Maryland

Chesapeake Bay Program

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On October 5-6, 1994, the Nutrient Subcommittee and Forestry Work Group of the Chesapeake Bay Program hosted a conference on the subject of Riparian Forest Buffers. Participants came together to discuss, debate and learn about the value of our riparian forest resources and their potential use as protective buffers for water quality, fish and wildlife and other diverse objectives.

Background- Forestry Work Group Efforts

In 1993, the Forestry Work Group presented an "issue paper" to the Chesapeake Bay Program calling for acceleration of a variety of efforts related to the use of riparian forest buffers. Throughout 1993-94, buffers were debated as a tool in the development of the Tributary Nutrient Reduction Strategies for the Bay watershed. Many involved both supported the concept and criticized its usefulness. It was clear that there was a keen interest in the subject but that a general knowledge and wider understanding and appreciation for the value of forest buffers did not exist.

The Forestry Work Group with support of State Forestry Agencies, the Nutrient and Living Resources Subcommittees, and the Chesapeake Bay Commission, began a number of efforts aimed at addressing these education and technology transfer needs. In 1993, we commissioned a "scientific consensus" on the state-of-our-knowledge about riparian forest buffers in order to provide a better scientific foundation for their use. This document will be available from the Bay Program in May of 1995. In addition, we began efforts to compile a handbook to transfer this knowledge to people in the field. We also began a watershed-wide riparian forest inventory. These projects are in progress today. We developed educational materials and spoke to dozens of conservation groups, workshops, government agencies, and industry, landowner, and citizen groups on the subject.

Why a Forest Buffer Conference?

The "Scientific Consensus" process provided a clear conclusion: Riparian forest buffers were a management practice of importance to the Chesapeake Bay Program; not only for helping to control non-point sources of pollution but also to improve the health of our aquatic resources and provide a host of other benefits. The consensus also provided our first view of a set of important considerations for forest buffer planning and use in terms of nutrient removal, a subject so important to accomplishing Bay restoration goals.

As a result, the conference was developed to expand the level of both technical and practical knowledge related to forest buffer use and to stimulate interest and new energy to address many of the issues of forest buffer implementation in the field. The format and presentations and exhibits attempted to represent the different issues and solutions that are often unique to different land use settings in the Bay Watershed. In addition to scientific information, we decided to go a step further; that is, to focus on bringing together a host of people with examples and practical experience in translating scientific knowledge into action.

TOPIC AREAS

→Scientific Foundations

→Definition and Design
→Establishment & Maintenance
→Future Management

→Urban lands
→Developing Areas
→Agricultural Areas
→Managed Forests

→Role of Local governments and Non-profits
→Incentives/Disincentives
→Partnerships and Education
→Case Studies

Attendance

Over 280 participants from the states within the Chesapeake Bay watershed and elsewhere around the country participated. The conference attendance represented an excellent crossection of interest and involvement with riparian forest buffers:

✓Local Government	78
✓State Government	74
✓Private and Non-profits	60
✓Federal Government	49
✓Landowners/Managers	10
✓Scientists	10

The Future

While planning this conference, the Chesapeake Bay Commission passed a resolution calling for the development of a Bay Program "policy" to favor the use of riparian forest buffers. The Governors and Federal Agencies formalized this commitment through an Executive Council Directive on October 14. A Policy Panel has just begun its work to carry out this Directive. The conference was appropriately timed to begin the discussion and debate for the policy and scope out the range of issues that will need to be addressed. Successful development and especially implementation of future forest buffer initiatives will require an informed and active grass roots network such as this conference assembled. We certainly hope to work with many of you in the future.

Victor Funk
Chair, Nutrient Subcommittee

Dr. John C. Barber
Chair, Forestry Work Group

Albert H. Todd
USDA Forest Service
Conference Chairman

Riparian Forest Buffers:
Restoring and Managing a Vital Chesapeake Resources

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Abstract not available

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RIPARIAN FOREST BUFFERS:

Restoring and Managing a Vital Chesapeake Resource

October 5-6, 1994
Turf Valley Inn
Ellicott City, Maryland

DAY ONE - Detailed Agenda

7:00 *Exhibit Set-up*

8:00 *Registration and Coffee,*

9:00 *PLENARY SESSION #1 -*

WELCOME - Vic Funk, Chair of the Nutrient Subcommittee
Chesapeake Bay Program

KEYNOTE ADDRESS - Neil Sampson, Ex. Vice President, American Forests

10:00 PLENARY SESSION #2 -

SCIENTIFIC FOUNDATIONS
Moderator: Dr. John C. Barber, Chair, Forestry Work Group

"Ecology of Forested Streams in the Chesapeake Watershed"
Dr. Bernard W. Sweeney, Philadelphia Academy of Sciences

"Ecological value of shoreline forests along the Chesapeake Bay"
Dr. Richard Everett, U.S. Fish and Wildlife Service

"Water quality functions of riparian forest buffers"
Dr. Richard Lowrance, Agricultural Research Service

SETTING THE FOCUS: Albert Todd, USDA Forest Service

12:00 LUNCH -

LUNCHEON SPEAKER: "The Human Dimensions of Riparian Conservation"
Dr. Thomas Makowski, Sociologist, Soil Conservation Service, National Technical Center

1:00-1:30 *EXHIBITS*

1:30-3:00 *CONCURRENT SESSION #1 - "Definition and Design of Riparian Forest Buffer Systems"*

URBAN RIPARIAN BUFFERS-
Moderator: Don Outen, Baltimore County Department of Environmental Protection and Resource Management

"Planning for the restoration of Riparian Forest Buffers in urban environments"
Lorrie Herson-Jones, Metropolitan Washington Council of Governments

"Emphasizing natural riparian areas in urban stormwater retrofit"
Fernando Pasquale, Prince William County, VA

"Building Community Involvement in Stewardship of riparian areas"
Gene Piotrowski, Urban Forestry Program, Maryland Forest Service

RIPARIAN FORESTS AND OPEN SPACE IN SUBURBAN AREAS-
Moderator: Jim Cox, Virginia Department of Conservation and Recreation

"Planning for Riparian Forest Buffers in the developing landscape"
Tom Schueler, Center for Watershed Protection -

"Providing wildlife values through the use of riparian forest corridors"
Rich Pais, Draft, McKuen, and Walker, Inc.

"Criteria and issues for forest buffer implementation in suburban areas"
Rocky Powell, Baltimore County Department of Environmental Protection and Resource Management

FOREST BUFFERS IN AGRICULTURE-
Moderator: Lynn Schuyler, EPA Non-point Source Program Leader, Chesapeake Bay

"Ecologically-based assistance to farmers: Integrating Riparian Forest Buffers in Farm Conservation Planning"
Jeffrey Loser, Soil Conservation Service

"The potential for managing riparian areas for as perennial vegetative systems"
Dr. Louis Licht, University of Iowa

"Practical considerations for riparian forest buffer use in agriculture"
George Beals, Virginia Soil and Water Conservation Districts

STREAMSIDE MANAGEMENT AREAS FOR SILVICULTURE -
Moderator: Robert Merrill, Pennsylvania Bureau of Forestry

"Forest Buffers vs Streamside Management zones: Defining their use in forest management"
Gordon Stuart, USDA Forest Service, Washington, DC

"Designing Streamside management zones in forest management"
Andrew Dolloff, Project Leader, Coldwater Fisheries, Southeastern Forest Experiment Station, Blacksburg, VA

"Integrating timber harvest planning in the Riparian Area with forest stewardship"
J. Michael Foreman, Virginia Department of Forestry

3:00 *BREAK -*

3:30-5:00 *CONCURRENT SESSION #2-*
"Establishing and Managing Riparian Forest Buffers"

FOREST BUFFER PLANNING CONSIDERATIONS -
Moderator: Rupert Friday, Chesapeake Bay Foundation

"Watershed/Landscape Considerations for Forest Buffer Use"
Dr. David Correll, Smithsonian Environmental Research Center

"Using the natural ecosystem as a guide: considerations for planning"
Dr. Charles Williams, Clarion University of Pennsylvania

"Transforming Science into Policy: How are buffer widths established?"
Cameron Carte, Society of American Foresters

DESIGNING AN EFFECTIVE BUFFER
Moderator: Dr. Cherry Keller, US Fish and Wildlife Service

"Crop Tree Management in Riparian Areas"
Karen Sykes, Forester, USDA Forest Service, Northeastern Area

"Stream channel erosion and riparian restoration"
Larry Lubbers, Watershed Evaluation Division, MD Department of Natural Resources

"Planning forest buffers with wildlife in mind"
Dr. Lisa Petit, Smithsonian Environmental Research Center

<u>FOREST BUFFER ESTABLISHMENT AND MAINTENANCE</u> -
Moderator: Dave Welsch; USDA Forest Service, Northeastern Area

"Using SCS Soil Surveys for Riparian Forest Buffer Establishment"
Carl Robinette, Soil Scientist, Soil Conservation Service

"Technical Considerations for selecting and planting riparian trees and shrubs"
Mike Hollings, Environs/Sylvan Nurseries

"Maintaining riparian plantings: Considerations and techniques"
Len Wrabel, Consulting Forester

<u>FUTURE MANAGEMENT OF RIPARIAN FOREST BUFFER SYSTEMS</u>-
Moderator: Eric Schwaab, Director of Maryland Forest Service

"Managing for riparian forest corridors in the urban environment"
Doug Pickford, Northern Virginia Planning District Commission

"Maintaining landowner options through Forest Stewardship"
Steve Koehn, Maryland Forest Service

"Managing forest buffers in the suburban landscape"
Marc Raab, Howard County Department of Recreation and Parks

5:00-7:00 EXHIBITS -

5:00 -7:00 COCKTAIL RECEPTION -

DAY TWO - Detailed Agenda

8:30 *PLENARY SESSION #3 -*

LAWS AND POLICIES RELATED TO RIPARIAN BUFFER PROTECTION AND RESTORATION
Moderator: Ann Swanson, Chesapeake Bay Commission

"National perspectives on riparian protection and management"
James Lyons, Assistant Secretary for Natural Resources and Environment, US Department of Agriculture

"Regional/State approaches to riparian buffer protection and management"
Dov Weitman, Environmental Protection Agency, Office of Watersheds, Oceans and Wetlands

"Status of Riparian policies and regulations in the Chesapeake Bay Watershed"
John Lipman, Chesapeake Bay Commission

9:40 *BREAK -*

10:00-11:00 CONCURRENT SESSION #3 -
"Implementation: Working together for Riparian Forests"

INCENTIVES AND DISINCENTIVES -
Moderator: John Riley, State Forester of Maryland

"Overcoming disincentives to Forest Buffer establishment on farms"
Tom Simpson, Maryland Department of Agriculture

"Incentives/Disincentives for private land managers to enhance and retain riparian forests"
Jack King, Chesapeake Corporation, West Pointe, VA

"Federal and State incentive programs for rural and urban riparian forest buffers"
Jeff Horan, Regional Forester, Maryland Forest Service

PRIVATE AND PUBLIC RIPARIAN PARTNERSHIPS-
Moderator: Lauren Wenzel, Maryland Department of Natural Resources

"Linking mitigation with riparian forest buffer establishment"
James Richardson, Forest and Wetland Conservation Associates, Inc.

"The Lancaster County Stream Protection Task Force: A grass-roots approach to agricultural riparian management"
Lamonte Garber, Chesapeake Bay Foundation

"A Non-profit role in working with Landowners to protect and enhance riparian forests"
Steve Bunker, Nature Conservancy

THE ROLE OF LOCAL GOVERNMENT IN RIPARIAN PROTECTION -
Moderator: Deborah Southard, Virginia Department of Conservation and Recreation

"Finding Creative Solutions to Riparian Forests through open space and stormwater planning" - J. Toby Tourbier, Toubier and Walmsley, Inc.

"Working with local interests to protect sensitive areas"
Ginger Howell, Forest Conservation Coordinator, MD Forest Service

"County/Municipal Partnerships for meaningful Riparian Protection"
Jerry Walls, Lycoming County Planning Commission, PA

REACHING THE LANDOWNER AND THE PUBLIC -
Moderator: Robert Tjaden, Maryland Cooperative Extension

"Lessons learned from the PA Stream Fencing Program"
Mark Dubin, Pennsylvania Bureau of Land and Water Conservation

"Riparian Easements and stream protection"
Robert Whitescarver, Soil Conservation Service, Augusta County, VA

"Building coalitions with the agricultural community for riparian forest enhancement"
Jeff Opel, Queen Annes Soil Conservation District

11:15-12:15 CONCURRENT SESSION #4

"Case Studies of Riparian Protection, Restoration, and Management"

OTHER REGION CASE STUDIES -
Moderator: Richard Everett, US Fish and Wildlife Service

NEW YORK: "A Plan to control Nonpoint Source Pollution to Long Island Sound through Riparian Enhancement"
Laura Tessier, Westchester County Planning Department

OHIO: "The Big Darby Creek Project"
Kathy Smith, Ohio Department of Forestry -

NORTH CAROLINA: - "Riparian Assessment, Protection, and Restoration in the Tar-Pamlico Basin"
Randy Dodd, Research Triangle Institute

AGRICULTURAL/RURAL EXAMPLES-
Moderator: Russ Mader, Soil Conservation Service, CBPO

"Using Agroforestry Systems"
Dr. Louis Licht, University of Iowa

"The Falling Springs Greenway Project"
Sam Small, Vice President, Falling Springs Greenway, Chambersburg, PA

"Monocacy Watershed Project"
George Eberling, Maryland Forest Service,

URBAN/SUBURBAN EXAMPLES-
Moderator: Scott Crafton, VA Chesapeake Bay Local Assistance Agency

"Revitalizing Baltimore's Riparian forests through neighborhood action"
Shawn Dalton, Yale University, Urban Resources Institute

"A County-wide Creek Valley District for Riparian Management"
Irish Grandfield, Loudoun County Department of Planning

"Forming Local Stream Teams"
Sharon Meigs, Prince Georges County, MD

FARMERS/LANDOWNERS PANEL

Moderator: Rob Northrop, Maryland Forest Service

Richard D. Norling, Deer Creek, Darlington, MD

Melvin Baile, Jr., New Windsor, MD

Johnston Hegeman, Tobacco Run, Churchville, MD

12:15 *BOX LUNCHES - Go to discussion groups*

12:30 *FACILITATED DISCUSSION GROUPS*
"Defining a riparian forest buffer policy/program that works"

URBAN LAND USE GROUP -Facilitators: Shawn Dalton, Baltimore City Parks and Recreation, & Gene Piotrowski, Maryland Forest Service

SUBURBAN LAND USE GROUP - Facilitators: Rocky Powell, Baltimore City & Rick Cooksey, USDA Forest Service

AGRICULTURAL LAND USE GROUP -Facilitators: Royden Powell, MD Dept of Agriculture & Deb Southard, VA Dept of Conservation and Recreation

FORESTRY LAND USE GROUP - Facilitators: Steve Koehn, MD Forest Service & Mike Foreman, VA Department of Forestry

2:00 *BREAK*

2:30 *PLENARY SESSION #5 : PANEL DISCUSSION-*
"Riparian Forest Buffers: Future Directions"

PANEL MEMBERS:
Caren Glotfelty, Pennsylvania Department of Environmental Resources
Royden Powell, Maryland Department of Agriculture,
Dave Welsch, USDA Forest Service, State and Private Forestry Program
Nick Carter, Maryland Department of Natural Resources

Moderator: Bill Matuszeski, Director, Chesapeake Bay Program

4:00 *ADJOURN*

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RIPARIAN FORESTS -- ENVIRONMENT ON THE EDGE

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AMERICAN FORESTS
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The Chesapeake Bay and its future are intricately tied to the land use and management of the entire watershed, and the entire region. Nowhere, however, is it more critical to manage land correctly than in that intimate edge where water meets land. Here, in the riparian zone, more than anywhere else, people can make an enormous difference -- either positive or negative.

So I commend the Chesapeake Bay Program, and the Alliance for the Chesapeake Bay, for sponsoring this conference on riparian forests. It is a subject of enormous importance, and I am impressed with the talent you have assembled to consider it.

In thinking about the challenge of managing riparian forests, it seems logical to start with a viewpoint about the nature of forests themselves, and the interactions between people, time and events that have resulted in the forests of the Chesapeake region.

In thinking about people and forests, it seems clear that we have gone through several periods in the past which, while they hold many common elements, can be described as signficantly different in many ways. Understanding these periods, which I will call eras, may be essential to understanding the current challenges we face, and in developing sound strategies to adddress them.

The forests of the Chesapeake, as is true around the world, evolved in association with human cultures. For 10,000 years or so, native American cultures and forests evolved together. Records from early explorers, along with the scientific evidence being amassed by a variety of historical analysis techniques, suggest both that the forests were subject to fairly significant changes and that many native cultures managed them quite intensively.

With fire as a primary management tool, native Americans cleared land for agriculture, kept the area around villages open so that enemies could not sneak up unseen, affected wildlife grazing patterns by keeping meadows open and affecting the quality of forage, and drove game for more effective hunting. The resulting forests were open in the understory, favoring large, fire-resistant tree species, and containing large openings, sometimes called "deserts" in the early journals. The myth of the forest primevial, dense and dark and unaffected by humans, reaching from the Atlantic to the Mississippi seems to be more an invention of creative writers and artists than an environmental fact.

To characterize this as an "era" of the ever-changing relationship between humans and forests oversimplifies much diversity in cultures over time and space, but it has the advantage of grounding our discussion in the full history of forest management in the region. The central organizing principle of native forest management was subsistence; the major scientific discipline would today be called ecology; the major tool was fire; the major crops were

firewood and building wood, wild game for food, and a wide variety of other food, medicinal, and useful plant and animal products. When fields, forests, or other sources of subsistence wore down, entire villages would move to new territory and clear new village sites and fields from the forest. A fairly lightly-populated society lived in, and significantly affected, Chesapeake forests, fields, and waters.

The arrival of Europeans changed all this, of course. Unfamiliar diseases wiped out many native settlements, in some cases decades before European settlement arrived, and the forest, unmanaged, grew into a jungle in many areas. Europeans wanted to replicate the towns, farms, and fixed property boundaries of their ancestors as they settled this new land. Forests were an impediment to agriculture and transportation, but provided a seemingly-endless storehouse of the wood needed to build and fuel a new civilization. Thus began the pioneer era of forest-human interaction. Its central organizing principle was development; its main scientific discipline was engineering; its tools were machines powered largely by water, wood, humanpower, and draft animals; its major forest crops were logs for building and fuel and wildlife for food. Forests literally vanished as the frontier moved west; as in many regions virtually the entire forest was either harvested or burned, or both. All of this was accomplished with only rudimentary roads; the transportation system relied heavily on water, with flumes, canals, and river drives being common features. Railroads, often built right in the stream bottoms, penetrated deeply into some forested regions to provide the means of extracting logs.

Only toward the end of the 19th Century did the excesses of the pioneer era stir people to establish a conservation movement, typified by the American Forestry Association and the National Park System in the late 1800's, and the National Forest System and Forest Service in the early 1900's. The spectre of a "timber famine" drove much of that early movement, which sought to import scientific forest management principles from Europe, educate more Americans in the basic notion of conservation, and assure that all wood products harvested were effectively utilized instead of wasted.

The constant improvement of machines, as well as fear of a "timber famine," ushered in the third era of human-forest interaction -- the industrial era. Although it started earlier, one major turning point for this era was World War II. With an enormous appetite for industrial materials accompanied by a huge leap in the production of large earthmovers, trucks, and other machinery, the war signalled a major change in how people viewed and used their forests. Productivity became the central organizing principle -- not just extraction of timber, but its sustained yield. That meant investments in forest management, and new forms of cost-return accounting. Economics became a major scientific underpinning in forest management, with managers searching for the "economic maturity" of a stand of timber in anticipation of its harvest and replacement.

Achieving high productivity in the industrial era meant controlling most variables, and focusing management attention on the most valuable commercial species in the forest. One of the natural outcomes was clearcutting, with its success at converting the forest to the most

productive species of trees, along with an intensive search for the chemical and other means that would exclude competing plants, as well as pestiferous bugs and other organisms. A major beacon here was agriculture, which seemed to be doing an increasingly good job of controlling and simplifying systems and increasing output on annual crops. A goal of many foresters was to emulate that success.

With bigger and more efficient machines, as well as an ever-improving highway-based transportation network in rural areas, the importance of roads grew apace during the industrial era. Big earthmovers built roads into previously-impenetrable places, and a network of road access reached, in many areas, into virtually every forest stand. Not just forest harvest, but forest protection and management depended on access, and access demanded roads.

While timber became the sole forest crop of industrial managers, the public increasingly looked to the forest as a recreational resource, and public demands for fish and wildlife, scenic resources, and "wild" places began to increasingly conflict with industrial goals. This became particularly polarized on the federal lands, and conflicts escalated. An environmental movement, intent at first on pressing the industrial foresters to modify their ways and give more priority to forest values other than timber, grew increasingly frustrated and militant, until recent years have seen them focus almost entirely upon keeping forest management out of sensitive areas and, increasingly, out of all public lands.

Out of this history of constantly changing public values and evolving technolgy, it is clear that today we are moving into a new era. This "New Era" is not just about forestry -- it is about how we, as a society, view our forests, and how we conceptualize our relationship to them. While it is somewhat presumptuous to say with certainty what this new era will involve, some aspects seem to be fairly clear. First of all, the central organizing principle will be sustainability -- sustainability of a wide variety of forest values including, but not at all limited to, timber. Since we now characterize the forest as being an important part of a larger ecosystem, management will focus on how well a particular forest fulfills its role within the greater landscape. That creates the need for enormous amounts of data -- far more than any human can process at one time. Thus, the science base for the new era will be information management -- computers, if you will, and all manner of geographic information systems and other data analysis methods to help us understand what we know and use it to make good decisions. The ability to process far larger amounts of data than at any time in the past will, in turn, lead to the gathering of additional data, in ways such as aerial surveys, satellites, and other technical wizardry.

The tools of the new era, in addition to computers, will be an increasingly-sophisticated array of equipment designed to work in the forest with a minimum of permanent environmental impact. Low-impact machines will move gently through forests, removing selected trees without damaging others, and without damaging fragile soils or aquifers. Helicopters and other types of aircraft will remove logs, and low-flying drone aircraft will provide low-cost environmental monitoring, all with virtually no direct impact on the land.

In addition, some old techniques and understandings -- many abandoned for decades -- will return. Prescribed fire will re-introduce fire into those systems that cannot be maintained without it. Plants that provided food and healing to native Americans will be rediscovered, and valued.

But, lest we get lost in theory and nostalgia, let us jolt ourselves into reality by realizing that this era of forest management must find a way to maintain the forests we need and want in association with a human population that is perhaps 100 times larger than in the pre-settlement era. The best we can bring, in terms of lessons from the past and technologies from the future, will be put to a test never before attempted. This will call for our very best science, our very best technology, our very best management. But under all this, it will demand, in our democratic society, a realistic and reasonably commonly-held public vision of what our forests can and should do in today's world. That, it seems to me, is our most significant challenge.

Let me share some ideas with you that I feel we need to debate, refine, and infuse into public consciousness.

First and foremost, if we can decide on what we want the forests of the Chesapeake to do for us, we'll have to manage them to get that result. Whether you talk about riparian forests or upland forests, urban forests or rural forests, young forests or old forests, none of them got where they are today without 10,000 years of human interaction, and none will proceed in any but a random, chaotic way in the future where we leave them untended. Where we can decide what we want, we'll have to work to get it.

