Cooperative Forest Watershed Management in Maryland: Watershed Restoration Across Land Ownerships

Anne Hairston-Strang
Maryland Department of Natural Resources, Forest Service, Annapolis, Maryland

The Maryland Department of Natural Resources Forest Service has worked cooperatively with USDA Forest Service Northeastern Area State and Private Forestry to develop a forest watershed management program that covers public and private land. Maryland has 41% forest cover state-wide, predominantly privately owned. The forest watershed program spans riparian forest buffer restoration, drinking water reservoir watershed management, forest harvesting Best Management Practices (BMP) assessment, and targeted watershed activities. Progress has included 1722 km of riparian forest buffers planted since 1996, statewide forest buffer survival estimates increasing from 60% of planted seedlings in 2000 to 78% in 2002, a comprehensive forest conservation plan for 7,225 ha of forest surrounding the Baltimore, Maryland, drinking water supply, developing the Potomac Watershed Partnership with five other major partners in the region, and assessing harvesting BMPs in the state in collaboration with the Northeast Area Regional BMP Assessment Protocol.

Keywords: *Aquatic/riparian; watershed restoration, watershed management, timber harvesting BMPs*

Introduction

The Maryland Department of Natural Resources Forest Service established a watershed forest management program in 2001 to better encourage the use of forests and forestry to improve watershed condition in the state. The USDA Forest Service State and Private Forestry has been an important resource for technical and financial assistance in developing an effective program. The design for a watershed program depends on conditions in the watershed. Some of the major