Second, we'll have to be careful of how our human institutions have created distinctions that don't help us conceptualize or manage ecosystems. People have historically viewed water as a boundary, marking the edge of our area. Rivers and bays form state boundaries, town boundaries, land ownership boundaries. The riparian area is often the outside edge of these operating and management units. It may also be the boundary in most people's minds, as they think of areawide problems and solutions.

But water bodies form the center, not the edge, of ecosystems and landscapes. To truly consider an ecosystem, we will have to consider entire watersheds, and this may mean finding ways to merge some of our current human boundaries into new combinations for planning and management. To truly consider a riparian forest, we will have to start with the water and consider the land use all the way to the top of the watershed, in order to make the riparian edge functionally integrated with the whole.

Thirdly, we will have to truly understand the term "adaptive management." Ecosystem management must be adaptive management. But this has some elements that may differ from what many people expect. First of all, it means that all management is, essentially, an experiment. We make a change in the ecosystem, based on a theory about how that action will affect the system, then we watch to see if the system responds in the way

we intended. This demands feedback information from monitoring. That feedback must then be fed into our models to make them more accurate for the future. When we set out to change a forest, we need to know what is there, and what is done. Then, we need to measure the results. Future management options, and the models upon which they are based, become better-informed with the information from each succeeding action. For the citizen watching forest plans discussed today, what that means is that, if there is not a solid plan (and budget) for post-action monitoring, the plan is not truly an ecosystem management design.

What adaptive management also means, however, is that surprises or failures are a normal part of the exercise. If we learn from our failures, they can be some of our most important efforts. This is a critical distinction. In the "control" model of industrial forestry, when the ecosystem responded in a surprising or unforseen way, this was called a failure. Professionals or agencies were criticized for failing; thus, there was a large incentive to hide surprising or unintended outcomes. In the adaptive management model of the new era, surprises or unintended outcomes enrich our data bases and inform future managers, often in a more useful fashion than a normally-expected result might have.

Fourthly, we need to recognize that, even with the best monitoring we can design and afford, we may have ecological changes that we can't foresee in time to forestall or prevent. It seems almost axiomatic that environmental trends tend to be slow and difficult to measure, while ecosystem responses seem to be episodic and often quite significant. In other words, while the levels of environmental pollution may rise slowly and give little indication of any cause-effect relationship on the ecosystem, suddenly the system will go through a major change. Our problem may be thresholds, which we do not understand and can't see coming. If that is true, and we only see the adverse effects some time after the threshold has been exceeded, it makes it very tough to make timely corrections. Our best hope here is to improve our data and modeling of large ecosystems like the Chesapeake, and hope that, when major changes occur, such as happened to the fisheries in recent years, we can reconstruct enough of the situation to better understand what caused us to break over that threshold, and what the best options are to try to reverse the situation.

Fifth, adaptive management means that you actually do things in the forest, on the land, and in the ecosystem. I have heard proposals today that seem to propose a form of "adaptive non-management," in that they propose that we do nothing and see what happens, then do nothing in response. That, it seems to me, is tantamount to watching traffic jams and counting accidents, in hope that somehow, fate will unscramble the mess somewhere along the way. Nature designs forests, including riparian forests, by accident. Some people believe that the outcome of those accidents, without human intervention, will somehow emerge as the most environmentally sound and effective solution. I do not share that view. I believe that, instead, you will simply get what you get.

Finally, we need to recognize that a major portion of the riparian forests of the Chesapeake in the 21st Century will be urban forests. By that, I mean that the forest

ecosystem of which they are an integral part will contain major human-constructed elements such as roads, bridges, houses, and other aspects of the developed environment. We need to assess those urban forests ecologically with the same rigor that we evaluate all forests, and we need to create planning and management tools that are effective in properly managing them for both their urban and riparian values.

But this is going to take an enormous amount of public education and understanding to achieve, and this may be where the Alliance can perform a great service. Would people today tend to favor the selective removal of some trees from a riparian forest zone in order to get the type of species mix, understory growth, and other character that science indicates would be best for that particular riparian zone? Can we use emerging science to inform public debate in the region so that we can agree on the best way to achieve the riparian forest function that both the land and water need? Or would some scientists and the public instead favor a total ban on forest management in that zone, prefering whatever tangle of vegetation might emerge over any sense of determined goals? Are we still captive of the "natural balance" ecological myth, or have we accepted modern ecology's lessons? Are we willing to submit our scientific conclusions to the rough-and-tumble of political debate, so that a public consensus can emerge?

Where the historic forest developed under a regular fire regime, are the residents of an area, and the air quality agencies, ready to allow land managers to institute a prescribed fire regime? If they don't, do you have any idea how you are going to get back a forest that resembles the historic condition? What options are we prepared to offer a citizenry that is deathly afraid of fire, conditioned by 50 years of Bambi and Smokey Bear?

I do not, as I am sure many of you do not, know the answers to all these questions today. Perhaps many of you feel these are not the right questions to ask. Many of you may be skeptical about the "new era" of human-forest interaction that I have posed. Some may think that the old industrial ways were just fine, and that any talk of "new ways" is premature. Others may be convinced that all forestry is still mired in the 1970's, and that the talk of new ways of conceptualizing forest ecosystems, doing adaptive management, and achieving sustainable forestry is just a smokescreen for the same old ideas and methods.

But I'm hopeful that there's a growing cadre of concerned conservationists -- both lay citizens and environmental professionals -- who are ready to lay those old stereotypes and mythologies aside, and come together to design a new vision for forestry in the 21st century. As they do, they could not find a better place to begin than in the critical riparian forests of the Chesapeake. And they could scarcely find a better venue for discussion, searching, and reaching for consensus than the Alliance for the Chesapeake Bay, , and this conference. I truly wish you the very best in that effort.

Ecology of Forested Streams in the Chesapeake Bay Watershed

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The presence or absence of trees on land adjacent to stream channels significantly affects the structure and function of stream systems draining into the Chesapeake Bay. Small forested tributaries are about 2½ wider than deforested streams and have more benthic surface area in the form of inorganic (sand, gravel cobble) and organic (tree roots, leaf litter, wood, etc.) substrates as habitat for aquatic plants and animals. Streamside forests affect food quality and quantity for macroinvertebrates and fish directly through inputs of particular food (leaf litter, soils, wood, etc.) and indirectly by affecting the structure and productivity of the microbial (algae, bacteria) food web through shading and modifying the levels of dissolved organic carbon and nutrients. Deforestation eliminates shading and can result in a 2-5°C warming of small streams which greatly affects important life history characteristics of the resident macroinvertebrates and fish (e.g. growth rate, survivorship, adult size and fecundity, timing of reproduction). The importance of streamside forests to steam recovery and restoration was described and a spatial protocol for planting streamside forests as buffers for mitigating non-point source pollution was reviewed. It was concluded that restoration of streamside forests can and should plan a critical role in restoring water and habitat quality to the tributaries feeding the Chesapeake Bay.

The Ecological Value of Shoreline Forests Along the Chesapeake Bay

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The importance of, and links between, riparian vegetation and aquatic habitat characteristics are well appreciated for freshwater ecosystems. Recent work in the Chesapeake Bay indicates that shoreline forests along tidal reaches also have important influences on nearshore shallow water habitats. As for freshwater ecosystem, trees at the aquatic-terrestrial ecotone are a source of coarse woody debris (CWD) which provides structural complexity in the nearshore aquatic habitat. Controlled and replicated field experiments have demonstrated greater abundance and diversity of fish and crustaceans at CWD compared to sites lacking debris. Further experiment have revealed that one ecologically important role of CWD in estuarine habitats is as a refuge from predation for small species and juveniles of larger species. Deforestation of shorelines during urban, suburban and agricultural development removes the source of CWD, and thus reduces the physical complexity of nearshore aquatic habitats. Although historic and continuing human activities have greatly decreased the amount of CWD in estuarine habitats, several lines of evidence indicate an important role over evolutionary time scales. The importance of CWD for shallow water fauna in the Chesapeake Bay may have increased in recent decades, due to the decline of submersed aquatic vegetation in many upper and mid-bay tributaries.

"Water Quality Function of Riparian First Buffers"

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Riparian (streamside) forests are known to reduce delivery of nonpoint source pollution to streams and lakes in many types of watersheds. In addition, riparian forests are known to be important in controlling the physical and chemical environment of streams and in providing detritus and woody debris for streams and near-shore areas of water bodies. Riparian forest were the original native vegetation in most streamside areas of the Chesapeake Bay Watershed.

Research conducted in naturally occurring riparian forests and experimental and on-farm grass filters has been used by the U.S. Department of Agriculture to develop a general "Riparian Forest Buffer System specification" for controlling nonpoint source pollution from agriculture and improving general water quality. The specification calls for a three zone buffer system, with each zone having specific purposes but also having interactions with the adjacent zones to provide the overall RFBS function. Zone 1 of the RFBS is an area of permanent forest vegetation immediately adjacent to the stream channel and encompassing at least the entire streams channel system. Zone 2 is an area of managed forest, upslope from Zone 1. Zone 2 is managed for control of pollutants in subsurface flow and surface runoff through biological and chemical transformations, storage in woody vegetation, infiltration and sediment deposition. Zone 3 is a grass or other herbaceous filter strips upslope form Zone 2. Zone 3 is managed to provide spreading of concentrated flow into sheet flow and to remove sediment and sediment associated pollutants.

The most general function of Riparian Forest Buffer Systems is to provide control of the stream environment. These functions include modifying stream temperature and controlling fight quantity and quality; enhancing habitat diversity; modifying channel morphology; and enhancing food webs and species richness. All of these factors are important to the ecological health of a stream and are best provided by a RFBS which includes a Zone 1 that approximates the original native vegetation. These functions occur along smaller streams regardless of physiographic region. These functions are most important on smaller streams, although they are important for bank and near-shore habitat on larger streams and the shoreline of the Bay. RFBS contribute to bank stability and thus minimize sediment loading due to instreams bank erosion. Depending on bank stability and soil conditions in Zone 1, management of Zone 2 for long-term rotations may be necessary for sustainability of stream environment function of Zone1.

The next most general function of RFBS is control of sediment and sediment-borne pollutants carried in surface runoff. Properly managed RFBS should provide a high level of control of sediment and sediment borne chemicals regardless of physiographic region. Natural riparian forest studies indicate that forests are particularly effective in filtering fine sediments and promoting co-deposition of sediment as water infiltrates. The slope of the RFBS is the main factor limiting the effectiveness of the sediment removal function. In all physiographic settings it is important to convert concentrated flow to sheet flow in order to optimize RFBS function. Conversion to sheet flow and deposition of coarse sediment which could damage young vegetation

are the primary functions of Zone 3 - the grass vegetated filter strip.

The next most general function of RFBS is to convert nitrate in shallow groundwater moving towards streams. When groundwater moves in short, shallow flow paths, such as in the Inner Coastal Plain (primarily the westerns shore), 90% of the nitrate input may be removed. In contrast, nitrate removal may be minimal in areas where water moves to regional groundwater such as in Piedmont and Valley and Ridge areas with marble or limestone bedrock, respectively. In these and some OUter Coastal Plain regions, high nitrate groundwater may emerge in stream channels and bypass most of the RFBS. In the areas where this occurs or where high nitrate water moves out in seepage faces, deeply rooted tress in Zone 1 or in seepage areas will be essential. The degree to which nitrate (or other groundwater pollutants) will be removed in the RFBS depends on the proportion of groundwater moving in or near the biologically active root zone on the residence time of the groundwater in these biologically active areas.

The least general function of the RFBS appears to be control of dissolved phosphorous in surface runoff or shallow groundwater. Control of sediment-born P is generally effective. In certain situations, dissolved P can contribute a substantial amount of total P load. Most of the soluble P is bioavailable, so the potential impact of dissolved P on aquatic ecosystems is greater. It appears that natural riparian forests have very low net dissolved P retention. In managing for increased P retention, effective fine sediment control should be coupled with use of vegetation which can increase P uptake into plant tissue.

Research on functions of natural, restored and enhanced RFBS is needed in all portions of the Chesapeake Bay Watershed. Research should be directed into four general areas: 1) assessment of existing riparian forests relative to the RFBS standard; 2) assessment of potential RFBS restoration for NPS pollution control; 3) assessment of NPS pollution control in pilot restoration and enhancement projects; 4) determine the effects of management factors on both pollution control and control of the stream environment. The research, because of the need to do relatively large scale projects which last for substantial periods of time, should be coordinated with demonstration/restoration/enhancement projects. Some of the major research questions should address the uncertainty associated with the functions discussed above. Research should be directed toward testing the hypotheses concerning which functions of RFBS occur in specific physiographic settings and the specific management conditions under which these functions are likely to be enhanced. In particular, research on the time to recovery of RFBS functions and the processes which control the various functions should be integrated into demonstration projects.

The Human Dimension of Riparian Conservation

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Purpose

To provide you with an understanding of landowners that will enable you to more effectively persuade people to establish and maintain riparian forest buffers.

Agenda

I. Landowner Decision-Making: Reasons landowners adopt or reject conservation practices and management systems

- Unable but Willing
- Unable and Unwilling
- Able and Willing
- Able but Unwilling

II. Attributes of Conservation Practices Which are Fundamental to Improving the Rate of Adoption:

- Relative Advantage
- Complexity
- Compatibility
- Trialability
- Observability of Results

III. Phases in the Adoption Process

1. Awareness
2. Interest
3. Evaluation
4. Trial
5. Adoption

IV. A Plan of Action for Implementing Riparian Forestry Programs

Persuasive Communication

- win landowner trust
- know your product
- keep your skin thick
- given them a smile and a handshake
- talk the landowner's talk
- trot out your testimonials
- never overpromise or underdeliver
- update your tool kit

Principles of Marketing

- Target groups;
- Identify group's needs, problems and concerns
- Meet needs and solve problems

Planning for Urban Forest Buffers in the Developing Landscape

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Benefits of Stream Buffers

Buffers allow streams to move laterally over time and should be a prerequisite for future stream restoration projects. They reduce watershed imperviousness and small drainage complaints. Buffers are the most effective flood control insurance and provide sites for stormwater detention ponds. They allow for forest conservation reforestation sties and serve as foundations for greenway systems. Lastly, buffers minimize the creation of new fish barriers and discourage storm drain enclosures.

A Suggested Stream Buffer Model:

Each buffer should have three zones including an inner (streamside), middle (floodplain) and outer (setback) zone. The width, vegetative target and allowable use within each zone should be different. The width of the middle zone can expand to include the following; 100 yr floodplain; steep slopes (4 ft per 1% increase in slope), any adjacent wetlands or critical habitats; and extra width for third order or higher streams. The stream should be defined in terms that can be clearly delineated in the field and on a mapping unit. The developer should be compensated with extra density outside the buffer, if the buffer consumes too much land. The number and kind of buffer crossings must be clearly defined. A stream buffer is one element of the total BMP system for the site. Lastly, the buffer must be mapped, posted and managed.

The Three-Stage Buffer Model

There are five techniques that maintain the integrity of buffers in the Planning Stage. Buffer limits need to be present on all clearing/grading and erosion control plans. The bugger boundaries need to be recorded on official maps. The acceptable/unacceptable buffer uses need to be established. Lastly incentives should be provided to owners to protect buffers through conservation easements rather than deed restrictions.

There ware four ways that the integrity of stream buffers is maintained during the Construction Stage. Define the limit of disturbance (LOD) for buffers by preconstruction stakeout. Set the LOD based on the drip line of the forested buffer. Conduct preconstruction meetings to familiarize contractors with the LOD and buffer limits. Lastly, mark the LOD with silt fence barrier, signs and other methods to exclude construction equipment and stockpiling.

To maintain the integrity of stream buffer systems during the post development stage four actions must be performed. Mark buffer boundaries with permanent signs describing allowable uses. Educate property owner and homeowner associations regularly. Conduct annual bufferwalks to inspect the buffer network. Lastly, reforest buffer areas that are grassed or in turf.

Buffers and Urban StormWater

Pollutant removal is the most frequently cited justification for urban stream buffers. However, there is little evidence that buffers actually remove urban pollutants in stormwater. Most sites will require a structural BMP for long term pollutant removal however, not all BMPs are always compatible with stream buffer objectives or forest targets.

Wildlife Corridors in the Suburban Environment

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The creation of wildlife corridors has been frequently cited as a rationale or potential benefit of the creation of stream buffers and greenways in Maryland. Citizen groups and others opposed to development near streams have attempted to use the corridor theory as a rationale to relocate or limit the scope of new construction. There have been numerous popular and semi-scientific publications and discussions regarding the necessity of buffers in maintaining biological diversity. Many of these dissertations have not been subject to peer review or make broad generalizations which do not apply to suburban ecosystems. For example, the Forestry Workgroup (FWG) of the Chesapeake Bay Program states that one of the physical and biological functions of buffers in the region is, "as connectors between isolated blocks of habitat" (FWG 1993). However, there is no reference to terrestrial vertebrate species which may benefit by this connection. This treatise is designed to provide factual information of the value of wildlife corridors in the suburban environment which can be used to help in land use and management decisions.

Definition and Theoretical Value

Wildlife corridors can be defined as, "a linear landscape feature that facilitates the biologically effective transport of animals between larger patches of habitat dedicated to conservation functions" (Soule 1991). It is important to note that emphasis on transport or movement. The fundamental value of corridors is to facilitate the movement of individuals (Forman 1983, Harris 1988, Lines and Harris 1989). This is because corridors are linear and lack the habitat quality of the patches they connect (Keller et al. 1993).

Forest corridors can provide valuable habitat for a wide variety of species and they can function as specialized habitats (Rodiek 1991). This is because their linear nature and frequent association with streams creates large areas of edge. Diversity and richness in terrestrial vertebrates is frequently higher in edge areas than in surrounding patches (Hunter 1990).

However, corridors in Maryland are typically created between two forest patches or "islands". Their biological objective should be to increase the likelihood that a given species will persist in the islands they connect and in the region (Soule 1991). In my opinion, species for which forest corridors may provide a vital component in sustaining future populations in suburban Maryland should meet the following criteria:

1. They must depend on large forest patches for survival during some portion of their life cycle.
2. Their population densities are naturally slow such that,"...they must receive immigrants if they are to survive in isolated patches" (Soule 1991).
3. They cannot move from forest patch to forest patch without an interconnecting forest strip.

Conservation Species

Management of corridors throughout North America has focused on large carnivores and on rare, threatened or endangered species. There are no large carnivores in suburban Maryland. Most of the rare terrestrial vertebrate species in Maryland which are forest dependent are nongame birds (Maryland Natural Heritage Program). It has been well document that these forest interior birds require large forest areas to successfully breed (Robbins, et al 1989) and their populations are frequently very low. However, most of these species are neotropical migrants and

are capable of extended periods of flight. Hunter (1990) states, "it is hard to image that migratory bird species would require corridors to find a suitable patch in which to settle". Robbins et al. (1993) found that riparian forest corridors must be at least 100m wide, "to provide some nesting habitat for area sensitive birds". He recommends a focus on preserving large tracts of woodlands (3,000 ha or greater) as critical to conservation of woodland dependent species.

In my experience, there are relatively few species which meet the criteria stated above in suburban Maryland. I believe wild turkey (Melagris gallopavo), ruffed grouse (Bonasa umbellus) and several species of reptiles (box turtles (Terrapene carolina) , copperheads (Agkistrodon contortrix), etc.) may benefit from corridors and may possibly avoid local extirpation if the corridors function only as movement corridors for these species. However, my observation and the scientific literature are replete with examples of corridors in distributed landscapes which may cause more harm to rare species than no corridors at all.

For example, Adams and Dove (1989) provide an excellent review of scientific studies conducted on the effectiveness of corridors in the urban environment. They state, "During the course of the present study, we found little empirical evidence documenting the use and value of interconnecting corridors among habitat reserves (islands)". The use of corridors by nontarget species may be more detrimental to the conservation of large forest patches than no corridors. Simberloff and Cox (1987) describe corridors as too expensive and too likely to allow disease, exotic organisms and predators to spread into forest patches. Corridors in the suburban landscape frequently are surrounded by commercial, residential and industrial developments. These habitats often hold significant populations of species which are potential predators on forest dwellers (cowbirds (Molothrus alter), raccoons (Procyon lotor), domestic cats (Felis catus), etc.). Corridors can be a vector for plant species such as Norway maple (Ace platanoides) which can cause the slow deterioration of the vegetation structure and diversity of an entire forest ecosystem (Pais, Personal Observation). Interspecific competition for forest resources with more ubiquitous species which use corridors may pose a treat to woodland species conservation. For example, white-tailed deer (Odocoileus virginianus) have been widely observed using corridors in Maryland and have been considered, "an insidious treat to neotropical migrants" (Gates and Giffen 1991) because of their grazing on forest understory plants needed for nesting and cover.

Probable Values of Wildlife Corridors

Wildlife corridors in the suburban environment can function to create scenery, recreation, pollution abatement and land value enhancement (Noss 1987). They can also provide a critical educational link for human with wildlife in suburban settings (Adams and Dove 1989). I believe the value of corridors to forest dependent wildlife is very questionable and, in fact, corridors may be detrimental. The determination of whether wildlife corridors are worth the time and resources extended by government agencies and private developers should only be made by certified professional biologists.

Note: The management of lands typically reserved as corridors for habitat of specific species in decline may have merit. A recent study of Breeding Bird Surveys have concluded that over the past 26 years, "woodland species have fared reasonably well with higher proportions of increasing species than grassland or shrubland birds (Peterjohn and Sauer 1994)". Lynch and Whigham (1984) found that, "Dissection of the landscape into small highly isolated patches of forest adversely effects some bird species, but structural and floristic characteristics of the forest are more important than patch size and isolation for many species... in Maryland". I believe that creating the proper vegetation species composition and structure can limit the effects of harmful edge species on the forest interior and create a habitat for early successional species in decline. This approach requires a long term commitment to management by property owners of the corridor and property owners in the surrounding area. I have observed this commitment to a limited degree through creation of Urban Wildlife Sanctuaries as marketing and educational tools for new communities. Expanding this concept may be the best way to insure continues species richness and diversity in suburbia.

Ecosystem Based Assistance for Farmers: Integrating Riparian Forest Buffers in Conservation Plans

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Riparian forest buffers serve many important functions in any ecosystem, and certainly those functions are vital for the Chesapeake Bay watershed. Restoring and managing riparian forest buffers can be done, but to do so will require the development of sound policies, use of effective information and education activities, and initiation of both technical assistance and financial incentives. Foremost in this effort must be the actions of private landowners, for they ultimately control the land adjacent to waterbodies and wetlands. Without the acceptance of those private landowners to restore and properly manage riparian areas, our most noble goals will not be met.

This presentation reviews how we can involve private landowners in the decisionmaking process through effective resource conservation planning. While the Natural Resource Conservation Service [NRCS] (formerly the Soil Conservation Service) primarily works with farmers and rural land owners, the concepts presented have application in urban and suburban area, too.

This presentation covers 3 primary topics:
1] ***Ecosystem based assistance*** as a way to assist land users and decisionmakers to develop their plans for sustaining, managing, protecting, and enhancing all natural resources -- including riparian areas -- while considering human needs and socio-economic concerns.

2] The ***Natural Resource Conservation Service's Planning Process*** as a dynamic and effective procedure that enables land users and decisionmakers to develop and implement viable and meaningful resource conservation plans.

3] How ***riparian forest buffers can [and should] be readily integrated*** into conservation plans as a part of a comprehensive resource management system.

ECOSYSTEM BASED ASSISTANCE

Most land planners and natural resource managers, in the public and private sectors, are now looking at all natural resources as land management plans and programs are being developed. But that hasn't always been the case. Many plans and programs have been oriented towards only one resource or resource concern. To overcome the limitations of addressing only one natural resource at a time, the concept of **ecosystem management** is being used. Ecosystem management has many definitions, but generally it involves the consideration of all natural resources -- the soil, water, air, plant, and animal resources -- along with the human needs and other socio-economic considerations. Within NRCS, we use the term **ecosystem based assistance** because we do not directly manage the resources but we provided assistance to others who manage the resources.

The goal of NRCS' ecosystem based assistance is to assist land users and decisionmakers develop resource management plans that serve as the primary document for describing the sustained use, management, and protection of the soil, water, air, plant, and animal resources. But its not just total resource management. The human factor is also involved. Human concerns such as economics, social issues, and cultural resource aspects are taken into consideration. Objectives of the land user and decisionmaker are an important part of the process.

Ecosystem based assistance is intended to provide technical assistance to natural resource users and decisionmakers. Ecosystem based planning provides the foundation to sound resource use and management. By involving the land users and decisionmakers in the process they will understand the principles of resource management, and will be more receptive and effective at managing the resources. When we establish a goal for our ecosystem, the ultimate success towards reaching that goal will be dependent on the actions of those individuals, groups, and units of government that have decisionmaking authority. We therefore must keep everyone involved in the process every step along the way towards establishing the programs and policies for the ecosystem.

NRCS PLANNING PROCESS

NRCS and other cooperating partners have developed and used an effective planning process that has been tried and proven for many years (over 30 years !). This process fits the needs for ecosystem management. When put to use, this process results in viable and meaningful plans for managing, protecting, and restoring natural resources.

The planning process is both effective and logical in its concept. It provides a mechanism to equip land users and decisionmakers to carry out sound resource management decisions based on knowledge of principles acquired during their participation in the process. All resource concerns or requirements can be integrated into a single management document that precludes the need for several plans to meet individual environmental, resource, and program requirements.

The NRCS planning process has several steps and should be done in order. No step should be omitted. The steps are:

Pre-Planning -- All activities leading up to resource planning with a client are in this phase. This normally begins in one of two ways: the potential client seeks assistance from the planner or the planner seeks the potential client. Explaining the planning process and the expected benefits of a plan are usually discussed at this time. Both the client and the planner has certain roles and requirements that must be understood. The client must devote time to develop the plan and to assemble related data about the planning situation, define the planning area, and commit to receiving the assistance and to being an active participant. The planner must order and prepare work maps of the planning area and surrounding areas, initiate a case file for the plan and client, assemble natural resource data, and commit to providing assistance in a cooperative manner, recognizing the planner is adviser and the client is the decisionmaker.

Identify Problems and Opportunities -- Identify resource problems in the planning area and associated problems of interrelated ecosystems. Identify conditions that are impairing or degrading the natural resources and identify the opportunities to enhance the resources. Problems and opportunities guide the remainder of the planning process. As planning progresses and additional information is developed, other problems and opportunities are usually recognized. All problems and opportunities do not have to be identified initially for the planning process to proceed.

Determine Objectives -- Develop an understanding with the client of the desired conditions for the planning area as compared to the existing conditions. This includes the desired resource uses, resource problem reductions and corrections, and onsite and offsite environmental protection. Plan objectives are based on the needs and values of the client and interested publics regarding the use, treatment, and management of the resources. Planners should use this time to help the client think more broadly about the problems and opportunities for resource protection and enhancement, whether that be for restoring riparian forest buffers, enhancing wildlife habitat, or other important ecosystem concerns.

Inventory Resources -- Collect data and information about the planning area's resources, including socio-economic conditions. This information is used to define the problems and opportunities and to formulate alternatives. Information concerning the natural resources and the land management is gathered from published reports, from other agencies, and from the client. A complete inventory provides a benchmark for measuring the effects and impacts of the planned actions.

Analyze Resources -- Study the resource and socio-economic data to clearly define the resource conditions, including limitations to their use and potentials. Benchmark conditions are determined. The process provides the information needed to formulate and evaluate alternatives. The analyses should clearly establish the cause and effect relationships among resources and the ecosystem that provide information about existing and future conditions.

Formulate Alternatives -- Develop alternatives to achieve the objectives of the client and interested public by solving resource problems and taking advantage of opportunities to improve the resource base. All reasonable alternatives should be considered, including those that will prevent a problem from occurring as well as those that address an existing problem. Measures that mitigate potential adverse impacts should also be included as appropriate. The client must participate in the forming of alternatives to allow more practical alternative formulation and improves the chances of successful implementation of the plan.

Evaluate Alternatives -- Evaluate the alternatives to determine their effect in addressing the objectives, problems, and opportunities. This step includes an evaluation of the potential effects on social, cultural resource, economic, and environmental concerns. This evaluation provides the client with the information needed to make firm and meaningful decisions. This provides the client further opportunity to be involved in the planning process and maximized the likelihood of full implementation of resource management systems.

Make Decisions -- Make decisions to determine which alternative(s) to implement. The step involves comparing the alternatives and selecting one for implementation. The client is the decisionmaker. Then prepare the necessary documentation [the plan] of the decision. Well documented and understood decisions are a prerequisite to application of the plan. When the planner has effectively taught ecosystem and conservation principles, the client may be able to implement the plan without further technical assistance.

Implement Plan -- Implement the selected alternative as it was recorded in the plan. This includes technical assistance for installing conservation management practices and systems, and obtaining needed permits, land rights, surveys, designs, and other items. It also includes the operation and maintenance needed to assure proper functioning after the initial installation is completed.

Evaluate Plan -- Evaluate the effectiveness of the implemented plan. Often this step is forgotten by the planner, but not by the client who has to live with the implemented system. This evaluation is done to:

> assure the plan is functioning as planned and meets the objectives;
> identify maintenance needs;
> identify need for modifications, additions, and revisions to the plan;
> identify reasons for lack of progress in plan implementation; and,
> encouragement the client to continue to operate and maintain the applied systems.

RIPARIAN FOREST BUFFER: AN EXAMPLE

Lets look at an example of how to integrate riparian forest buffers in a farm conservation plan.

Pre-planning -- Assume that a dairy farmer has requested a farm conservation plan.

Identify Problems and Opportunities -- The farmer indicates he has streambank erosion problems, surface water problems (sediment), pasture management problems. A review of the planning area indicates that cattle have direct access to a stream, including areas where the stream flows through a grass pasture and a wooded area.

Determine Objectives -- The farmer's objectives are to improve animal health, improve milk production, stop streambank erosion.

Inventory and Analysis of Resources -- Inventory of resources includes soils information, identification of various water pollution causes (sediment, nutrients, bacteria), identification of spring in pasture.

Formulate Alternatives -- Several alternatives are prepared:
#1 -- Improve pasture grazing system; exclude cattle from wooded area;
#2 -- Improve pasture grazing system; exclude cattle from most of wooded area, especially adjacent to stream; spring develop and watering trough; exclude cattle from stream; and,
#3 -- Improve pasture grazing system; exclude cattle from all of wooded area; spring develop and watering trough; exclude cattle from stream and plant riparian forest buffer.

Evaluate Alternatives --
#1 -- Pasture improvement helps increase milk production; livestock exclusion from woods helps reduce streambank erosion; streambank erosion still exists in pasture; access to stream doesn't help improve animal health; animals no longer have shade.
#2 -- Pasture improvement helps increase milk production; livestock exclusion from woods and stream helps reduce streambank erosion; no access to stream and clean spring water helps improve animal health; some shade provided in woods.
#3 -- Pasture improvement helps increase milk production; livestock exclusion from woods and stream helps reduce streambank erosion; no access to stream and clean spring water helps improve animal health; no shade provided in woods; riparian forest buffer enhances water quality, increases wildlife habitat.

Make Decisions -- The farmer chooses Alternative #3. He is not happy that he has no shade for the dairy cattle, and requests further alternatives for that new objective.

Implement Plan -- The farmer implements the plan after it was revised to allow for livestock use to limited portions of woods only during high heat/humidity days in July, August.

Evaluate Plan -- Planner and client agree to evaluate the plan at least once each year for next 3 years.

Forest Buffers vs. Streamside Management Areas

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BACKGROUND

At a 1978 national conference on Floodplain Wetlands and Other Riparian Ecosystems, many agencies made commitments to improving riparian protection and management programs. Since that time the Conservation Reserve Program set up the Filter Strip practice for agriculture, the Coastal Zone Act established the Streamside Management Area Management Measure for silviculture, and research has documented the effectiveness of riparian forest buffers for agriculture. A certain amount of chaos in terms and specifications has resulted.

The issue is not so much one practice vs. another as it is to apply an appropriate practice in the appropriate location based on land use, legal requirements, landowner preference and practice design while taking the natural variability of conditions along a stream into account.

Riparian areas support a variety of human uses and include a range of physical conditions. It is also important to realize that the varying conditions along a stream mean practices and specifications will change from place to place.

SORTING IT OUT

1. Viewing riparian management as a system rather than as a practice.

This is the concept of the Soil Conservation Service Resource Management System approach. Resource Management System are developed for specific land uses. They are a grouping of practices and specifications designed to address an overall goal.

These practices are ecosystem based, landuse specific measures, which meet landowner goals and protect public values are desired.

Land uses:

Forest land - Streamside Management Area
Cropland - Forest Buffers and Grass Filter Strips
Pasture land - Forest Buffers and Stream Access Control
Urban - Storm Water Management and Flood Ways

The Streamside Management Area term is used for the shoreland area where adaptive forest management practices ar applied to existing forest lands because of water.

Forest Buffer in this paper means establishing or maintaining a riparian forest and porus forest soils between land cleared for agriculture and a stream (Welsch 1991).

2. Three scenarios for riparian trees:

- Establishing Forest Buffers to restore riparian ecosystems
- Managing an existing forest to maintain the riparian ecosystem
- Retaining forested areas during development to retain riparian functions.

3. Forested stream corridors

Forested stream corridors are an important component of achieving and sustaining the biological integrity goals of water quality legislation. While intensive forestry activities anyplace on a watershed may affect water quality, silvicultural activities near water are the most critical. The following are examples of Streamside Management Area policies:

Streamside Management Area Position Statement
National Association of State Foresters:

"NASF believes guidelines for streamside management should be flexible, reflecting stream variability, yet adequate to protect water quality and quantity as well as stream channel integrity. Activities that occur within a streamside cone should take into consideration statutory requirements, water quality objectives and landowner management objectives and options."

Streamside Management Areas
Coastal Zone Act Management Measure Guidelines

"Establish and maintain a streamside management area along surface waters, which is sufficiently wide and which includes a sufficient number of canopy species to buffer against detrimental change in water temperature regime of water body, to provide bank stability, and to withstand wind damage. Manage the SMA in such a way as to protect against soil disturbance in the SMA and delivery to the stream of sediments and nutrients generated by forestry activities, including harvesting. Manage the SMA canopy species to provide a sustainable source of large woody debris needed for instreams channel structure and aquatic species habitat.

Riparian Area Management
USDA Forest Service Policy

2. "Mange riparian ares under principles of multiple-use and sustained yield, while emphasizing protection and improvement of soil, water, vegetation and fish and wildlife resources. Give preferential consideration to riparian dependent resources when conflict among land use activities occur."

4. SMAs perform four basic function:

- Retain sufficient shade to protect temperature sensitive streams
- Retain the rough forest floor to infiltrate runoff from roads
- Provide large woody debris for aquatic habitat and channel stability
- Provide habitat for riparian dependent species

5. State in the Bay Watershed have adopted the following BMPs for SMAs:

NY	Riparian Buffer Protection practice is a 100 to 150 feet on slopes over 30%.
PA	Forest Filter Strip of 25 to 165 feet on 70% slopes. Allows for partial cutting.
WV	Forest Filter Strip of 25 to 200 feet on 70% slopes. Allows for partial cutting.

MD Streamside management Zone of 50 to 250 feet on slopes over 41%. Allows for partial cutting

VA Streamside management Zone 66 to 200 feet on slopes over 45%. Partial cutting is allowed.

6. Research basis of Streamside Management Area practice

Forest Filter Strip Practice.

Developed by FS research at Hubbard Brook, NH (Trimble 1957). Intensively studied by Packer (1966) and Swift (1987). Forest floor roughness, side slope steepness and distance between roads and channels are three key factors for keeping erosion out of streams.

Retaining Canopy Shade on Streams.

Green (1950) documented forest streams were 10 degrees cooler in the summer than streams in the mountains of NC. EPA's 1980 Silvicultural procedural handbook addressed temperature control on small streams.

Flood Velocities.

Arcement (1989) documented the relationship between the number of woody stems and flood velocity. Increasing the number of woody stems increases flood plain roughness (Mannings N) and slow velocity.

Sediment Deposition.

Aust (1991) documented a net increase in sediment deposition where harvesting increased the number of woody stems.

Channel Stability

Beschta (1986) reported the value of trees in providing the woody debris which stabilizes small headwater streams.

Substrate for Aquatic Life.

Benke (1985) documented the importance of snags as substrate in Georgia Coastal Plain streams. Snags comprised 4% of the habitat surface, but provided 60% of the biomass for 4 major fish species

NO WEAK LINKS IN THE SYSTEM

Streams are linear features which cross jurisdictions and ownerships. A coordinated approach across boundaries is needed.

Stream segments are affected by upstream sources of pollution and downstream channel changes.

A critical mass of "good" practices is needed to make a measurable difference. It is easier for a few problems to impair the system than for a few good spots to correct it.

Meeting the water quality goal of biological integrity will require a coordinated system of practices.

Biolgical Integrity is the Sum of Many Parts.

Designing Streamside Management Zones in Forest Management

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Historical evidence suggests that stream habitats and riparian areas in the Southeast, like those in other parts of the country, were structurally more complex than at present. Much of the land over which many Appalachian streams flow has been used for a variety of purposes including timber production, livestock grazing and other agricultural activities, mining and recreation. Many streams still exhibit the effects of past land and water use practices such as splash damming stream "improvement" for transportation of logs, and erosion associated with roads and the removal of streamside vegetation.

Riparian areas have become focal points for many conflicting interests. Interest in riparian areas is increasing because of their influence on floodplain hydrology, streamflow, water quality, fisheries, wildlife, recreation and the value of timber and other products. As major components of landscapes, riparian areas do not conform to patterns of ownership or jurisdiction. Coordination among all upstream, downstream, instream and near-stream users is vital to protect, manage or enhance riparian areas. Under the paradigm of ecosystem management, impacts and influences on entire ecosystems are addressed and natural processes are highly valued. Riparian issues must now by considered on multiple spatial scales and resource planning must incorporate best management practices to address the concern of diverse publics.

Researchers at Virginia Tech are developing processes to unify the knowledge available in the literature and from resource professionals for merging diverse user values, legal mandates and biological criteria into long-term management goals. Fundamental to the applicability of this process is a clear understanding of "desired future conditions". Natural resource managers and professionals are increasingly asked to consider all user groups, not just the traditional consumptive users such as timer industry, hunters and anglers, when developing management goals and research agendas. A process that accounts for the value and uses of key riparian tree species to all user groups would assist in meeting these goals. Managers should than be able to make decisions regarding riparian zones based on long-term objectives that include designated or allowable uses, costs and compatibly with surrounding landscapes. Benefits include syntheses of information necessary to provide a range of "desired future conditions" in southern Appalachian riparian zones and enhanced understanding of the ability of management to influence the composition and structure of riparian areas. Needs for specific research also will be identified. Armed with this knowledge and an appreciation for the benefits of interdisciplinary management, future generations of managers will be better able to meet the increasing demands for traditional and potential new uses of riparian ecosystems.

Integrating Timber Harvest Planning in the Riparian Area with Forest Stewardship

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The Forest Stewardship Program is a multi-agency land management effort to enhance the quality of forest management activities on private land. This program provides private landowners with technical assistance in the management of their natural resources, including fish and wildlife habitat, soil and water, recreation and wood products. Any landowner or manager with 20 acres or more may qualify for Forest Stewardship.

Historically, landowners and managers contacted natural resource agencies when they believed a timber harvest was an appropriate management consideration at that point in time. Often, a timber sale was already planned or being conducted, thus eliminating the possibility for the adequate planning of a streamside buffer or riparian area. The Forest Stewardship Program offers a unique opportunity to foster initial contacts into well-planned timber harvest with suitable riparian buffers.

In the context of the Stewardship Program, there are three actions that landowners or managers can perform to ensure the riparian area is protected. First, locate your riparian areas on your Forest Stewardship Plan by requesting this information through your forester or by locating these areas yourself. Second, locate these areas on the ground utilizing a visible marking system. Specifically labelled flagging, for example, can be used to identify these areas. If trees are to be harvested from the riparian buffer area, mark those individual trees. Also, put the stipulation in your harvest contract to minimize disturbance in the buffer area. Finally, evaluate the health of your riparian area. What is the upstream land use? Are my stream banks eroding? Does my stream contain beneficial large, woody debris? If these questions do not lead you to conclude that your riparian area is healthy, consider a restoration or enhancement project. In Virginia, the Forest Stewardship Program provides opportunities for restoring riparian area through cost-share benefits and plan preparation.

The last chance to protect water quality lies in the area closest to the water. Take care of what we are managing by using programs like Forest Stewardship or consider restoring it if not present. To integrate timber harvesting and riparian area management takes careful purposeful planning. The restoration of the Chesapeake Bay depends, at least in part, in our efforts in the woods.

Chesapeake Bay Riparian Forests: Their Role in Filtering Agricultural Drainage

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The Atlantic Coastal Plain of North America was almost entirely forested prior to European settlement in the 17th century. The settlers soon cleared the forest, but along small streams and in the rather hilly inner Coastal Plain it was often not worth the effort to clear the riparian areas. Thus, a landscape developed in which the uplands were farmed and the lowland riparian zones were left as relict deciduous hardwood forest. These forests were usually logged but otherwise left unmanaged.

We have studied nutrient dynamics in three Coastal Plain riparian forests. All receive both overland storm flows and shallow groundwater discharges from uplands managed for rowcrop production. These sites are on small headwaters streams. Although the soil surface in these forests is seldom covered with standing water, the groundwater table is near the surface, except during extended drought. The oxidation/reduction potential of the soils beneath the water table is normally quite low. Conceptually, it is important to remember that all of the water in a headwater stream had to traverse the riparian zone before entering the channel, while for larger streams only the lateral flows interact with the floodplain except during large storms.

At these three sites we have extensive data and a number of technical publications have resulted. We have tracked both overland storm flows and shallow groundwater from the farm fields through the riparian zones. We have found that most of the nitrate in the agricultural runoff, both on the surface and in the groundwater is removed before it gets to the stream channels. In addition much of the acidity is neutralized, and in some setting most of the suspended soil particles are also removed. Since most of the phosphorus and much of the ammonium and organic nitrogen moves as eroded soil particles, these are removed when soil particles are trapped in the riparian zone. This nutrient and sediment removal is almost equally effective in all seasons of the year. Similar results have been reported at other Coastal Plain sites in North Carolina and Georgia. All of these sites have confining impermeable clay layers near the soil surface, so that all groundwater percolating from these fields is forced to pass through the root zone of the forest.

Only 18% of the area of the Chesapeake Bay watershed is in the Coastal Plain. In the Piedmont and Appalachian parts of the watershed the groundwater pathways are quite different. In many types of setting in these regions groundwater moves at greater depths and may only come near the surface as it is discharged directly into stream channels. In these settings riparian forests still have high values by providing excellent habitat for both stream and terrestrial biota, and they still play a beneficial role in processing overland storm flows, but these forests are less likely to remove nutrients from groundwater efficiently. Riparian forests along streams underlaid with limestone bedrock in the valleys of the Ridge and Valley region are among the least likely to provide groundwater quality benefits. Riparian forests in much of the Piedmont and some parts of the Appalachians collect groundwater that flows only 20 to 50 feet below the surface in a zone of fractured rock above fairly impermeable bedrock. As this groundwater approaches the stream channels this layer of fractured rock usually thins and this gives riparian forests in those settings an intermediate likelihood to remove nutrients.

USING THE NATURAL ECOSYSTEM AS A GUIDE: CONSIDERATIONS FOR PLANNING

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Streamside forests are the dominant riparian ecosystems in the northeastern United States. Typified by distinctive vegetation, soils and hydrology, riparian ecosystems may vary greatly in structure and composition among sites within the region. The plant community in particular is the most variable component of northeastern riparian ecosystems. Understanding the range of variation in riparian plant community composition, and the factors that affect the structure of riparian plant communities, are key to planning successful riparian conservation and restoration programs. Natural riparian ecosystems can serve as baseline models to guide restoration efforts in degraded systems, as a source of locally adapted biota for restoration projects, and as centers of biodiversity for conservation projects in riverine landscapes.

But what is a "natural" riparian ecosystem? Quantifying the composition and variation of riparian plant communities is central to characterizing the natural state of riparian ecosystems within a region. In streamside forests, plant communities are generally organized into three distinct strata: 1) a canopy stratum consisting of small and large trees; 2) a shrub stratum composed of shrubs and tree saplings; and 3) a ground stratum consisting of herbaceous plants and woody plant seedlings. Composition of the plant community, particularly the importance of flood-adapted riparian species, will vary greatly with stream order. In small headwater systems where seasonal flooding impacts are less severe, the riparian plant community usually consists of woody plants typical of the surrounding forest matrix and a mixed ground layer of mesic forest herbs and riparian or wetland herbs. In larger riverine systems, the riparian plant community is dominated by both flood-adapted woody plants and herbs. Thus, the importance of "true" riparian plant species generally increases with increasing stream order for both woody and herbaceous plants.

Natural riparian vegetation also varies with stream valley geomorphology. Common geomorphic surfaces within a stream valley in the northeastern United States include the: 1) active floodplain; 2) inactive floodplain; 3) terrace; 4) toeslope; and 5) valley slope. In the geomorphic gradient from active floodplain to valley slope, substrates change from alluvial to upland soils and the intensity and extent of flood disturbance decreases. Riparian plant species, particularly herbs, track both soil and disturbance gradients and are generally most prevalent in the frequently flooded, alluvium-dominated soils of floodplain and lower terrace geomorphic surfaces.

The final major factor that influences the composition of natural riparian plant communities is site history, particularly human land use impacts. In many areas in the eastern United States, riparian ecosystems have been extensively altered or destroyed outright by pollution, poor farming practices and urbanization, among other factors. The degree and duration of human impacts to riparian ecosystems greatly influences the composition of the plant community. In heavily impacted riparian systems, plant species diversity is often greatly depressed from natural levels, dominance is shifted to a few stress-tolerant species and alien plant species assume greater importance in the community. In riparian ecosystems that have endured some human impacts in the past, the degree and speed of recovery of the plant community depends on the extent and intensity of the disturbance and the length of time since the disturbance occurred. When choosing a riparian ecosystem as a potential model for restoration, some knowledge of past and present site history is essential for evaluating the "naturalness" of the system and thus, the appropriateness of the potential model.

Allegheny National Forest (ANF) and Clarion University of Pennsylvania (CUP) have recently entered into a research partnership focusing on characterizing the major structural and taxonomic components of natural headwater riparian ecosystems in the 500,000 acre ANF. ANF lies within the nonglaciated Allegheny Plateau Physiographic Province of northwestern Pennsylvania. The region is heavily forested and the predominant land uses include timber harvest and gas and oil extraction. Upland plant communities, particularly plateau forests, have been extensively studied from both basic and applied standpoints, but the composition of riparian plant communities of the nonglaciated Allegheny Plateau is poorly known.

Information on riparian ecosystem structure generated by the cooperative ANF/CUP project will be used to improve the resolution of ANF's GIS-based ecological land types map and in the development of a comprehensive riparian management plan for ANF. We have employed both intensive and extensive field sampling techniques to characterize headwater riparian ecosystems. Seven intensive riparian study sites were selected along a geomorphic gradient ranging from an intermittent stream system to a broad, forested floodplain system. Permanent monitoring plots were established at each intensive site to track ecological changes on a long term basis. Baseline data collected from permanent plots at each site included: composition of the plant community, presence and decay condition of course woody debris, age and density of the forest canopy, soil types and stream valley geomorphology. Extensive sampling, involving the rapid assessment of riparian vegetation, soils and geomorphic surfaces, was conducted along seven additional headwater riparian systems in ANF. The goal of extensive sampling was to determine the degree of variation present in headwater riparian ecosystem structure and to provide a validation of vegetation types predicted by analysis of intensive study sites. Although we are in the early stages of analysis of the riparian project data, some benefits are already obvious. Perhaps the most important is the recognition that riparian ecosystems support the greatest diversity of plant species of virtually any terrestrial plant community in ANF.

Transforming Science into Policy: How Are Buffer Widths Established

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There exists a broad, comprehensive compilation of scientific literature that is applicable to the development and implementation of forestry related non-point source pollution abatement techniques, known as best management practices (BMPs). Forested buffer strips, more commonly referred to in the forest literature as "streamside management zones" (SMZs) are an essential part of any forestry BMP program designed to remove the amount of runoff and sedimentation resulting from silviculture activities.

A streamside management zone is a sensitive zone immediate to the intermittent streams, continuous flowing streams and lakes where specific precautions during forestry activities are needed to protect water quality. The ability for a SMZ to prove itself effective in non-point source water pollution abatement is directly tied to how wide it is. The establishment of effective buffer strip widths is a topic of considerable debate within the forestry community. Simple logic would cause one to arrive at the conclusion that the wider the buffer strip under the auspices of *ceterus paribus*, the better the sediment control, and this is in fact true. It is in the context of practical forestry where the debate originates. It is at this point where the economic costs of leaving buffer strips are weighed against the effectiveness in controlling sediment produced by forestry operations. In fact, this economic feasibility criterion is the central decision-making hurdle that must be negotiated in *any* sort of environmental protection policy.

How wide must an SMZ be before it is considered wide enough to adequately protect water courses from silvicultural non-point source pollution? Why is the minimum recommended SMZ width for Tennessee 25 feet and 50 feet in Maryland? Are Tennessee and Maryland so different geographically and silviculturally that these difference in minimum recommended SMZs are caused by these dissimilarities, or does something other than science-based attributes affect the decisions involved in establishing minimum SMZ widths?

This paper will look at the scientific, economic, political and social considerations policy-makers must explore when establishing environmental protection policies, specifically minimum SMZ widths. We will try to shed some light on how the political policy process converts science into science-based policies. In short, we will attempt to explore how a state such as Alabama arrives at a given minimum width, in this case 35 feet, for a SMZ. Is the science on which the policy was based consistent in its findings? Was science utilized at all or is it that these types of decisions are purely political in nature? Is the SMZ width of a given state arbitrarily set with no real rationale for doing so, or is it "keep with the Jones" -- in essence copying what other state have done? Could it be that establishing minimum effective SMZ widths is a combination of all of these in some way? The contemplation of these questions will be the central focus of this presentation.

Designing an Effective Forest Buffer

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An effective riparian forest buffer must have a close physical connection with the surface and groundwater of the adjacent stream system. Many riparian woodlands have lost their buffering capacity because of changes in hydrology and accelerated rates of erosion and sedimentation.

Channelization, water withdrawals, increases in storm flows and reduced base flows due to development are a few of the factors that can affect stream and groundwater hydrology. Unfortunately most storm water management (SWM) designs generally do not compensate for the cumulative impacts of multiple SWM facility discharges within a stream system. Road crossings, curbs and gutters and other "drainage improvements" will short circuit the infiltration capacity of riparian zones and help to lower near stream groundwater levels. Reductions in groundwater levels can alter forest species composition and reduce nutrient uptake rates.

Erosion of stream banks and beds is another problem that will reduce the functional value of a riparian forest buffer. Forested stream system have evolved to accommodate certain levels of erosion and sediment transport. Many of the land use changes mentioned above can also cause accelerated erosion problems that will disrupt the biological processing of organic material within the stream and forest. Unlimited livestock access to stream banks is another source for erosion and sediment loadings that will cause problems that extend beyond the pasture area.

Once a stream channel has become incised and unstable it can set off a chain reaction of channel adjustments that will increase forest and stream habitat degradation far downstream. From a geologic perspective the erosion rates and channel adjustments may appear inconsequential but the biological and water quality impacts can be significant to both the local and downstream environments.

In order to design or maintain an effective riparian forest buffer it is important to assess the physical conditions of the stream corridor. A multi-disciplinary team assessment of the watershed can provide a broader understanding of problems and potential management alternatives. The EPA Rapid Bioassessment Protocol (RBP) for habitat assessment is a particularly efficient way to characterize the structural integrity of the biological community. The Rosgen stream classification system is another important tool for determining channel stability and for designing ecologically sound stream stabilization projects. These methods have been used in several watersheds in Maryland in order to improve or protect the ecological value of riparian forest buffers.

PLANNING FOREST BUFFERS WITH WILDLIFE IN MIND

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Wildlife corridors can be defined generally as linear strips of habitat that allow movement of individuals among larger habitat patches. Corridors can be established at many scales, ranging from regional levels in which fairly contiguous habitat may extend across multiple state lines, to the scale of a single hedgerow or riparian buffer strip within a local landscape. The conservation value of wildlife corridors has been thoroughly debated. Proposed advantages of corridors all concern the enhancement of movement between isolated habitat patches for animals that would be otherwise impeded from crossing through unsuitable areas (e.g., agricultural fields, highways, urbanization). Corridors may promote gene flow among disjunct populations, provide migration pathways, or enhance natal dispersal of young individuals. Disadvantages of corridors may include providing a barrier to movement of species that use a different type of habitat, enhancement of the spreading of fire or disease, and an increase in the numbers of exotic "weedy" species, or of detrimental species such as predators. Additionally, because of the negative edge effects associated with the high edge-to-interior ratio, corridors could become "ecological traps" for species usually associated with habitat interiors through lowered reproductive success.

Establishment of riparian buffers for enhancement of water and soil quality along watercourses also may provide benefits to wildlife if they serve as suitable habitat corridors. However, the potential utility of these buffers as corridors for different wildlife species will depend on the extent to which those species use the corridors for movement versus for reproduction. Unfortunately, very little is known currently about the use of corridors by wildlife. The few studies that have examined the issue have focused on birds and mammals. Results of those studies indicate that riparian buffers in areas such as the western U.S. or Australia, where the surrounding landscape often is largely denuded, can harbor large numbers of species. However, it is unclear whether these corridors are acting as a conduit for animals to move between suitable areas, or whether the buffers simply are the only (albeit low quality) habitat available. Two studies conducted in the Chesapeake Bay watershed have examined use of forest corridors by songbirds. One study (Keller et al. 1993, *Wetlands* 13:137-144) examined use of riparian buffers of different widths by breeding birds. Those authors recommended a minimum buffer width of 100 m to attract breeding Neotropical migratory birds, as many of those species were not present in narrower buffers. Yet, past research has indicated that, even if a species of songbird is present, reproductive success of that species may be lower in narrow strips compared to larger habitat patches. Thus, riparian buffers may not provide high quality breeding habitat for many songbird species.

Another study conducted in 1992-94 by D. Petit, L. Petit, and J. Lynch of the Smithsonian Institution indicated that forest corridors, including riparian buffers, may be very important for songbirds during migration. In that study, more species of migratory songbirds were found in large (>500 ha) than in small (<100 ha) forest tracts, whether or not the tracts were connected to

other forests by corridors. However, small tracts that were connected to other forests by an intervening corridor supported significantly more species than did isolated small tracts. The presence of a corridor apparently increased the use of small forest tracts by migrating birds, possibly by serving as a conduit from other habitat patches. Further studies are needed to determine appropriate corridor widths to enhance use by migrating birds.

The few studies on wildlife use of corridors have suggested that corridors may be beneficial for movement of individuals during some periods, but may not provide high quality breeding habitats. Before designing riparian buffers to enhance their value for wildlife populations, land managers should consider the following key issues: (1) Which wildlife species are of greatest conservation priority in the region?, (2) How important would the corridor be (as compared to other patches or reserves) as habitat for those priority species within the region?, and (3) Can the buffer be enhanced enough to meet the minimum area requirements of target wildlife species? For example, riparian buffers that join with large forest tracts may not need to be designed to provide high quality breeding habitat for songbirds, yet still may provide breeding habitat for some reptiles, amphibians, or invertebrates, and useful connecting habitat for migrating songbirds. On the other hand, in areas where riparian buffers provide most of the woodland habitat available, managers may want to widen the buffers as much as possible (preferably $\geq$100 m) to increase the breeding habitat quality for birds and other interior species. In most cases, vegetation within the riparian buffer should be planted or managed to maintain both a high structural diversity and a high plant species diversity, using native plant species.

Technical Considerations for Selecting and Planting Riparian Trees and Shrubs

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The success of any mitigation planting, reforestation or afforestation effort is determined to a large degree by the decisions made prior to ever placing a plant in the ground. The design of a successful afforestation or reforestation project is primarily dependent on three major factors 1) species and community distribution and range; 2) site analysis including edaphic factors and 3) biological interactions.

Species and community distribution primarily take into consideration the species appropriate for the physiographic region and more specifically the topographic position. Changes in the micro-topography and the moisture regime may occur within a few feet in riparian plantings due to the nature of riverine and wetland systems. Matching the species to edaphic factors including soil type, texture, structure and depth, along with directional orientation and the soil moisture regime on the site, are essential. Species interaction is another major consideration that is often overlooked in planting design. The primary concern of species interaction include crafting the correct species assemblage or association, encouraging mychorhizal colonization in the root zone, guarding against invasive and competing vegetation and assuring the availability of water during the crucial establishment period.

After site analysis, decision can be made regarding the appropriate species, size or grade of the planting material, availability of the desired material, costs and scheduling of the planting. Planting techniques and their implementation are determined by these decisions and the site analysis.

Maintenance and integrity of the planting after installation involves protection from drought, protection from wildlife damage, proper diagnosis of disorders and the guarantee provisions of the design specifications. Commitment to the success of the project should be the responsibility of all parties including the designer, reviewer, installer and client.

Greenways and the Future Management of Riparian Areas

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Future growth in the Washington Metropolitan region present both opportunities and challenges to the preservation of riparian areas. The Northern Virginia Planning District Commission, in conjunction with loc al, regional, state, federal and private organizations has initiated the development of a regional greenways and open space plan that is designed to help address many of the issues associated with growth and the preservation of the region's environmentally sensitive areas.

The development of a regional plan is being pursues as a grassroots, bottom up process where community based organizations and local government plans for preserving riparian areas through the use of greenways and other similar mechanisms (such as Fairfax County's environmental 1 quality corridors) are being aggregated into a common, regionwide format. This planning process allows for the identification of inconsistencies, gaps and opportunities for cooperation among all of the agencies and organizations involved.

The presentation provided an overview of the greenways concept - detailing the elements of a greenway plan, their benefits and the roles and responsibilities of the organizations and agencies responsible for greenway planning and implementation. The discussion also addressed issues such as resolving conflicts between the preservation of riparian areas and the placement of active recreational facilities; how to limit public access to area of sensitivity; and enhancing the riparian effects by corridors through active management. The discussion was accompanied by examples of techniques for riparian preservation, greenway implementation and facility construction through out the Northern Virginia region.

Managing Landowner Options through Forest Stewardship

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Forest Stewardship Program

To improve the management of private forest lands, the Forest Stewardship Program has been developed by the Maryland Department of Natural Resources, Forest Service in cooperation with other natural resource conservation agencies, consulting and industrial foresters and forest advocacy groups. Through the Forest Stewardship Program, comprehensive and inter-disciplinary Resource Conservation Plans are prepared for non-industrial private forest landowners. Cooperating agencies provide technical assistance to private landowners for implementing sound conservation practices designed to meet the landowner's objectives for all their forest resources including water, recreation and wildlife. This State program is part of a nationwide effort initiated by the National Association of State Foresters in cooperation with the USDA Forest Service, State and Private Forestry Program.

Stewardship Incentive Program

The Forest Stewardship Act of 1990 authorizes the cooperative Stewardship Incentive Program (SIP) to stimulate enhanced management of non-industrial private forest lands through cost-sharing of approved practices. The State Forester, in consultation with the State Forest Stewardship Coordinating Committee, has determined cost-share levels, practice priorities and minimum acreage requirements. Technical responsibility for SIP practices will be handled by the Agricultural Stabilization and Conservation Service (ASCS). Cost-sharable practices include: management plan development, tree planting, forest and agroforest improvement, windbreak and hedgegrow establishment; soil and water improvement, wildlife habitat improvement and forest recreation enhancement.

Buffer Incentive Program

The Buffer Incentive Program has been established to encourage the planting and maintenance of forest buffers on private land. Landowners who plant and maintain forested buffers will be eligible for a one-time $500 per acre grant. Land within 300 feet of a waterway, between one and 50 acres, a minimum of 50 feet wide and within 100 year floodplain on H.U.D. maps would meet the eligibility requirements of the program. Landowners must plant at least one acre of eligible land and agree to protect the trees for a minimum of 10 years. After one growing season if the landowner has 65% survival of the planting stock, they will receive a $500 per acre grant.

OTHER COST-SHARE PROGRAMS

FEDERAL

- Forest Incentive Program: This production oriented program was authorized by Congress in 1973 to share the cost of tree plantings with private landowners. The federal share of these costs range up to 65%, depending upon the cost-share rate set by the county Agricultural Stabilization and Conservation Committee.
- Agricultural Conservation Program: This program is intended to provide funding to accomplish

maximum conservation and environmental protection. It provides up to 65% of the costs of establishing as well as agricultural conservation practices such as tree crops and grasses waterways. The ACP Program is administered by the USDA Agricultural Stabilization and Conservation Service (ASCS). Technical assistance is provided by the Soil Conservation Service and the Department of Natural Resource Forest, Park and Wildlife Service.

Conservation Reserve Program: Created by the 1985 Farm Bill, the intent of this program is to take highly eroded acreage out of production for at least 10 years, if not permanently. A 50% cost-share for tree establishment is provided as well as annual rental payments for 10 years while the practice is being maintained. The program is administered by ASCS, technically assisted by SCS and Maryland DNR and complemented by MDA's Maryland Agricultural Cost-Share Program.

STATE

Woodland Incentive Program: The purpose of this cost-share program is to provide non-industrial private woodland owners with financial assistance for tree planting, timber stand improvement and other forest management activities. Those eligible must own 10 to 500 contiguous wooded acres capable of producing 20 cubic feet of wood per acre per year; accept cost-share assistance not to exceed 50% of actual or fixed rate cost, whichever is less; not currently applying for or receiving federal cost-share for the same practice on the same acreage; manage their woodland according to a plan prepared or approved by a Licensed Forester and agree to limit cost-share funds to a maximum of $5,000 each year or $15,000 for a three-year accomplishment. Other conditions include the owner's commitment to at least 15 years of management and allow access to his property for periodic inspections.

TAX ABATEMENT PROGRAMS

FEDERAL

Public Law 96-451: This federal incentive permits up to $10,000 of capitalized reforestation costs each year to be eligible for a 10% investment tax credit (subtracted from taxes owed) and 7-year amortization (subtracted from gross income to compute adjusted gross income).

STATE

Forest Conservation and Management Program: The intent of this program is to preserve forest lands from alternate uses and conserve the resource using the principals of scientific forest management. Landowners having five or more contiguous forested acres who agree to adhere to a resource conservation plan for a minimum of 15 years, sign a contract and receive a tax incentive in the form of frozen assessments (usually at the agricultural rate) on those forested acres for the 15 year period. Participating landowners who plant trees and increase their forest acreage can add those acres to their agreement one year after seedling establishment.

Reforestation/Timber Stand Improvement Tax Deduction (TAXMOD Program): The intent of this program is to protect and enhance our forests as well as create an economic climate conducive to growing trees. Owners or leases of between 10 and 500 acres of "commercial" forest lands (capable of growing 20 cu ft of wood/year) may deduct double their direct costs associated with certified reforestation and timber stand improvement from their federal adjusted gross income for Maryland income tax purposes. Reforestation must result in at least 400 healthy seedlings or sprouts per acre. TSI included thinning by mechanical or chemical means as well as pruning.

Managing Forest Buffers in the Suburban Landscape

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Selectivity in Acquisition

Our program begins with selectively in acquisition. We review each parcel of Open Space which is scheduled to come to us in the dedication of each subdivision. Our analysis focuses on site features/ecosystems with emphasis on environmentally sensitive areas such as steep slopes, wetlands, rivers and streams, flood plains, forests and significant meadows.

Inspection

Each site is inspected prior to dedication to insure that the developer is in compliance with our Conditions of Open Space Land Necessary to Release of Performance Surety. These General Conditions are part of the Developer's Agreement and are a legally binding document. It addresses such things as limits of disturbance, grading and stabilization, marking of property boundaries with surveyor's pins on all land coming to the County, removal of hazards and debris and the removal of any and all encroachments.

Education

Education plays a vital role in our natural resource protection program. We have developed a series of environmental brochures to educate the public on various aspects of natural resource management. At the time of dedication we send a letter and brochures to all residents who abut Open Space to explain what Open Space is and how it is managed. We meet with Home Owners Associations to discuss the same. We have a host of other programs geared at education or such things as our school lectures, slide presentations, interpretive programs and our Stream Monitoring Program

Enhancement

Our enhancement program covers such things as working with scouts, civic and community groups, school, etc. to plant trees, create riparian forest buffers, enhance wildlife habitat areas, etc.

Protection

In the summer of 1992 Howard County Council passed the Parkland, Open Space and Natural Regulations. These regulations are the first post-development environmental regulations in Howard County and are enforced by the Land Management Division Staff. We inspect the Open Space land within the communities and when violations are found, the residents are issued a written warning which gives them ten days to cease the violation and make any necessary restorations to the area. If, in ten days they have not complied, we issue a civil citation with fines ranging from $ 25 to $ 1,000. We have issued over 250 violation warnings which have resulted in the issuances of six civil citations. To date we have gotten 100% compliance. Much of this is due to the excellent support and backing by our Director, the County Executive, the Howard County Council and the Maryland District Courts.

National Perspectives on Riparian Protection and Management

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I always pause when someone asks me to give an"national perspective". Because the real truth of the matter is that the policies and programs I deal with grew out of a collection of experiences in more than 3,000 conservation districts and 156 national forests. At the actual management of any area depends on the natural resources and people at the site.

Our policies and program that help us deal with riparian buffer systems evolved piecemeal, without a common definition of riparian areas or a clearly defined set of data. They evolved from the experiences of people with a strong sense of stewardship and knowledge of how vegetative buffers reduce erosion, absorb nutrients, shade our waterways and provide wildlife habitat.

But ecosystem management demands that we take a broader view. When we take that broader view on riparian zones, we see them as part of the larger watershed. In this context, therefore, riparian zones are key elements of that watershed - key pieces of the jigsaw puzzle - but not an end in themselves. I want to speak at length on ecosystem management a little later.

USDA's experience with riparian areas in the Chesapeake and in other estuarine and river system around the county give us a good idea as to: the utility of our present programs, policies and activities;

new directions we should move toward in the future and how we can better use the tools we have;
the importance of an ecosystem approach and
the importance of partnering.

I'd like to take this time to explore each of these areas with you.

Where are we now?

Our activities in the Chesapeake watershed involve technical and financial assistance of several USDA agencies. Two of the most active are under my jurisdiction — the Forest Service, mainly on public lands, and the Soil Conservation Service, which primarily provides technical assistance on private lands.

We are key players in helping farmers in the Chesapeake watershed deal with agricultural nonpoint source pollution through voluntary programs.

Our toolkit contains: (1) technical assistance, (2) cost-sharing programs, (3) land-retirement tools such as Farm Legacy, Farm of the Future, and the Conservation Reserve Program.

Let me elaborate on some of these.

The Conservation Reserve Program gives landowners an economically viable option for taking highly erodible cropland out of production. Under this program, USDA enters into 10-year contracts in which producers agree to plant permanent cover — grass or trees — on that land. Some 35 million acres of marginal cropland nationwide have been idled under this program.

Because the land was marginal, its production value was minimal. Our 1992 National Resources Inventory shows a reduction in erosion of some 370 million acres annually from CRP lands, with the attendant benefits to receiving waters. And one of the unintended consequences of this program has been a dramatic improvement in wildlife habitat.

A special wetlands tree practice under the CRP has placed some 83,000 acres of

riparian areas in trees and protected the adjacent streams. In the states surrounding the Chesapeake Bay approximately 2,300 CRP acres have been planted to trees. And the total tree planting in the watershed under CRP is 34,200 acres.

The Wetlands Reserve Program is newer than the CRP, but like the CRP, has proven its value. The 1992 NRI showed a dramatic decrease in conversion of wetlands to agricultural uses, and we can thank the WRP for some of these gains.

Another tool at our disposal is our formal working relationships with the governments of the states in the Chesapeake Bay watershed. We originally signed memoranda of understanding with those states in the late eighties.

In February of this year, I renewed our commitment to the nonpoint-source effort in the watershed by signing an MOU with the leaders of our partner agencies and with the governors of the states in the watershed.

The Forest Stewardship Program was instituted in 1990. It was designed to help landowners manage their forest land in a sustainable way.

The Program provides the assistance of a natural resources professional to assist the landowner in writing a plan to meet his or her objectives. The Stewardship Incentives Program provides cost-shares for up to 75 percent of the expense of implementing the practices prescribed in the management plan. The national practices available include: Reforestation, Forest Improvement and Agroforestry; Windbreak Establishment; Soil and Water Protection; Riparian and Wetland Protection and Improvement; Fisheries and Habitat Improvement; Wildlife Habitat Enhancement; and Forest Recreation Enhancement.

To date, the Riparian and Wetland Improvement has resulted in 80,000 feet of streams protected by tree planting within the Chesapeake Bay Watershed.

Where we're headed

Where do we go from here? Well, first of all, the new Congress next January will bring the farm bill debate to the forefront. The new farm bill will decide, among other questions, the question of a permanent, or at least long-term, extension of the CRP. If this happens, we expect to make more effective use of CRP by planting more trees. Targeting specific watersheds will enhance the accomplishments.

The Forest Incentives Program, which was targeted for "sunsetting" in December 1995, may well be enhanced by adding elements of the Forest Stewardship Program to the requirements for cost-sharing. The Forest Stewardship and Stewardship Incentives Programs could receive more attention and more funding. Income tax issues will also be addressed — this seems to be the main concern of landowners.

I expect that riparian areas will receive more attention in the Farm Bill. New tools will be presented to help private landowners with the conservation and enhancement of riparian areas. All USDA agencies will be directed to utilize their authorities to promote the proper use of these riparian areas and discourage their conversion to other uses.

We will be encouraging the multiple benefits management of our agricultural lands.

Land retirements will be reviewed again and the Forest Legacy Program will be available to assist in the preservation of forests in developing areas.

In other words, we'll be working with a much different toolkit — and to my mind a better one. We have more knowledge, and we'll have the flexibility to apply and transfer that knowledge. At the same time, we'll be working from our traditional strengths: A solid base of technical and scientific knowledge and strong working relationships with partners, local and state governments, and landowners.

From our conversations with the Hill, the budget office, our partners, and people on the countryside — and from our own good professional sense — I believe we are headed towards a new look at SCS conservation program design and delivery.

I believe we need to get program control to the state and local level.

We need to simplify our program design, look at the potential for consolidating programs – perhaps one for cost sharing and one for land retirement – to give us greater flexibility in the field and simply to make it easier on our customers.

We need to do this in a way that keeps all the stakeholders involved, enables us to account to the taxpayer, keeps our programs voluntary, and targets the most critical priorities.

But a caveat here, as I talk about the voluntary approach, which is one of our strengths. We do have new responsibilities and we are headed toward accepting a role other than silent partner on the land.

We will be part of the evaluation process. We will be learning how regulation is a part of the toolkit – a backup tool – and how to use it with reason and judgment.

We are headed toward enhancement of our natural resource assessments and inventories, and a major new role for them.

Likewise, we are headed toward continual improvement in terms of low-cost and effective solutions to environmental problems.

And we are headed towards focusing and organizing ourselves around the natural resources themselves, not around political boundaries.

Let me take a moment to focus on this.

We at USDA are key players in ecosystem management. Fundamental ecological science recognizes the complex inter-relationships among the physical and biological components of our environment. Ecosystem management goes beyond that. It also recognizes and embraces the role of people in the environmental scheme of things.

Ecosystem management is one of the principal thrusts of Vice President Gore's "Reinventing Government" recommendations. As ecosystem management concerns USDA, however, keep in mind the fundamental dichotomy between the Forest Service and SCS. The Forest Service, as a manager of public lands, *practices* ecosystem management. SCS, as an advisor to private landowners, *fosters* it. That's why SCS refers to its ecosystem management initiatives as ecosystem-based assistance—to convey more accurately its true role.

In searching for a graphic way to help you understand ecosystem management, I thought of the situation concerning the salmon fisheries in the Pacific Northwest. The fisheries have declined for a host of reasons, each bearing on the next.

We can't restore salmon fisheries without restoring salmon habitat. We can't restore salmon habitat without addressing the various factors affecting it—from agricultural runoff, to urban runoff, to logging runoff, to the dams and other obstructions that impede migration, to overfishing, to Native American fishing rights, and many others.

If we try to isolate one problem and deal with it separately, we face what one might call "the law of unintended consequences" — whatever we do will have a high probability of bringing about events we have not foreseen. We can minimize those unintended consequences by considering problems and solutions in relationship to the whole.

Two words that we have tended to think of as completely separate spheres — "ecology" and "economy" — actually have a common origin. That word is the Greek *oikos,* maining "house." We can't separate these two spheres in language, and we shouldn't try to separate them on the land. Our goal is to help the nation achieve sustainable production of food and fiber indefinitely.

Having the right technology foundation for ecosystem management includes identifying ecosystem health indicators, understanding ecosystem interactions — the physical, chemical, and biological processes — and the social, cultural, and economic factors. It

means understanding what level of precision we need to reasonably assess or appraise conditions, ensuring that all our procedures are science based and widely accepted.

Having the right technology also means packaging the information in easy-to-use formats for our employees and for our customers, many of whom have direct access to our data and our analytical programs. It also means setting measurable goals, monitoring effects and outcomes, and being flexible enough to alter conservation treatments to meet our goals. This essentially means the ability to adapt and respond to natural resource conditions and to customize solutions as never before.

We also want to be able to measure results—to account for the value we've added — and, even more important, to be able base policy on the status and condition of the resource base in a more holistic manner. And we want to know when programs, or policies, or actions need fixing or alteration.

In sum, understanding ecosystems requires understanding their components, the relationships among those components, and the processes that influence those relationships. This understanding requires us to think geo-spatially. Not only do we have to know what's there, but also where it is in relationship to everything else.

We don't have to reforest every tributary to the Bay to reach our goals. But we should maintain forest buffers and respect the economics of the landowner. Encourage plantings, show income.

The theme of the Administration is manage our lands on a ecosystem management basis and not be a threat to private landowner rights. We are expecting to encourage proper management through incentives, on-the-ground technical assistance, and educational activities to promote awareness of the proper use of our natural resources.

Ecosystem management is clearly a concept whose time has come. And it is clearly a concept that can provide multiple benefits as it offers a context in which agriculture can frame the forestry, farming, and ranching of tomorrow and demonstrate its commitment

to sound resource management and land stewardship.

The Federal Government can't do it alone, but must rely on partnerships with state and local agencies as well as the private sector to encourage the maintenance and enhancement of forested riparian areas. We can't force landowners to do the right thing, but we can work with them toward the ends we want to achieve. And if we listen to them as well as tell them — and if we're willing to change our directions when our customers and our common sense tell us we should — we'll have even stronger policies and programs, and a greater chance of making real progress.

There is one other way I would characterize the direction USDA is taking in fulfilling its responsibilities to natural resources and the environment.

Partnering for the future

We are headed toward building a broader constituency. Just look at this group here. You represent a fairly broad cross section of society. This is progress, and we have to take in that next step. We need to build linkages with city people and facilitate on issues that crosscut all sorts of land areas.

Some of our people call this being an "honest broker," meaning that our job is to bring all sides to the table and help them find the common ground that will lead toward working relationships and, ultimately, progress on the land.

Reorganization

We believe that the reorganization that has just passed the Congress will help us do these things. I'd like to close my remarks this morning with a few highlights of that reorganization:

First of all, the SCS will be renamed the Natural Resources Conservation Service

and will assume additional responsibilities. This name change in part validates the directions that SCS has been moving in for years — toward a multi-resource approach to providing assistance to landowners on and off the farm.

Among the new responsibilities for the NRCS will be cost-sharing for several programs, including the Water Bank and the Colorado River Salinity Control Program. These programs are currently under the Agricultural Stabilization and Conservation Service, and we believe the shift will bring more consistency to these and other conservation cost-sharing programs.

NRCS local offices will work more closely than ever with local offices of another new agency, the Consolidated Farm Services Agency, which will pull together the current ASCS, Farmers Home Administration, and Federal Crop Insurance Corporation.

My job is being upgraded from assistant secretary to under secretary. I say this not out of pride, but because it reflects the importance that USDA places on the environment.

In all, USDA will be streamlined and smaller. It will provide better service at less cost. And it will have a strong focus on the environment.

Riparian Protection and Management: Regional and State Approaches

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1. Buffers are used by State nonpoint source programs in many ways, with many objectives, including buffering streams from the effects of nutrients, sediments and pesticides; maintaining shade to prevent elevation of stream temperature; providing shelter for fish; and providing wildlife corridors.

2. At a national level, EPA supports the use of riparian buffers. For example, EPA grants policy supports riparian buffers by providing for States to set aside at least 10% of nonpoint source grant funds ($8 million in 1994) for watershed resource restoration. Much of this is used for instream and near-stream restoration activities. Riparian buffers are a major component of these activities. EPA has also published a summary of state forestry laws and an extensive forestry BMP bibliography that includes much material on streamside management zones' effectiveness.

3. EPA's Regional offices also promote riparian buffers. For example, EPA's Region 10 office, covering the Pacific Northwest region, has a specific policy to incorporate riparian protection into nonpoint source projects that they fund.

4. Many States are increasingly stressing riparian protection in their work. Examples include:

   - Demonstration and evaluation of multi-species riparian buffer strips (Iowa).
   - Streamside management zones in forestry operations (new policies and programs in Montana, several southeastern States, and elsewhere throughout the United States)
   - Riparian stream restoration projects in urbanizing watersheds (Mill Creek, Utah).
   - Riparian wetlands restoration throughout the United States, many of them focusing on restoring and/or protecting areas harmed by grazing.

5. These trends will continue to grow as EPA, other Federal agencies, and the States continue current trends toward looking holistically as watershed, and stressing the physical and biological, as well as the chemical aspects of waterbody health.

The Status of Riparian Forest Policy in the Chesapeake Bay Watershed

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This draft compendium briefly describes the laws and programs that protect or address riparian forests in Maryland, Virginia and Pennsylvania. It is intended as a general guide to the presentation, and thus focuses on riparian forests, rather than the large universe of stream protection efforts. In addition, this guide highlights only the major laws and programs. There are indeed other programs, both public and private, which are notable for their efforts to maintain and restore riparian forests. A broad view of riparian forest laws and programs is presented, illustrating a range of protection efforts, from stream fencing to tree planting and maintenance. Although some of these programs do not have specific forest components, they are worth noting because they provide opportunities for increasing the emphasis on forests in their riparian protection elements.

Riparian forest protection has been divided into five basic areas: Development-related laws, agriculture, forestry, cross-land uses, and tax programs. This will impart to the reader a sense of how many ways riparian forest maintenance and restoration can be applied. It will also convey a sense of how dispersed these approaches are. Clearly, riparian forest policy does not fall into a neat category or a single law. Working towards a more comprehensive policy will require a greater consistency and better coordination among these approaches.

I. DEVELOPMENT

Maryland

Chesapeake Bay Critical Area Act: This act controls development within 1,000 feet of tidal waters, measured from the heads of tide or the landward side of tidal wetlands. A 100-foot mandatory buffer is required for all tidal waters, tidal wetlands and tributary streams in the Critical Area, including both perennial and intermittent streams. Exemptions exist for lots platted before the law was passes and for lots that would otherwise be rendered unbuildable by the law's requirements. For agricultural land, the buffer may be reduced to 25 feet with natural vegetation. It may be reduced further and grass may be permitted if an approved Soil Conservation and Water Quality Plan with Best Management Practices is in place. For silvicultural land, a 50-foot buffer is required.

Forest Conservation Act: This act protects forest cover from development throughout the state by limiting forest clearing for residential and commercial development and by requiring replanting where needed. The Act designates "priority areas" for retainment of forests and replanting, including 50-foot buffer areas around both perennial and intermittent streams. This area must remain undisturbed, unless an applicant has demonstrated to the satisfaction of the state or local authority that reasonable efforts have been made to protect such areas and that plans cannot reasonably be altered.

Nontidal Wetlands Act: A mandatory 25-foot naturally vegetated buffer is required around all nontidal wetlands greater than 5,000 square feet. This provides a forested or naturally vegetated buffer in cases where a wetlands exists within or adjacent to a stream.

Reforestation Act: This is basically a "no-net-loss" scenario for highway construction. The law seeks to minimize forest loss and replace unavoidable losses from highway construction projects, placing the highest priority on forests near or adjacent to streams.

Economic Growth, Resource Protection, and Planning Act: This act does not regulate the riparian area per se, but does encourage such protection as part of each county's requirement to develop a "sensitive areas element" in their comprehensive plans. The Act, however, permits the local governments to define each sensitive area and its level of protection. Among the environmentally sensitive areas that are specifically mentioned in the act as needing protection are streams, stream buffers, and 100-year floodplains.

Local Zoning Ordinances: Forty-two percent of the counties in Maryland have regulations requiring stream buffers of 50 to 100 feet on developed land (exclusive of Critical Areas). The characteristics of the buffer required may vary from simple setbacks to native vegetation.

Virginia

Chesapeake Bay Preservation Act: This act establishes "preservation areas" that comprise between 50% and 60% of Virginia's coastal plain. The so-called "Resource Protection Areas" require a 100-foot buffer around tributary streams. Exemptions allow reduction of the buffer to 50 feet in cases where a lot would otherwise be rendered unbuildable. Exemptions also allow reduction of the buffer to 25 feet for agriculture land if an approved Soil and Water Quality Conservation Plan is in place.

Local Zoning Ordinances: All the tidewater counties have adopted Chesapeake Bay Preservation Act regulations into their local zoning ordinances, which extends riparian buffers to those stream areas not designated as protection areas. In addition, several other counties outside of tidewater Virginia have incorporated Chesapeake Bay Preservation Act regulations into their zoning ordinances to protect sensitive areas.

Pennsylvania

Dams Safety and Encroachments Act: This act regulates development in both wetlands and stream areas by requiring a permit from the Department of Environmental Resources. Although there are no specific buffer requirements, applicants must avoid, minimize, or mitigate impacts to these areas that would degrade water quality.

Federal

National Flood Insurance Program: All three states have counties that participate voluntarily in the National Flood Insurance Program. In Maryland, counties and towns that adopt the state's Model Floodplain Management Ordinance require a 100-foot flood protection setback from streams with floodplains designated on FEMA maps. In Virginia, participating counties curtail development in the floodway. Pennsylvania state law *requires* flood-prone municipalities to

participate in the national program, and adds some technical requirements above federal standards.

II. AGRICULTURE

All Three States

Permanent Vegetative Cover: Cost-share is provided for establishing trees, grasses, and shrubs in order to stabilize soil on eroding areas, including riparian areas.

Grazing Land Protection: Cost-share is provided for spring development, trough, and tanks so as to provide watering sites for livestock away from the stream area.

Stream Protection: Cost-share is provided for establishing permanent vegetative cover, which can include trees, along the banks of streams, as well as related items such as remote watering systems, stream crossings for livestock, and stream fencing.

Maryland

Buffer Incentive Program: One-time payments of $300 per acre are provided for the planting and maintenance of minimum 50-foot forested buffers along streams and shorelines on private land of 5,000 acres or less.

Virginia

Woodland Buffer Filter Area: One-time payments of $100 per acre are provided to establish minimum 50-foot forested buffers along streams. This practice is permitted only on crop and pasture land that has recently been in production.

Loafing Lot Management System: Cost-share is provided for a rotational grazing system. This practice requires a minimum 25-foot fenced buffer around streams. Vegetation is not specified.

Pennsylvania

Streambank Fencing Program: Fencing with 10-foot buffer is provided free to rural landowners by the Pennsylvania Game Commission in exchange for allowing public hunting on their land. The Department of Environmental Resources is currently in the process of setting up a parallel program that omits the hunting requirement.

Pennsylvania

Voluntary Guidelines: There are no mandatory requirements in the riparian zone on private forest land, although a 50-foot buffer is recommended.

Special Protection Streams: Mandatory forested buffers are required for commercial logging operations on state forest lands around streams designated for "special protection" by the Bureau of Water Quality Management. A 200-foot no-cut buffer is required around "exceptional value" streams and a 100-foot no-cut buffer is required around "high quality" streams.

Federal

Forest Stewardship Program: This federally funded program, which is administered by the states, provides technical assistance to private landowners for implementing conservation practices while meeting harvesting needs. Forest Stewardship Plans are required for participation in the federal cost-share programs for forestry (see FIP and SIP below). Funding comes from the U.S. Forest Service.

Forestry Incentive Program (FIP): This program is designed to increase the future supply of timber on private non-industrial (between 10 and 1,000 acres) forest land. Cost-share is provided for tree planting, including in forested wetlands and riparian areas. The program is funded by the Agricultural Stabilization and Conservation Service.

Stewardship Incentive Program (SIP): This program addresses a broad range of ecological enhancements on non-industrial private forest land. Cost-sharing is provided for tree planting, stream fencing, riparian and wetland improvement, tree shelters, and fisheries habitat improvement. The program is funded by the U.S. Forest Service.

IV. CROSS-LAND USES

Maryland

Special Rivers Project: This project fosters forest stewardship and best management practices in both rural and urban watersheds to improve water quality, although its geographic scope is limited to the Susquehanna, Monocacy, and Anacostia river basins. In rural settings, the program establishes Forest Stewardship Plans, riparian forest buffers, and agricultural BMPs. In urban areas, the program works with local planning agencies to implement urban forestry practices.

Greenways Program: This program provides long-term planning assistance to protect public lands and coordinate with federal and local governments and the private sector on a statewide greenways network, of which stream and river valleys are an essential part. The Greenways Program also prepares scenic river plans and assists local governments in developing long-term management strategies through the Scenic and Wild Rivers Program.

Agricultural Use Assessment: This program provides a preferential assessment on the value of land that is used for agriculture. Woodlots can also receive an agricultural assessment. There are no specific requirements for riparian areas.

Virginia

Use-Value Taxation: Counties voluntary participate in this program, which provides preferential assessments on the value of agricultural and forest land consistent with its use. Although popular in urbanizing counties, it can have a negative impact on the tax base in rural counties. There are no specific requirements for riparian areas.

Pennsylvania

Covenant-Preserving Land Uses: This law authorizes a county to enter into covenants with landowners for the preservation of farmland, forest land, water supply land, or open space. The real property tax is reduced to reflect the fair market value of the land with the covenant restrictions. The covenant is good for ten years, and can be extended with the agreement of both parties for one year at a time.

Farmland and Forest Land Assessment Act ("Clean and Green Act"): The county Board of Assessment can grant a preferential assessment for ten or more contiguous acres of land devoted to agricultural, forest reserve, or open space purposes. Land is assessed at the use value rather than the prevailing market value. This can apply to land in the riparian zone as well, although there is no requirement for forests in the riparian zone.

All Three States (Federal)

Public Law 96-451: This program provides federal 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 a 7-year amortization. This can include reforestation efforts in the riparian zone.

Incentives and Disincentives to Forest Buffer Establishment on Agricultural Land

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Incentives to Forest Buffer Establishment

Forest buffers provide many benefits to an ecosystem such as improved water quality and temperature, they create habitat, encourage biodiversity, stabilize streambanks and control pollution. There are two forest buffer cost-share incentive programs, Conservation Reserve Program (CRP) and the Buffer Incentive Program. For these programs to be successful, it is essential that the government agencies win the support of farmers and landowners by convincing them that this is a cooperative program working for the benefit of the environment and their farm operation. According to the MD DNR Forest Inventory there is a maximum of 85,000 acres of cropland in Maryland that could be converted to forest buffers.

Disincentives to Forest Buffer Establishment

Some disincentives to forest buffers are real and some are perceived, however they both hinder forest buffer establishment. One of the biggest disincentives is the loss of income for the landowner. In many cases the most productive land is adjacent to a stream, and shading and competition for water encroach on the field. Another disincentive is the landowner's fear of losing their rights to use that land for farming or development. Landowners are wary that forest buffers will require a great deal of maintenance and perhaps even introduce noxious weed invasion. There is a fear of losing commodity support program "base" acres. In certain localities, when land is taken out of agriculture the landowner might have to pay a real estate tax because the land is considered potentially developable. Landowners fear that threatened and/or endangered species might inhabit their buffer. Another disincentive is that the landowner might encounter bureaucratic hurdles in obtaining cost-share and technical assistance. Some landowners are misinformed on streamside forests, they might believe that they lead to increased flooding, greater streambank erosion and stream blockages. Lastly, the landowner might believe that the forest buffers will carve small fields into unmanageable pieces.

Overcoming Disincentives/Enhancing Incentives:

- Increase cost-share
- Expand mitigation banking
- Reduce paperwork and processing time
- Change definition of "base" in commodity programs
- Extend/refocus CRP
- Cross-train field staff
- Better target buffer locations
- Develop a menu of options
- Expand educational program
- Change real estate taxes

Incentives for Land Management to Enhance and Retain Riparian Forests

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Proper Forest Management Practices offer a very real way to conserve America's estimated 80 million acres of forested wetlands. Forestry provides landowners with a valuable incentive to maintain the overall character of their wetlands. If we are to expect landowners to follow Best Management Practices on their riparian forests, we must also come to the realization that these forest represent a considerable investment to the landowner.

In Virginia, approximately 4% of our timberland is in riparian forests. Following state BMPs means that landowners will recover only 40% of the timber value on each acre of riparian forest. Chesapeake Forest Products Company has left Streamside Management Zones on our forest land for over thirty years. I estimate that we have $7.5 million worth of timber in these SMZ's of which $3 million to $4 million will never be harvested; we own and practice sustainable forestrv on 330.000 acres of woodlands (225,000 acres in Virginia).

Giving up as much as $500 per acre in timber value on 4% of their land can have a devastating financial impact to a private woodlands owner.

We must find a way to compensate landowners for the loss of timber value in SMZ's. I suggest that localities consider tax incentives and/or cost share programs. If only 40% of the timber value is available, why not reduce ad valorem taxes on these acres by 40 to 60%? This is a good place to start.

Implementation: Working Together for Riparian Forests

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There has already been a great deal of discussion at this conference on the details of government programs, particularly incentive programs. John Lipman's "The Status of Riparian Forest Policy in the Chesapeake Bay Watershed" presented earlier, provides a comprehensive look at these programs. Instead of focusing on these same details I will talk about some of the dynamics that impact the effectiveness of these government programs.

As a resource agency, our goal is to protect and restore the Chesapeake Bay, one of the richest and most diverse estuarine systems in the world. To be successful we must positively impact land use decisions that are being made every day. In the rapidly developing Chesapeake Bay Watershed there is an intense competition among land uses for every acre of land. Government for its part has three primary mechanisms through which it can influence land use decisions; 1) Legislation, Regulation and Enforcement, 2) Information and Education and 3) Incentives. Clearly, an astute balance of all three mechanisms is required.

Legislation and Regulation sets up the crucial framework for the programs that follow, but can become cumbersome and inefficient when taken too far. Information and Education are also crucial but tend to be most effective over a relatively long time frame. Incentive Programs on the other hand can begin to have an immediate effect in the specific area for which they are designed.

There is currently an impressive array of government incentives programs available to land owners within the Chesapeake Bay watershed to encourage forests, since they are recognized as the most productive land use. These incentives range from professional management assistance available through state forestry agencies and the newly reorganized Natural Resources Conservation Service, to cost-share programs, tax incentives, conservation easement acceptance programs and other incentives that include direct payments or grants to encourage specific practices.

The U.S. Department of Agriculture's five year old Stewardship Incentive Program is a very effective cost-share program that has provided cost-share assistance to plant forest buffers along miles of streams and rivers in the Bay Watershed. Another federal program is the Conservation Reserve Program that has encouraged farmers, in the Bay Watershed, to take over 30,000 acres of crop land out of production, in favor of planting trees or grass. Maryland has provided $200 to $500 per acre grants directly to landowners for the planting of forest buffers within 300 feet of a stream or wetland. This Buffer Incentive Program (BIP) has encouraged the planting of nearly 800 acres of forest buffers in Maryland over the past five years.

Another extremely effective approach for a rapidly urbanizing state like Maryland are tax incentive programs that allow for a significant reduction in assessed value as long as the landowner follows a resource management plan that includes conservation measures. Special incentives for planting trees such as Maryland's Chesapeake Bay School Reforestation Program and TREEMENDOUS Maryland, as well as federal programs like the Small Business Administrative grants, have helped create outdoor classrooms and effective forest buffers in urban areas.

Currently there is no clear and comprehensive policy in the Chesapeake Bay watershed that encourages riparian forest buffers. This conference has presented overwhelming evidence indicating the crucial role that forests and forested riparian buffers play in enhanced water quality, nutrient reduction and wildlife habitat in both urban and rural settings. Once this fact is accepted by all the cooperative resource agencies, clear policy can be set and resource managers can begin to use the many existing cost-share and incentive programs as tools to have a very favorable impact on this amazing ecosystem.

The Role of A Private Firm in Creating Regulatory Mitigation and Nonpoint Source Pollution Reduction Projects in Support of Local and State Government Agencies in Reaching Local Tributary and Chesapeake Bay Tributary Strategies

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Regulated mitigation of nontidal wetlands and forestry has been limited to a no-win proposition in the past. Our company looked at the required mitigation programs in Maryland and decided that a more positive process was needed. We developed a process that provides a WIN-WIN solution, which preserves and restores riparian buffers and reduces nonpoint source runoff pollution.

The single greatest source of nonpoint source pollution to our tributaries and the Bay comes from rural and agricultural lands. The task of identifying innovative and cost effective tributary strategies is important to the future of local and regional creeks, streams, rivers and the Bay. Tributary planners have been working to identify new and innovative programs and financial resources for tributary strategy implementation. Our firm has developed a cost-effective process that is innovative, time sensitive and that compliments all of the existing Tributary Strategy programs.

Forest and Wetland Conservation Associates, Inc. (FAWCA) is a private firm that works with both public and private developers. The goal of the firm is to turn the mitigation process into a positive outcome for all concerned. Mitigation for forest and wetland losses is important; however mitigation requirements have become time consuming and burdensome and in many cases provides limited environmental benefits. FAWCA specializes in providing turn-key projects that exceed regulatory mitigation requirements, provides additional nonpoint source pollution abatement benefits, are supportive of the State's volunteer program for implementation of agricultural BMPs and saves developers, builders and regulators valuable **time** and **money**.
Our projects also provide greater environmental benefits than traditional mitigation and can assure success by restoring areas that historically were forested wetlands, forested steep slopes and forested Critical Areas.

Our firm has found that when only on-site mitigation is considered and provided, that the mitigation project will often achieve limited environmental benefits, may be contrary to sound land use principals, is very costly, benefits a small watershed area and benefits very few landowners. The FAWCA, Inc. program takes this limited benefit situation and turns it into a **win-win** mitigation project for landowners, for government, for developers and for the environment. In addition, we reduce government's financial and administrative burden and also create a series of significant community environmental benefits.

The FAWCA concept is to provide linear mitigation projects on numerous rural (Farm) properties. The areas used for mitigation are sensitive lands that include stream valleys, steep slopes, prior converted croplands or intensely pastured areas (the most agriculturally productive areas not utilized fro mitigation). The land that is used for mitigation is placed in **permanent conservation** and protected perpetuity by covenants that run with the land.

Our program provides numerous benefits besides cost savings and environmental gains. Though our program, state and local governments will be assisting to concentrate growth in designated growth areas, implement permanent land use control and goals (Greenways), improve wildlife habitat, preserve open space and rural (farm) land and reduce or eliminate nonpoint source loadings from hundreds of acres of land. Therefore, each mitigation project has a multiplier effect that benefits a much larger watershed area and ecosystem in the County and State

The FAWCA, Inc. program provides the following services:

1. We locate offsite forest and wetland mitigation sites in the same County as is the impact and obtain approval from regulatory agencies for the selected mitigation site.
2. We provide mitigation project coordination with regulatory agencies.
3. We provide all mitigation site planning, legal, survey and recordation services.
4. We design and plant the acreage to meet all regulatory agency specifications.
5. We design and install additional agricultural best management practices on the mitigation property as part of the mitigation project, in coordination with the agricultural agencies. FAWCA's goal is to provide Total Resource Management of the mitigation property.
6. We perform long term compliances and spot checks of the mitigation site and submit reports to all regulatory agencies.
7. We replant or replace plantings that fail - FAWCA, Inc. becomes the risk manager for the project.

Our private firm's innovative mitigation program can provide acre for acre mitigation of forest and wetland losses, on rural riparian sensitive lands. As an example, we recently completed a forest and wetland mitigation project on a dairy farm that restored 12 acres of nontidal wetland and forestry on sensitive lands and we installed 10 years of needed BMP practices for a 120 acre dairy farm, all in one year!

Lancaster Stream Work Group

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The Lancaster Stream Work Group was formed in 1993 to promote the protection and restoration of the streams of Lancaster County (Pennsylvania), particularly those flowing through farmland. The work group is comprised of many interests from both the public and the private sectors. The group helps to disseminate information, coordinate programs for landowners, discuss developing technologies and bring government agencies together with private volunteer organizations that are actively working on local streams.

There is a great need for stream protection efforts in the region. Lancaster County's high animal and human populations have exerted tremendous pressure on its streams. Pastures are common where cattle have free access to streams and riparian vegetation is sparse. Non-farm riparian areas have also lost considerable tree cover. Despite its rural atmosphere, Lancaster County lacks the substantial forests that maintain good water quality in many other Pennsylvania counties. The largest river in the county - the Conestoga - carries the highest concentrations of nutrients and sediments of any monitored stream in the Susquehanna River watershed.

The Lancaster Stream Work Group is working to promote better stream management by helping coordinate the many different programs available for landowners who are interested in practices such as stream bank fencing and forest buffers. For example, the group recently completed a flyer describing all the financial assistance programs available in the county for stream bank fencing projects. The group has also initiated a mapping project to record the many stream protection projects completed throughout the country to better gauge progress. Possibly its most important function is to match stream projects with the agency best-equipped to provide assistance.

Another function of the work groups is to bring together the public and private sector more effectively. Streams bring together many interests with a wide variety of goals, such as fisheries management, wildlife habitat, nonpoint source pollution control and soil conservation. There is also a greater potential for volunteer organizations to get involved in stream restoration than in many other environmental programs. The Stream Work Group seeks to support these local efforts. For example, a local fishing club and dairy farmer were interested in fencing a pasture stream and planting trees but had found no assistance that fit their needs. Members of the work group informally arranged for materials and the job was completed. As a follow up activity, the work group will be hosting a public open house this fall to recognize the project.

Public-private partnerships like this will be necessary to address natural resource problems like stream corridor degradation, which would otherwise exhaust the resources of single agencies or organizations. In addition, these partnerships will help develop a broader constituency for stream corridor management, riparian forest buffers and habitat restoration.

A Non-profit Role in Working with Landowners to Protect Riparian Forests

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Non-profit organizations can play a key role in working with landowners to protect riparian forest buffers. Experience of Nature Conservancy offices in Maryland and other states have demonstrated the important role of non-profits in such diverse activities as the direct acquisition of riparian corridors, negotiating voluntary buffer easements or organizing volunteers to plant trees along streams. In Maryland, we have an outstanding example of a successful riparian protection program in our Nassawango Creek Preserve and are just beginning a number of new initiatives whose success will depend on implementing riparian buffer protection programs.

Nassawango Creek

Nassawango Creek is one of the northernmost bald cypress swamps in the country. The creek originates in Wicomico County on Maryland's eastern shore and runs for 15 miles before joining the Pocomoke River near Snow Hill in Worcester County. In addition to bald cypress, the swamp contains Atlantic white cedar, seaside alder, at least 14 species of orchids and some fifty unusual plant and animal species in all. Because of its significance, The Nature Conservancy began a protection program in 1978 which to date has protected over 3,300 acres of swamp and upland buffer in fee ownership.

Sideline Hill Creek

Sideling Hill Creek is a relatively pristine stream in the Ridge and Valley region of Maryland that flows from Pennsylvania through Maryland to the Potomac. The stream and riparian corridor support an abundance of rare plant and animal species including two rare freshwater mussel species, a globally rare plant called the harperella and a variety of state-rare floodplain plants. To protect these resources, TNC has developed a strategic plan for the watershed which calls for the protection of a riparian corridor from Purcell, Pennsylvania to the Potomac River.

Nanticoke River

The Nanticoke River is a lower Eastern Shore river system which runs from lower Delaware to the Chesapeake Bay draining a watershed of over 700,000 acres. The watershed is laced with non-tidal wetlands and contains about one-third of all tidal wetlands in Maryland. The tidal and non-tidal wetlands harbor a host of rare plants and animals, as well as creating habitat for a variety of waterfowl of such significance that the Nanticoke is a focus area under the North American Waterfowl Management Plan. Riparian buffers on the Nanticoke will protect some of the sensitive wetland areas and enhance the use of the wetlands by waterfowl.

Finding Creative Solutions to Riparian Forest

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Most municipalities have stormwater management regulations that are lacking a holistic approach and full consideration of this hydrologic cycle, leading to unimaginative engineering solutions.

A municipal ordinance can require infiltration, runoff pollution control, reduction of thermal impacts and peak flow control. Riparian forest buffers that follow stream valleys can be expanded and enhanced through stormwater management measures on adjacent sites that can be integrated to form functional greenways.

Municipalities have an opportunity to formulate a stormwater management approach that can function as a tool to help structure the present pattern of environmentally destructive sprawling subdivisions. Municipal decision makers need to understand stormwater problems, define goals and related standards, and establish an ordinance with stormwater management requirements and a plan submission, review and approval procedure. London Grove Township in Pennsylvania will be presented as a model.

Riparian Easements and Stream Protection

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WHAT:

A Riparian Easement is a special type of conservation easement that applies only to a streamside, or riparian zone mutually agreed upon by the landowner and the easement holder. Like all easements, it is a legal agreement in which the landowner retains ownership and full control of the property, yet conveys certain specified rights to the holder of the easement.

Specifically, the landowner releases or gives up the right to destroy the riparian zone and works with the easement holder to develop a management plan to ensure the protection of the riparian zone. Typically this is done by establishing and maintaining vegetation and limiting livestock access to the stream. Each easement is tailored to the property and the desires of the individual landowner.

WHY:

A well-vegetated streambank protects the soil from erosion and flood damage, improves stream health and provides essential wildlife habitat.

HOW:

The landowner's first step should be to consult with a prospective easement holder, such as a local Soil and Water Conservation District or the Virginia Outdoors Foundation, to determine whether his or her plans for the property would meet conservation goals. If so, the terms of the easement can be negotiated and drawn up with the assistance of a lawyer. If tax benefits are desired, an appraisal will also be needed.

MANAGEMENT PLANS;

The management plan is the means of assuring that the riparian zone is protected. Technical agencies such as Natural Resources Conservation Service, the Virginia Department of Forestry and the Virginia Department of Game and Inland Fisheries can help develop the plan. In addition, these agencies may also be able to provide significant cost-share funding for conservation practices such as tree planting or developing an alternative water source for livestock.

REGULATIONS:

The restrictions on how the property can be used and the management plan itself are determined jointly be the landowner and easement holder. The terms are enforced by the easement holder.

ACCESS:

The public does not gain access to the property

TERM:

Easements must last a least five years under state law. For federal tax deductions, however, they must be in perpetuity.

TAX BENEFITS:

A riparian easement can save the landowner considerable money through tax benefits. A deduction can be taken on state and federal income tax return in the amount of the charitable gift represented by the easement. The allowable deduction is the difference between the fair market value of the land before the easement was placed on it compared to the value after the easement is in place. An appraisal is necessary to calculate this benefit. Estate taxes are another area in which a conservation easement can make a positive difference. By removing some of the potential for development, the easement brings down the fair market value of the estate and can result in a lower tax bill for the heirs.

Local tax assessments also can be lowered since state law requires that localities recognize the reduction in value caused by an easement. Usually, however, land on which an easement is placed is already taxed at land use value, and there is little or no additional tax advantage gained.

COMMUNITY BENEFITS:

Riparian easements, by protecting the streambank, improve water quality and wildlife habitat. Benefits can be increased further if landowners band together and place riparian zone easements on contiguous parts of a body of water.

INDIVIDUAL BENEFITS:

The technical and financial assistance offered by the cooperating resource agencies can help the landowner realize their goals for the land. Projects can be designed to prevent soil loss and flood damage and to enhance wildlife habitat and water quality. Most importantly, the landowner can know that the riparian zone will always be protected and that their forethought can make a positive impact not just on their property but downstream as well.

A Plan to Control Nonpoint Source Pollution to Long Island Sound through Riparian Enhancement

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Westchester County is located northeast of New York City and west of Connecticut and is contained within the metropolitan New York region. It is 450 square miles in size and is bordered on the west by the Hudson River and on the south by the Lone Island Sound. It supports a population of approximately one million and is urban/suburban in character.

In January 1992, Westchester County Executive Andrew O'Rourke established a Citizen Committee on Nonpoint Source Pollution in Long Island Sound to respond to nitrogen reduction targets promulgated by the Long Island Sound Study (LISS), a federal estuary program within the states of New York and Connecticut. The LISS identified nutrient pollution from sewage treatment plants and urban runoff as causes of hypoxia in the sound. The Citizen Committee consisted of municipal elected officials, environmental organizations, civic and business interests and was charged with developing a plan to control nonpoint sources of pollution originating from Westchester County. The committee recommended 33 actions, or categories of actions, all of which were accepted by the County Executive. A 10-member Steering Committee was subsequently appointed to implement the program.

Westchester County's Long Island Sound Nonpoint Source Planning Program consists of immediate and long-range actions that are predominantly voluntary and involve both county and municipal governments. It recognizes nitrogen as the pollutant of immediate concern but maximizes opportunities to control other pollutants. And it offers both preventive measures and watershed retrofits as options to reduce pollutant loading. Specific categories of actions include fertilizer/pesticide controls, septic systems controls, pumped facilities programming, public education initiatives and intermunicipal watershed planning. Watershed Advisory Committees (WACS) have been formed to oversee preparation of detailed plans to control nonpoint sources of pollution; each plan is expected to reflect the natural resources and land use characteristics of the basin.

A major component of the watershed planning initiative is the protection of water resources important to nonpoint source reduction and the preservation or restoration of a minimum natural buffer associated with those systems. Woody (forested) buffers are preferred, both because of their pollutant removal capabilities and ancillary benefits. A minimum target buffer width of 100 feet was selected as the maximum feasible within an urban setting, but with a provision for expanded buffers if/as identified by a watershed planning committee.

The Big Darby Creek Project

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The Top of Ohio RC&D covers a ten county area in the west central region of Ohio. The area's primarily focus is production of agriculture with a heavy emphasis on livestock in several of the counties. Within this project area there are four organized watershed projects that are currently funded with federal monies. One of these projects is the Darby Creek Watershed. This watershed covers a six county area and contains 338,152 acres that contain the Big and Little Darby State Scenic River system that was just designated a National Scenic River system.

The problems in the watershed include sedimentation from streambank erosion, lack of wooded riparian corridor in some areas, tillage systems and their impact on the stream and livestock operations in the watershed. Programs and demonstration areas are being established to educate landowners on how to deal with these problem areas. Groups made up of farmers, landowners and other private citizens have formed to help educate those people living within the watershed area. Their educational efforts are being duplicated in many other watersheds throughout the state. The primary water quality objective within the watershed is to preserve, maintain and enhance the aquatic and riparian ecosystem.

Riparian Assessment, Protection and Restoration in the Tar-Pamlico River Basin

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The purpose of this presentation will be to explore riparian management efforts in eastern North Carolina, with a focus on the Tar-Pamlico River Basin. Topics that will be covered include GIS-based landscape characterization studies as well as relevant management approaches being considered.

We have used GIS technology to study forested buffers in northeastern North Carolina. Specifically, we have overlayed buffer zones (100'-1000') along surface waters onto LANDSAT-generated land use/land cover data. This study has shown that a relatively high percentage (75% or more) of the land within these buffers remains forested in the Piedmont. In the Coastal Plains subbasins, the percentage of streamside land with forest cover is less (50% or less). This phenomenon can be explained, at least in part, by the extensive hydrologic modification that has occurred in the Coastal Plain area. Drainage (e.g., water level adjustment, controlled drainage, channelization) practices are common in many agricultural areas featuring flat topography and water tables that are at least seasonally close to the surface. Where drainage is widely used in a region, forest buffers may still stabilize streambanks and provide habitat for aquatic life. However, reductions in pollution loadings to surface waters will of necessity rely more heavily on upland BMPs.

GIS tools also provide an ability to identify individual stream reaches where lack of buffering may warrant special attention. We are in the process of preparing a map series that will center on this concept. Another insight which GIS has revealed is that the headwater systems (first order streams) are the systems that have been the most heavily disturbed.

We have also looked at the ability of various programs to protect and restore forested buffers. This review suggest that while a wide array of relevant federal, state and local programs exists, the institutional structure to champion the protection of **continuous linear forested corridors** does not currently exist. Much of the forested riparian land has likely been spared conversion in the recent past more because of environmental and economic factors than legal or regulatory efforts. In the Tar-Pamlico Basin, pioneering approaches to river basin planning and nutrient management provide new opportunities to focus on riparian protection and restoration.

Monocacy Project Case History

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In Maryland, one of the programs developed to combat non-point source pollution of some of its tributaries is the Special Rivers Project administered through the Forest Service. There are currently three projects within the Special Rivers Project:

- Susquehanna (northeast MD), 1986
- Anacostia (DC suburbs), 1992
- Monocacy (Frederick and Carroll Counties), 1989

These are all funded by the Clean Water Act Section 117 and 319 funds from the EPA and administered through the MD Department of the Environment. Although the specific intent of each of these projects varies, the overall goal of the Special Rivers Project was to stem non-point source pollution by providing and managing forest filters along the Bay's tributaries.

The Monocacy Watershed is located mainly in Frederick County, MD with smaller portions in Carroll County to the east and Pennsylvania to the north. The Monocacy River is formed by the confluence of Marsh and Rock Creeks near the MD-PA border and winds 58 miles through Carroll and Frederick County finally flowing into the Potomac River near the Montgomery County line. To give you a better idea of where this is located, Frederick County is about 35 miles northwest of DC and 40 miles west of Baltimore. The overall size of the Maryland portion of the watershed is about 565,000 acres or roughly 880 sq. miles. Frederick County, the largest and most rapidly developing county in Maryland, is quite diverse. It lies on the border of the Piedmont and Blue Ridge regions with the mountains forming the western boundary of the watershed. The northern end of the area is still quite rural and heavily influenced by agriculture while central and southern Frederick County are rapidly expanding with new growth in the way of housing and industry occurring daily.

The Monocacy Project was developed to stem non-point source pollution from runoff from the then primarily agricultural watershed through the establishment and management of forested stream buffers. The establishment of forest buffers was still a relatively new practice then and rarely used, much less heard of in controlling non-point source pollution. So we proceeded to carry out this charge in several ways. First, we addressed the private sector by identifying and contacting all landowners with 10 acres and larger bordering the Monocacy and its tributaries within the entire Maryland portion of the watershed. This was accomplished by sifting through the county tax maps and sending direct mailings to these selected landowners. These mailings explained the importance and function of forest buffers, various incentives for their establishment and management, and our services and involvement. They were also sent a pre-addressed reply card for them to return if they were interested. Initial response was fairly good, but progressively dropped the further along we got in the watershed. From these contacts we would develop riparian forest management and buffer planting plans for the landowners along with assisting in the implementation of these plans.

Next came the public sector, which we addressed several ways. Through Maryland's Greenshores Program, we used volunteers and civic groups to plant forest buffers on public lands within the watershed such as parks and schools. We also provided input for policy making groups involved in land management such as the Monocacy Scenic River Advisory, ASCS, Soil Conservation, etc., along with various citizen groups such as the Monocacy Watershed Conservancy. A large part of the Monocacy Project involved Information and Education efforts which we have handled in several ways. We developed a project brochure explaining forest buffers and encouraging people to become involved, and we developed a project display to take to various environmental and agricultural functions. We also developed two demonstration areas where the public can go see how buffers are planted, what they look like, their maintenance needs, and so forth. One is in Walkersville and is a Forest Buffer Nature Trail in the Town's Heritage Farm Park. The other is located in southern Frederick County at Monocacy Natural Resources Management Area and incorporates some agricultural water quality practices such as fencing waterways and establishing watering troughs for livestock. Both of these demonstration areas have also been designed as self guided tours where the public can pick up a pamphlet on site and view the areas themselves. We are also heavily involved in various school programs such as talks and school plantings. Media events are a part of our project as well with various articles appearing in the local papers, agency literature and in outside publications including EPA's News/Notes. We have also supplied pictures and information to many other groups and agencies to assist in the development of their riparian forest publications. We have also worked with some developers in implementing buffer plans and planting floodplains on housing sites along with providing input on development site reviews for county and local planning officials.

To date, we have developed over 150 management plans on 5,500 acres of private lands involving about 500,000 linear feet of buffer recommendations. We have planted 200 acres of forest buffer on public and private lands and another 200 acres of non-buffer plantings. We have exhibited the project display and made presentations on forest buffers and non-point source pollution to over 11,000 people and involved over 2,000 volunteers in various projects, primarily buffer plantings. We have had a number of overwhelming successes in private land management, the most notable being the Dublin Tree Farm. This 90-acre property fronts the Monocacy River near Walkersville and was historically used primarily for crops and pasture. Upon our contacting the landowner, a retired veterinarian from Frederick, he decided to turn the entire property into a Tree Farm. All 90 acres were subsequently planted into trees, and the property is now a showcase for tours as well as serving as another demonstration area, and is used regularly for Frederick area elementary school trips to learn about natural resources management.

Overall, though, agricultural response, despite being the initial focus of our project, has been quite low. We have done work on farmland, but usually the owners we deal with are not the actual farmers. Due to this, we have somewhat sifted our target audience to more effectively deal with those who have become the main users of our services. We have also recently expanded the project boundaries to the west to include most of Washington County as well, resulting in a total project ares of about 835,000 acres or roughly 1,300 sq. miles. As forest buffers and buffer management have become more commonplace, we are now changing course to include more innovative approaches and programs to combat non-point source pollution. We are focusing more on urban plantings, storm water management projects, recommendations and input to various urban groups and involvement in a new Greenways commission established for the Monocacy corridor. We are also focusing on more traditional forest management work to complement the project expansion into the more heavily wooded Washington County. We have a few different demonstration areas in the works to highlight such water quality practices as stream crossings, best management practices and urban issues as well as plans to produce an urban water quality brochure.

Revitalizing Baltimore's Riparian Forests through Neighborhood Action

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Baltimore Urban Resources Initiative is a partnership of the Baltimore City Department of Recreation and Parks, the Parks and People Foundation, the Yale University School of Forestry and Environmental Studies and local community groups. By helping neighborhoods take back abandoned open spaces in Baltimore, URI also helps people to reinvest in themselves, their neighborhoods, their communities and their environment.

URI has been working in Baltimore for five years, and has developed several programs aimed at assisting the process of social revitalization through ecological restoration in inner city neighborhoods. These include community forestry, park planning and management, job training and environmental education for inner city youth, geographic information systems and natural resource management training for employees of the Department of Recreation and Parks.

Community Forestry

The Community Forestry Program involves local communities with the Division of Forestry in the planning, implementation and maintenance of community greening activities. To date, this program has captured the imagination of representatives of over 30 diverse communities throughout Baltimore.

Park Planning and Management Program

Through its Park Planning and Management Program, URI helps the Department of Recreation and Parks improve its land management practices. To contribute to improving the environmental health of the City and the Chesapeake Bay, the Department of Recreation and Parks is planting more trees and wildflower meadows, and protecting wetlands and streambanks to combat erosion, increase infiltration and improve the wildlife habitat value of the park system

Environmental Education and Job Training for Youth

During the summers of 1992 and 1993, in partnership with the Chesapeake Bay Outward Bound program, URI developed a six-week outdoor experiential education program for inner city kids. The program provided 14-18 year olds with a hands-on opportunity to learn about careers in natural resource management. In the summer of 1994, URI will work with representatives of the Department of Recreation and Parks to develop a similar program for middle school kids. This program, KidsGrow, will be run out of local recreation centers and will emphasize environmental education and dovetail with local school initiatives and curricula.

Natural Resource Management Training

In 1992-1993, a former URI intern worked with five employees of the Department of Recreation and Parks to develop and teach the sixty-five field employees of the Bureau of Parks who work in the Herring Run Watershed about Watershed Management, Streams, Wetlands, Meadows, Trees, Forests, Wildlife and Serving the Public. In 1994, after "co-teaching" the pilot program in the Herring Run Watershed, the Department of Recreation and Parks' trainers conducted a similar program in the Jones Falls Watershed. URI is now working on training community representatives in the Gwynns Falls watershed.

Geographic Information Systems

Geographic Information Systems (GIS) involves several components including computer mapping, information integration and analysis and visual displays of information. The power of GIS lies in its ability to integrate disparate sources of information to analyze them in a similar context. URI uses such a system to integrate biophysical information such as stream, park, forest and land use locations with socioeconomic information such as census data, vacant lot and property locations and neighborhood surveys. GIS is used as a tool to help collect, organize and analyze information to answer questions.

A Countrywide Creek Valley District for Riparian management

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Portrait of Loudoun County

Loudoun County, Virginia is part of the Metropolitan Washington region. Located 35 miles northwest of Washington D.C., the County covers 520 square miles. Eastern Loudoun County is home to Washington Dulles International Airport and consists primarily of suburban, commercial and industrial land uses. The western two-thirds of the County has primarily agricultural and rural residential land uses.

Loudoun County has an estimated population of 102,100. The County's population increased by 50% between 1980 and 1990 and continues to grow at roughly a 5% annual growth rate. The rapid growth has placed increasing pressure to provide services and accommodate the new development in a well planned manner. In order to plan for the growth, the Board of Supervisors adopted a new Comprehensive Plan in September 1991 and updated Zoning Ordinance in June 1993.

Environmental Planning and Regulation in Loudoun County

Loudoun County's Comprehensive Plan has policies for protecting a wide range of water, air, land, geologic and living resources. For water resources alone, the Plan outlines strategies to protect water quality, floodplains, wetlands, scenic rivers, the Potomac River shoreline and stream corridors.

The County Zoning and Codified Ordinance implement many of the goals of the Comprehensive Plan by regulating solid waste management, sediment and erosion control, floodplain management, mountainside development, steep slope protection, tree planting and replacement and creek valley buffers. Creek Valley buffer requirements first went into effect with the adoption of the 1993 zoning ordinance.

Creek Valley Buffers

Section 5-1000 (Scenic Creek Valley) of the Loudoun County Zoning Ordinance sets the criteria for development adjacent to any stream that drains greater than 640 acres. A Creek Valley Buffer is in effect wherever the width of the floodplain is less than the width of the Creek Valley buffer. The width of the buffer is measured from the stream bank and varies depending on whether the stream is the Potomac River, one of the County's two state scenic rivers, or other streams. Buffer widths are set at 250 feet for the Potomac, 200 feet for state scenic rivers and 150 feet for other County streams. Flexibility is built into the regulations by allowing for up to an 100 foot buffer reduction for using storm water management best management practices (BMPs) or preserving (or establishing if one does not exist) a forest along the stream. The construction of buildings, structures, parking lots or other impermeable surfaces is prohibited in the buffer area. Existing buildings and structures within the buffer area are permitted to expand or be rebuilt. The County is requiring the buffer to protect water quality, promote wildlife habitat and preserve the scenic beauty of the County's streams as development occurs.

Forming Local Stream Teams

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Levels of Participation

The purpose of the Adopt-A-Stream Program is to satisfy the NPDES Permit requirements of public outreach, enforcement and monitoring. This program is promoted through public involvement, stewardship and awareness to two targeted groups, a Phase I group and a Phase II group. The Phase I group includes schools, Girls and Boy Scouts, community organizations, homeowners associations and environmental organizations. While the Phase II group includes businesses, colleges and universities and seniors.

Structure of Stream Teams

The stream teams consist of three levels of participants who agree to a one-year commitment to adopt any stream. These three levels include stream reporters, stream activists and stream monitors. The stream reporters, who are given minimal training, conduct stream walks where they observe physical, biological and pollution conditions as well as storm drain outfalls. Stream activists participate in tree plantings, stream clean-ups, storm drain stencilings and public education. Lastly, the stream monitors are responsible for conducting macroinvertebrate sampling and for assessing the quality of the stream's habitat.

Relationship to Riparian Forests

Stream reporters observe the forest cover/canopy, forest buffers and stream bank vegetation. The stream activists conduct stream tree planting, reforestation projects and education of riparian forest buffers. Stream monitors perform habitat assessments which includes an evaluation of the bank vegetation, riparian zone width and lastly bank stability.

Assessment of the Program

The program has held five introductory workshops and two biological workshops that have trained 169 people. Thus far twenty-three streams and two ponds have been adopted. Volunteers have collected data for three stream walks, distributed 5,000 brochures and 200 posters, stenciled eighty-eight storm drains, identified six pollution problems and sponsored one stream clean-up.

Riparian Forest Buffers: Restoring and Managing a Vital Chesapeake Resource

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First I should mention that I am a new landowner with a background in both small business and government, and a commitment to the environment. You will have to judge whether I am typical of other new purchases of land in sensitive areas.

When I make a major purchase, as a businessman I conduct a review to assess the conditions of resources and identify problems that need immediate or long-term attention. Among the things I found when I reviewed my newly-purchased horse farm were a small amount of gullying from soil erosion during storm runoff, and a need to improve streambank stabilization.

About 20 acres of my farm is low land located along the bank of Deer Creek, and about half of that area was flooded when Deer Creek overflowed its banks a few months after I purchased the farm. I saw that unvegetated areas, which included a horse training track, experienced gullying during the flooding (the track is now being removed and replaced by a grassed gallop). But my principal concern was that the stand of trees along the creek bank was in some spots just a single line of trees - not enough, in my opinion, to hold the bank together during high water and prevent my field from being carried downstream. I really hate to spend a lot of money buying something, just to have it wash away. So I decided to plant some more trees in the barest areas along the creek.

The Soil Conservation Service referred me to State Forester Michael J. Huneke, who when I told him I wanted to plant a few trees, asked "How many acres?" He educated me in the environmental benefits of riparian buffers, and my plans enlarged in scale from maybe 30 trees to 1,050 trees covering 2.6 acres. We planted 300 each of sycamore, green ash and black walnut, plus 150 dogwoods, with 12' X 12' spacing on the landward side of the trees already along the creek bank.

The planting was done by myself and two helpers over a period of about three weeks. Because the seedlings that arrived from the state nursery had fairly good root systems, I decided to do the extra work and plant them in holes dug with shovels. We mowed between the trees quite regularly during the summer, and I am very pleased with the survival rate. A few of the green ash will need to be replaced next spring, but the sycamores and black walnuts have done very well. Some of the sycamores are already more than three feet tall!

Lessons learned:

- Planting the hard way using shovels is worth it because of the higher survival rate.
- Get all the clearing of brush, etc., done before the seedlings arrive.
- Do the regular mowing - it really pays off.
- Those little plastic tree flags on wires are nice, but they are no way tall enough to help you locate tree seedlings in waist-high weeds.

This project would have been just a few trees and would not have happened on such a large scale without the following help:

- Advice, encouragement and preparation of Forest Stewardship Plan by the Maryland Forest, Park and Wildlife Service, DNR.
- Tree seedlings available at reasonable price from Buckingham Forest Tree Nursery.
- Cost-sharing from SIP and Green Shores programs.

Riparian Forest Buffers: Restoring and Managing a Vital Chesapeake Resource

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THE SETTING

The farm size and location, the watersheds involved and the stream affected (Tobacco Run) was stated.

THE PROJECT

The description of the project included a discussion of the acreage, tree species, tree planting, planting protection, pronounced stream meandering, fencing considerations and herbicide sprays. The presentation also covered the assistance provided by high school students, the SIP Program, project cost breakdown, MACS and Green Shores support and DNR Forestry Division support.

MOTIVATION

The motivation for this project came from a need to explore crop farming vs. grass farming. As well as; livestock expansion, cattle water quality in a developing watershed, wildlife habitat, promoting community involvement, demonstration projects and aesthetics.

RESULTS

After six months, the site experienced a late spring drought. The presentation also covered herbicide effectiveness, deterioration of "flags" and species survival in a physically rough environment.

LESSONS LEARNED

If this project was to be repeated the following is a list of things that would be done differently: species selection, vegetation competition, better markets, mid-summer herbicide application, different herbicides (Rodeo and/or pre-emerge, e.g. Surflan), vegetation removal by weed eater, tree shelters and additional costs affecting the attractiveness of the programs to farmers.

FACILITATED DISCUSSION GROUPS OF THE RIPARIAN FOREST BUFFERS CONFERENCE

Although it was nearly the last session of the conference, the results of the discussion groups could be, and have been, described as one of the most significant outcomes. It is extremely important to capture and share the ideas, concerns and questions that people have about riparian forest buffers and their use. This information could potentially impact formulation of a watershed-wide policy to implement riparian forest buffers for protecting water quality and other environmental values in the region.

People came to the conference to learn, to teach and to share information, insights and perspectives. The Discussion Group sessions were conducted as a forum to allow people to react to what they had heard during the program and as an opportunity to provide advice and guidance to policy-makers about *"Defining a Riparian Forest Buffer Policy/Program that Works."* The forum had two objectives: The first was to gather ideas, feedback and input that people from diverse interest groups have on the issues after hearing about the scientific, social and economic aspects of riparian forest buffer management and restoration. The second objective was to then encapsulate or coalesce those thoughts and questions so that they may be used as a basis for developing a riparian forest buffer policy that reflects sound science, attention to social needs and economic realities.

The approach of the session was to provide four facilitated discussion groups that represented different land uses, and thus, differing perspectives and interests. The groups included an urban land use group, suburban land use group, agriculture land use group, and forestry land use group. Participants attended the discussion group of their choice for the entire session or were free to circulate. Each group was asked to respond to three prepared questions and to develop several questions on what the participants believe are the biggest barriers, most troubling issues or greatest opportunities related to riparian forest buffers. The questions generated by each group were then presented to a closing panel for discussion in the final plenary session of the conference. The three questions presented to each group were:

1. Which elements do you feel are necessary for a successful riparian forest buffer policy/program on agricultural (or urban, suburban or forested) land?

2. What do you think are the most important barriers or issues which presently inhibit the implementation of riparian forest buffers in your area?

3. What existing or innovative approaches do you feel offer the best models for consideration in developing a riparian forest buffer program or policy?

Below are the responses by each group and follow-up questions the participants posed to the closing panel. Each group will be treated separately to provide continuity of the perspectives and advice that emerged.

URBAN RIPARIAN FOREST BUFFERS

1. Elements of a Successful Program

This session focused on generating ideas for using and improving riparian forest buffers in urban areas. The many suggestions centered around two basic themes: **clarity and community**. Defining the project, its goals and expectations are seen as important elements in a successful urban forest buffer program/policy. Planning appropriately for the urban environment is a key element that ties the theme of being clear about what is trying to be accomplished and the necessary limitations placed on the project by it being located in an urban landscape with a dense human population. Investment and ownership in the program/policy by the community was the other strong theme that emerged from this discussion. Planning the project using a "bottom-up" approach, ensuring that the project meets community as well as environmental needs, using a local, grassroots organizations to help plan/oversee/monitor the project site, and ensuring that monitoring efforts include social, economic and environmental health aspects are examples of the needs expressed in the forum. The group felt strongly that community involvement, education, and ownership of the program will help ensure its success.

2. Important Barriers or Issues

The discussion focused on the **need for education**, both inside and outside the urban area, to reinforce the importance of the riparian forest buffer to the health of the entire ecosystem. Not only does the immediate community need to understand the functions and importance of buffers, but populations that are removed from urban areas also need to know how the quality of streams in cities affect the quality of their lives in rural areas. Agencies need to learn the importance of taking an ecosystem perspective on environmental issues, as opposed to a narrow view of the environment. The public needs to learn how the "mow/manicure" philosophy harms riparian areas, and the country as a whole needs to understand that despite the problems inherent in inner city areas, they still merit consideration and effort for planning riparian forest buffer projects. Governments need to learn to work with their constituencies, regardless of how large or impermanent they may be. Lack of physical space and the abundance of cement in cities was also mentioned as a barrier to successful riparian forest buffer projects.

3. Existing or Innovative Approaches that Serve as Models

In this discussion, several specific school and community groups were mentioned by name. The group's discussion simply reinforced the idea presented earlier that community involvement and ownership is critical to establishing successful, functioning riparian forest buffers in urban areas. Watershed associations, forest stewardship programs, Adopt-a-Stream programs, and using local students to help plant and/or monitor projects are all examples that indicate the need for the community to feel that they are a part of the project and that the quality of the environment around their home is, to some degree, within their control. Dealing with urban forests as "green infrastructure" was also suggested as an approach.

4. Questions

Finally, four questions were raised to be presented to the closing panel of the conference. They are:

1. Three-fourths of the population (and the voting public) live in cities. How do we get our policy makers and the general public to understand the vital link between improving the livability of our cities and the protection of our rural natural resources?

2. How can we orchestrate a basic change in the way government works to allow a bottom-up process to occur in order to hear, understand and act on community needs while meeting environmental objectives?

3. How do we facilitate government agencies to "work together" to avoid conflicting objectives and bureaucracy, and to share resources?

4. How do we integrate science and technology (high- and low-tech) into the implementation of projects in urban areas?

SUBURBAN RIPARIAN FOREST BUFFERS

1. Elements of a Successful Program

Several themes emerged as elements the group believe are important for a successful riparian forest buffer program. The themes are: a need to **define objectives**, **plan thoroughly**, **educate people**, **regulation may be necessary**, and **monitoring and enforcement are essential**.

Participants emphasized a need to **set policy/program priorities and objectives at the outset**. This requires looking at the full range of benefits protected with forest buffers, not just stream water quality. Setting priorities will help us determine what we want to achieve and to be more specific about where efforts should be applied. A policy can not be expected to be good for all locations and it is more efficient in terms of time and money to set priorities. Also, alternatives to forest buffers should be explored to achieve water quality and any policy/program should allow for innovative approaches to the use of buffers or alternatives.

Planning was identified repeatedly in the discussion as a way to map the future and to avoid conflict and failure of the program/policy. Public participation early in the process by all interested parties was identified as a key component to success. It is critical to obtain understanding and support from local governments and citizen interest groups. Another component of planning is to identify or inventory the resource to use as a guide to actions and future policy. An inventory will help us to consider what scale is meaningful and feasible, both ecologically and economically. Also, it is important to locate the resource and plan development

accordingly so that development impacts are minimized.

Education is seen as a primary component for program/policy success. People must be informed about the public and private benefits that are protected by forest buffers, what the values are and why they matter. Education must be extended in a broad and understandable way.

Regulation may be the most effective means of ensuring participation. If regulation is the approach taken, several elements should be kept in mind. First, be mindful that the policy must be legally defendable as it will probably be challenged over time. Second, regulators need to make sure that the policy is flexible, so that it can adapt to knowledge-base changes, but can remain consistent over the long term. Many people are concerned that regulations change so frequently that compliance suffers and enforcement becomes difficult. Third, the language must be clear to avoid loopholes, define allowable and restricted uses, and assure perpetuity.

Lastly, **monitoring and enforcement** were seen as integral components in program success. People recommended that language and mechanisms be specifically written into the policy to ensure their inclusion. Many times these factors are the weak links in an environmental protection strategy. Clear guidance needs to be giving for best management practices to be applied on the ground and technical practices should be addressed.

2. Important Barriers or Issues

People who look at a forest buffer policy/program from a suburban perspective see impacts on private landowners as the source of important issues. Two areas surfaced as potential barriers to success: **responsibility and liability placed on private landowners**, and **political and institutional difficulties**.

People expressed concern about perceptions of property rights and the burdens that would be placed on landowners. We must address fears people have about forest buffers. Landowners have expressed concern about home security, uninvited public access, wildlife damage and control, and their responsibilities for maintenance, invasion of exotic species, threatened or endangered species, and their liability in inappropriate use by others. The group also felt that encroachment on the buffer may be a problem. Landowners need to be aware of the buffer location and size so that intentional or inadvertent removal does not become a problem. People also need to see what a new buffer or restoration area will look like in the future so that alteration does not occur because it is perceived as "ugly."

Political realities and institutional issues were seen as serious barriers that could derail a policy/program's success. Creating a policy that is flexible enough to meet local needs and be applicable region-wide is seen as the biggest challenge and potential barrier. Additional issues include the assurance of long-term protection, concern that there is little overlap with other policies and concern about creating another layer of regulation intended to supersede existing laws. Political palatability is perceived as a barrier to implementing a forest buffer policy that puts ecological protection needs first. Cooperation on the part of the real estate and development

community are also seen as barriers to success. We must be cognizant of what is expected from a program/policy: education and acceptance of change is a slow process. Finally, the funding needed to assure monitoring and implementation need to be addressed in policy formation.

3. Existing or Innovative Approaches that Serve as Models

Several existing programs and laws were mentioned as approaches to be modeled in formation of a successful riparian forest buffer policy/program. Baltimore County uses the concept of "use zones" in its community planning and development activities. The formation of these zones and their definition could be useful in establishing "forest buffer zones" in residential areas. The Revitalizing Baltimore Project has a "Neighborhood Stewardship Program" that considers the dynamics of a local area to apply ecological restoration or land use change. The Maryland Critical Areas and Forest Conservation Act were noted as existing policies that could be used as models and reference to avoid policy overlap. The Virginia Ecological Quality Corridors is a policy that is perceived to be close to the desired effects of a riparian forest buffer program.

4. Questions

The suburban land use group formed six questions to be addressed by the closing panel and to be considered for the future.

1. Who is going to pay for this? A policy like this needs a bigger "carrot" not a bigger "stick".

2. How can we avoid this becoming another program that is not integrated with existing policy?

3. What will be the fate of a riparian forest buffer policy in the face of the upcoming elections? Will it still be important?

4. How do we get the message out? How do we make the public aware?

5. How do we account for people's needs? Where do the regulations stop?

6. How do we convince future generations to keep forest buffers?

AGRICULTURAL RIPARIAN FOREST BUFFERS

1. Elements of a Successful Program

The agricultural land use group discussed a series of elements that also followed distinct themes or categories. People who carry the perspective of the farming community see successful forest buffer policy/program elements as those that are **based on good science**, **make economic sense**, **have flexibility**, and are **primarily voluntary vs. regulatory**.

Participants asserted that any policy/program that involves land management practices needs to be **based on good science**. That is, it should be based on sound research, result from interagency consensus that resolves technical issues and is consistent on issues of ecological function and maintenance requirements. The knowledge needs to be accessible to the farmer and should inform them about ecosystem restoration and the function of a buffer system.

A buffer policy will need to **make economic sense** to be successful. Farmers need information on how buffers will impact costs, profits, and they need to have economic benefits illustrated to them, if they exist. The ability to derive income from buffer areas would provide incentive to establishment and maintenance. However, adequate funding for cost-sharing and technical assistance would be important if costs were to exceed financial benefits over the long haul.

A forest buffer policy will need to be **flexible** to be successful. It should not be a blanket policy, but should be targeted to specific locations. It needs to be simple and considerate of regional differences. It should recognize that "one size does not fit all", there should be specific recommendations to specific landowners and developed through a comprehensive approach that considers everything on the farm.

The agricultural group believes that elements of a forest buffer policy need to be **primarily voluntary versus regulatory** to be successful. Trust is a necessary element to be successful and is frequently lost when policies become regulatory. It is important to attempt to make innovative use of existing programs and statutes instead of creating new regulations. Incentives work better than regulations and they should be tied to performance and sustainability. Despite the above comments, at least one person said that a forest buffer policy/program needs to be regulatory to work in the agriculture community.

2. Important Barriers or Issues

Participants see potential barriers that focus on issues of **fear, costs, trust and cooperation, and technical aspects of forest buffers**. People listed issues that reflect the **landowner's perspective** and others expressed **agency concerns in delivering the information and technology** to do the job right.

A central theme involved **fears** people have about the impacts of forest buffers on their farms and livelihood. There is concern that forest buffers would result in loss of income is seen as a significant barrier. For example, some farmers fear that weed encroachment from buffers will impact production. A related fear was that compliance would mean a loss of future land use options and public benefits such as wildlife benefits and aesthetics would be forced on them at the expense of row-crop goals and other farm operation priorities. Lastly, a strong concern was voiced about this program/policy leading to future regulations. The farming community also see the perception of "takings" as a barrier to success with a policy/program.

Costs associated with implementing and maintaining forest buffers were seen as issues to

be addressed in the policy/program process. Many feel that there is already a lack of available land to forego production on forest buffers. The costs and time required to install buffers may be seen as prohibitive and concern about maintenance responsibility was cited. The impacts on assistance programs were perceived to be barriers. There was concern that a buffer policy could change the "base acres" definition for commodity support programs and could also result in additional fractionalization of agency technical assistance personnel time .

Trust and cooperation were named as issues that could become barriers in the policy process. The group felt that many farmers will point fingers stating that "it is not my problem" and may not be willing to participate. People also stated that there is a general close-mindedness that has led to both the public and the farming community to have a lack of trust for the other. Some mentioned that there are inconsistencies between current programs that may cause confusion and skepticism about "new" policies/programs. The current political climate and general political attitudes of people in the farming community were described as presented as possible barriers.

Participants named **technical aspects and definitions** as possible problems for a forest buffer policy/program. People feel that there are mixed messages from various agencies on riparian forest buffers and result from different interpretations of a limited science. The group see some basic uncertainties about design, function and ecological implications that could become issues for agriculture.

3. Existing or Innovative Approaches that Serve as Models

The agriculture group described a hypothetical approach as a model instead of looking to specific programs or policies that currently exist. The model program was described as one that is a voluntary, comprehensive (whole-farm) approach that operates with multiple goals or stages to implementation, is flexible and site-specific considerations for practice are allowable. The policy would be formed by consensus about the problem and priorities for implementation and has good community support that involved all stakeholders in the decision-making process. The policy would be based on good science, be tied to a thorough resource inventory and target specific areas and flexible practices to meet buffer needs. There would be compensation provided to landowners for loss of crop production, market support would be developed for products that come off buffer areas and a system of graduated incentives based on effectiveness of the buffer area would be instituted. This would involve cooperation from a coordinated federal and state agency partnership. The education approach would use case studies, demonstrations and testimonials to promote the practices. Agencies would monitor effectiveness and provide technical and financial assistance.

4. Questions

The agriculture land use group developed eight questions to be addressed by the closing panel and considered in the formation process of a forest buffer policy.

1. How will economic issues such as compensation and cost-sharing be addressed in a riparian management policy?

2. In order to be accepted voluntarily, it must be: feasible, practical (usable), economical (time, talent, money), safe, legal, moral, politically acceptable, and culturally acceptable.
3. Do riparian forest buffers meet these criterion in agriculture areas?

4. How do we set goals and standards that are flexible and also address fairness to all?

5. How can the agricultural community get trust and cooperation?

6. How can we be creative in providing adequate resources to implement these programs, including technical assistance and capital?

7. How do agencies prioritize efforts? Where do we apply our practices and technical assistance?

8. How do we develop effective watershed management teams with longevity? Should we develop formal interdisciplinary teams?

FORESTRY AND RIPARIAN FOREST BUFFERS

1. Elements of a Successful Program

The theme of the discussion from the forestry land use group was **balance**. There were people who advocated strict regulatory controls of buffers on silvicultural land, and conversely, others wanted to avoid "burdensome regulation". Some people believe that timber harvests should not be totally excluded from buffer areas, but harvesting should not be allowed in all buffers, either. The group felt that **cost-sharing**, Memoranda of Understandings for **interagency cooperation**, **tax incentives**, and **long-term stable funding** would all contribute to a successful buffer program. Ecosystem, particularly native species, protection was thought to be a primary function of forest buffers. However, we need to consider other benefits derived from these areas, including economic. Basing buffer policy on **strong science**, a commitment to **long-term monitoring**, regular **in-service training of agency personnel**, **mitigation easements**, and **livestock exclusion** were all mentioned as elements that could ensure a successful program.

2. Important Barriers or Issues

Trust, **lack of understanding or knowledge**, and fear of change were the main themes discussed during the segment on "Important Barriers or Issues". Some people have firm ideas about how forest resources should be used, and there has been little communication in which to find common ground. People are very divided about how forest resources should be managed, many people distrust government, and competing forest uses appear to be mutually exclusive. There is also a

lack of understanding about how and why riparian forest buffers work ecologically, and how these functions can be used for a diverse array of interests (agriculture was one interest mentioned specifically). Economics also play a large part -- timber harvest and subsequent development is more lucrative in the short-term than preserving trees for vague, distant environmental interests. Government mandates go unfunded, programs are not integrated and not coordinated, and property rights advocates are a vocal group. Finally, the lack of ability to view environmental issues from a watershed perspective was reiterated.

3. Existing or Innovative Approaches that Serve as Models

A model of policy development carried themes of strength and control. The group suggested that "bad actors" be recognized, regulations protecting Streamside Management Zones be implemented, and development growth be managed. Others suggested the implementation of a tributary strategy, and the general use of "adaptive management" techniques. Zoning should be for resource management as well as for development, and clear communication of why these measures are important is crucial. There was also a community involvement and education component that is needed to be successful. Using grass roots organizations to foster community ownership, organizing volunteer programs "with teeth," and organizing field trips or canoe trips were suggested as ways to get the public involved.

4. Questions

Three questions were raised from the group for submission to the panel at the close of the conference. They are:

1. How can we get cooperative and coordinated implementation from the various federal, state and local agencies?

2. What is the state of the science now? Where do we need to go?

3. How do we achieve consistent policy across all jurisdictional levels including Delaware, West Virginia and New York?

Riparian Forest Buffers Conference
Summary of Evaluations

Sixty evaluation forms were submitted at the end of the conference. The first few comments listed were the most common responses for each question, and the rest are more specific comments not widely received, listed here for interest/information. The evaluation forms themselves are on file for reference.

What did you like the most about the workshop?

- #1 POSITIVE COMMENT: *Variety, diversity in both speakers and topics.*
- *Brought together the entire spectrum of the issues: regulators, farmers, private industry, technical, policy, social/economic, etc.*
- *Presentations by landowners*
- *Case studies from different regions of the country*
- *Good exchange of ideas; free and open discussion*
- *Seeing program strengths/weaknesses*
- *Examples of stream ecology and restoration*
- *Final sessions that pulled information together & discussed barriers*

What did you like the least about the workshop?

- #1 NEGATIVE COMMENT: *Too many sessions/feeling of missing something important*
- #2 NEGATIVE COMMENT: *"Program assumed that buffers are good and that everyone agrees with that." Needed to include more who disagree with the benefits of riparian forest buffers, especially more landowners & farmers; lots of comments about "preaching to the choir"*
- *Rooms too crowded, difficult to see slides, uncomfortable, sitting too long*
- *Lunch speaker who talked about behavior*
- *Need to include/invite more teachers, high school & college students, suburbanites, community associations*
- *"Locating the conference at Turf Valley, a resort with a history of repeat wetlands violations and a blatantly expressed desire to remove the Little Patuxent River's riparian area."*

Were the handouts and other available materials helpful? If not, why not?

Yes. Everyone wants proceedings/summaries of the presentations.

- *Wanted more technical information in handouts*
- *Want examples of model documents for many programs, or resources for getting them*
- *CBC legal information especially good on handouts*

What did you think about how the workshop was organized? If you feel it was poorly organized, how might it be improved?

- VIRTUALLY UNANIMOUS COMMENT: *Very well organized; stayed on time*
- *Good facilities*
- *Want a field trip, ideally to a restored buffer*

- *Want more specific suggestions for change (i.e. technical suggestions)*

Which speakers/topics did you find most useful or informative?

- *Landowners perspective*
- *Bio-engineering, tried-and-true public education methods*
- *Transforming science into policy, PA Stream Fencing, Rip easements & stream protection*
- *Topics that stressed need to communicate one-on-one & importance of being out in the field, looking at the land*
- *Suburban Land use group*
- *workgroup sessions*
- *The Ag perspective & how riparian buffers can benefit the economics of a farm. Incentives needed by farmers to put in forested buffers.*
- *"Soil! (I love soil!) actual technical discussions of plant/soil types -- what really works"*
- *Social and individual dynamics*
- *Effects of buffers on wildlife*
- *Practical speakers w/field knowledge*

MOST USEFUL OR INFORMATIVE SPEAKERS: Speakers mentioned by name

Most frequently mentioned	**Frequently mentioned**
Bern Sweeney	Rich Everett
Neil Sampson	Jeff Horan
Richard Lowrance	John Lipman
Kathy Smith	Tom Makowski
Andy Dolloff	Rocky Powell
Louis Licht	Tom Schueler
	Laura Tessier
	Len Wrabel

Can you think of any speakers/topics that should have been included but were not?

- *More hard science on the actual design and establishment of buffers: species selection, planting distance, protection from erosion, grazing, and other wildlife threats, stream dynamics, impact of macrofauna and exotics, etc.*
- *Include Cooperative extension service; SCS, ASCS, MDA, MDE staff to explain how their organizations deal with putting in a buffer (people who help implement this on the ground)*
- *More landowners, including suburbanites with 5-40 acres of land unfarmed, non-profit and citizen's groups, especially urban citizen activists*
- *Development community and county level supervisors*
- *"Trout streams for the first time in 100 years are getting cooler as streamside tree canopies close and more of the stream is shaded."*
- *Role of storm water mgmt today*
- *MD National Capitol Park & Planning Commission*
- *Stream Valley Park acquisitions & management*
- *Living resource considerations, total watershed considerations*

- *Knowing the audience(s) & market strategies to reach them*
- *Multi-objective buffer projects*
- *More local BMP case studies*
- *Economist to address economic issues related to buffer establishment*

Is there anything else you would like the conference organizers to know?

- #1 COMMENT HERE: *Great job!*
- *Wanted to hear more from landowners and farmers, particularly those that 1) disagree with the value of buffers, or 2) implement them on the ground.*
- *Invite more media next time to raise public's awareness of the issue*
- *Want participants' list w/contact numbers; mailing list or even a newsletter*
- *Dinner option w/group for those from out-of-town who don't know anyone*

The following additional comments are in no particular order:

- *"Environmental protection & preservation of the future is more essential than economic greed and "property rights'."*
- *"What is the possibility of creating the riparian buffer program by integrating a policy into existing regulation rather than all new regulations and allowing a buffer program to become a means of coordinating goals of all the other programs?"*
- *"Create a registry of community organization contact persons at high schools, colleges, maybe some sort of E-mail or Bulletin Board to facilitate networking."*
- *"What about using the recreational fishing public for establishing riparian forest buffers? Using license fees, adopting streams & rivers, etc."*
- *"Follow-up and keep all conference attendees informed of Forestry Workgroup progress."*
- *"Hold another conference in 2-3 years!"*
- *"Come up and do a workshop for the Delaware Bay estuary!"*
- *"CBC should have researched the effectiveness of existing programs. The exemptions associated with various laws should have acres/feet lost so people could use on a local or county level."*
- *"ACB does great work with conferences."*
- *"You set the stage in plenary, then you break out in sessions to develop consensus -- but if you wait till 2:30 the final day, you've lost a lot of people for that consensus. I don't know how to solve this."*
- *"You all did a great job. When's the next one?"*
- *"We should have done a lunch time reforestation along the stream valley of the Turf Valley Country Club."*

FACT SHEET

Riparian Forest Buffers in the Chesapeake Bay Watershed

Background

When colonists first arrived on the shores of the Chesapeake Bay, over 95% of the landscape was forested. Captain John Smith wrote in 1608, "the country is overgrown with trees...and affords little grass but that which grows in the marshes". This vast forest was an important regulator of the Bay's environment - a "living filter" which protected the land, filtered pollutants and sediment from rainfall, regulated stream and air temperatures, controlled runoff and provided wildlife habitat.

The last 300 years have brought dramatic changes to the Bay's forests. By the mid-1800's, agricultural clearing, deforestation and the growth of cities resulted in the removal of more than 50% of the watershed's forests. These changes in land use resulted in a fragmented forest landscape that impacted the Bay, its streams and rivers, as well as its wildlife and fish. While many forests have returned or have been replanted, less than 60% of our original forested areas remain. With 14 million people living in the Bay's watershed, urban growth now results in the permanent loss of almost 100 acres of forests every day.

What is a riparian area?

Riparian refers to the area of land adjacent to a body of water, stream, river, marsh or shoreline. Riparian areas form the transition between the aquatic and the terrestrial environment.

Linking the landscape to the Bay, close to 100,000 miles of interconnected streams, rivers, wetlands and their riparian areas serve as a "circulatory system" for the Chesapeake Bay. In the Bay region, forests are the natural riparian vegetation. Although comprising only 5-10% of the land in the watershed, riparian areas have an extremely important role in maintaining the health of the Bay. But today, 50% or more of these streamside and shoreline forests are disturbed or degraded and more continue to be lost. Protecting and replanting riparian forests is one of the goals of the Bay restoration effort.

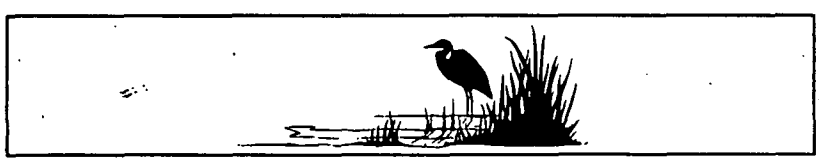
Functions and Values

Riparian forests are integral to the health of the Bay and its rivers for many reasons. Their position in the landscape makes them excellent buffers between upland areas and waters that eventually enter the Bay. Studies have shown dramatic reductions of 30% to 98% in nutrients (nitrogen and phosphorous), sediment, pesticides and other pollutants in surface and ground water after passing through a riparian forest. In addition, trees provide deep root systems which hold soil in place, thereby stabilizing streambanks and reducing erosion.

Cool stream temperatures maintained by riparian vegetation are essential to the health of aquatic species. Shading moderates water temperatures and protects against rapid fluctuations that can harm stream health and reduce fish spawning and survival. Elevated water temperatures also accelerate algae growth and reduce dissolved oxygen, further degrading water quality. In a small stream, temperatures may rise 1.5 degrees in just 100 feet of exposure without trees.

Riparian forests offer a tremendous diversity of habitat. Layers of habitat provided by trees, shrubs, grasses and the transition of habitats from aquatic to upland makes these areas critical in the life stages of over one-half of all native Bay species. Forest corridors provide crucial migratory habitat for neotropical songbirds, some of which are threatened due to loss of habitat. Also, many ecologically important species such as herons, wood ducks, black ducks, as well as amphibians, turtles, foxes and eagles utilize the riparian forest.

Riparian forests also offer many benefits to migratory fish. Forested streams and rivers provide suitable spawning habitat for shad, herring, alewife, perch and striped bass. The decline of these species is partly due to destruction of habitat, which for some, like shad and herring, extends well into small streams. Trees and woody debris provide valuable cover for crabs, small fish and other aquatic organisms along the Bay's shoreline, as well. Degradation of any portion of a stream can have profound effects on living resources downstream. While the overall impact of these riparian forest corridors may be greatest in headwater streams, there is a clear linkage all the way to the Bay.



The Benefits of Riparian Forests

1. Filtering Runoff

Rain that runs off the land can be slowed and filtered in the forest - settling out sediment, nutrients and pesticides before they reach streams. Infiltration rates 10-15 times higher than grass turf and 40 times higher than a plowed field are common.

2. Nutrient Uptake

Fertilizers and other pollutants that originate on the land are taken up by tree roots. Nutrients are stored in leaves, limbs and roots instead of reaching the stream. Through a process called "denitrification", bacteria in the forest floor convert harmful nitrate to nitrogen gas, which is released into the air.

3. Canopy and Shade

The leaf canopy provides shade that keeps the water cool, retains more dissolved oxygen and encourages the growth of diatoms, nutritious algae and aquatic insects. The canopy improves air quality by filtering dust from wind erosion, construction or farm machinery.

4. Leaf Food

Leaves fall into a stream and are trapped on woody debris (fallen trees and limbs) and rocks where they provide food and habitat for small bottom dwelling creatures (such as, insects, amphibians, crustaceans and small fish) which are critical to the aquatic food chain.

5. Stream and Habitat

Streams that travel through woodlands provide more habitat for fish and wildlife. Woody debris serves as cover for fish while stabilizing stream bottoms thereby preserving habitat over time.

The Forest Buffer Concept

The concept behind a riparian buffer is to put the natural benefits and functions of riparian areas to work in nonpoint pollution control. When considering the range of benefits and potential effectiveness, forests are the most effective type of riparian buffer available. These linear strips of forest can serve as the last line of defense from the activities we undertake in managing the land, such as agriculture, grazing and urban development. Unlike most best management practices, the high value of forests to wildlife and fish, helps buffers accomplish habitat benefits at the same time they improve water quality.

A three-zone buffer concept is proposed to assist technical professionals and landowners with planning and design of riparian forest buffers. It provides a framework in which water quality, habitat, and landowner objectives can all be accomplished.

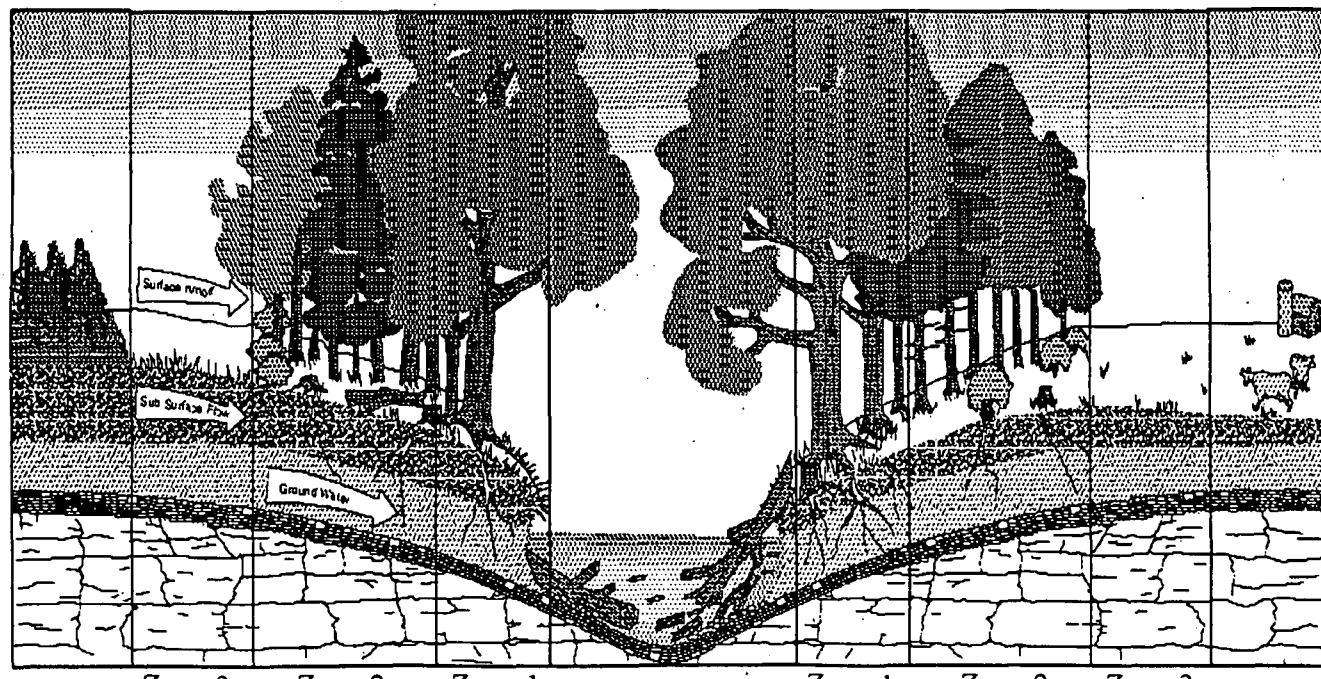
ZONE 1 - A mature forest along the water's edge maintains habitat, food, water temperature and helps stabilize stream banks and remove nutrients.

Definition of a Riparian Forest Buffer:

According to the U.S. Forest Service, a riparian forest buffer is an area of trees and other vegetation which can intercept surface runoff, subsurface flow and deeper ground water flows for the purpose of removing or buffering the effects of nutrients, pesticides or other chemicals from upland land use, which could otherwise enter bodies of water.

ZONE 2 - This zone contains a managed forest. The primary function of Zone 2 is to remove sediment, nutrients and other pollutants from surface and ground water. It also provides habitat and allows for economic benefits to the landowner from the forest resource.

ZONE 3 - Zone 3 contains grass filter strips, level spreaders or other features which can slow runoff, infiltrate water and help filter sediment and its associated chemicals.



Programs Which Can Help

Many state and federal agencies have initiated programs to help protect and restore riparian forest buffers. USDA Programs such as the Conservation Reserve Program, Wetland Reserve Program, Forest Stewardship Program, as well as numerous agricultural conservation practices are designed to provide technical and financial assistance to landowners who want to protect or restore this resource. In developed areas, zoning, land use and stormwater provisions may provide opportunities for greater use of riparian forest buffers. Volunteer assistance with design and planting can be obtained. In some states, easements and tax incentives may be used to protect and restore buffers on private land. A Buffer Incentive Program in Maryland makes a per acre payment to landowners. Call your local forestry, soil conservation, farm service or local planning office for more information about programs that are available in your area.

Chesapeake Bay Program Riparian Buffer Initiatives

The Chesapeake Bay Program has initiated a number of actions to promote better understanding and appreciation for the value of riparian forests and to encourage their protection and restoration. Building a scientific foundation, the Bay Program published a scientific synthesis which defines the water quality function of buffers in the watershed. The Nutrient Subcommittee and its Forestry Work Group have also initiated research and established demonstration projects. In addition, an inventory of the status and condition of riparian buffers throughout the six state watershed is underway. In partnership with each of the states, the Bay Program is developing a handbook for the design and establishment and the initiation of training programs for technical specialists, landowners and mangers and local governments. Protecting buffers and stream corridors where they exist and planting in disturbed riparian areas are significant elements of a Baywide strategy to reduce nutrients - the Tributary Strategies.

In October 1994, the Executive Council of the Chesapeake Bay Program signed a Riparian Forest Buffer Directive, which recognized the need for greater riparian forest buffer protection and restoration. With the help of citizens, landowners and other stakeholders, an expert panel of scientists and managers will set future goals and develop a basinwide policy to enhance existing programs which protect, maintain and restore riparian forest buffers. Combined with habitat restoration strategies, this multi-faceted program will help improve riparian management and the health of our streams and rivers and the Chesapeake Bay itself.

For more information contact:

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VEGETATED STREAM RIPARIAN ZONES: THEIR EFFECTS ON STREAM NUTRIENTS, SEDIMENTS, AND TOXIC SUBSTANCES

An Annotated and Indexed Bibliography

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Third Edition

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INTRODUCTION

The goal of this document is to comprehensively cite and subject index the World literature on vegetated stream riparian zone water quality effects. Each citation, with the exception of student theses, has been obtained, studied for content, and cross-indexed for other relevant citations. Only publications which were readily obtained through a research library system were included. Publications on tidally-influenced wetlands and exclusively lake riparian zones were excluded.

In order to make this goal tenable I have established somewhat arbitrary, but fairly rigid boundaries for relevant subject matter. Studies of all types of vegetation were included; forest, grass, herbaceous. Relevant studies include influences on water quality of inputs of surface and groundwater from the uplands and interactive effects among the water in the channel, the hyporheic zone, and the floodplain. Water quality includes concentrations of nutrients, suspended sediments, dissolved and particulate organic matter, pH, metals, and pesticides of all types. Studies of large woody debris are specifically excluded. Also excluded are studies of the application of municipal sewage and industrial/mining effluent to riparian zones. However, studies were included of effects on agricultural waste waters and a limited number of studies on urban or suburban drainage waters. I have excluded riparian vegetation habitat effects, both terrestrial and aquatic, and in-stream processes such as productivity, nutrient cycling/spiraling, water temperature, channel morphology. I have also excluded the many studies of water quality transformations by stream bed sediments in which only shallow depths were measured and no inferences of riparian zone effects were evident.

All citations except for those of student theses have brief annotations to help identify the aspects of these studies which are particularly relevant. They are also coded for subject matter as listed below.

I. Document Type
- D = Contains New Research Data
- M = Management Oriented
- R = Review of Relevant Publications

II. Vegetation Type in Riparian Zone
- F = Forest
- G = Grass
- H = Herbaceous

III. Stream Order, e.g. 1st order, 2nd order

IV. Hydrologic Parameters

GW = Groundwater
HZ = Hyporheic Zone Interactions
OF = Overland Storm Flows
TS = Hydrologic Tracers Utilized

V. Geology of Study Site

CP = Coastal Plain Province
PT = Piedmont Province
MT = Mountain Provinces

VI. Water Quality Parameters

Al = Aluminum
Ca = Calcium
DAM = Dissolved Ammonium
DOM = Dissolved Organic Matter
DPP = Dissolved Phosphate Phosphorus
DTKN = Dissolved Total Kjeldahl Nitrogen
DTP = Dissolved Total Phosphorus
Fe = Iron
HERB = Herbicides
INS = Insecticides
K = Potassium
Mg = Magnesium
Mn = Manganese
Na = Sodium
NIT = Nitrate & Nitrite
PAM = Particulate Ammonium
pH = pH
POM = Particulate Organic Matter
PPP = Particulate Phosphate Phosphorus
PTN = Particulate Total Nitrogen
PTP = Particulate Total Phosphorus
PTKN = Particulate Total Kjeldahl Nitrogen
TN = Total Nitrogen
TP = Total Phosphorus
TrM = Trace Metals
TSS = Total Suspended Sediments

VII. Riparian Processes

BioStor = Storage in Biomass of Riparian Zone
Denit-F = Denitrification Measurements in the Field

Denit-L = Denitrification or Denitrification Potential Measurements in the Laboratory
Nitrif = Nitrification Measurements
ET = Evapotranspiration in Riparian Zone
Flux = Flux Rates Measured Through Riparian Zone
Infil = Infiltration in Riparian Zone
MBal = Mass Balance of Movement Through Riparian Zone
NutCyc = Special Effects of Nutrient Cycling Within Riparian Zone
SedTrap = Sediment Trapping Rates Within Riparian Zone

While these subject codes are not comprehensive, they cover most of the topics relevant to this bibliography. A maximum of eight subject codes were assigned to each publication. In some cases many more could have been selected so those that seemed the most important were selected.

The materials in this bibliography will be maintained in a bibliographic computer file, which can be searched for individual or combinations of factors for special interests of users. Obviously, it can also be updated periodically. I hope it will be a useful research and management tool for everyone interested in this topic.

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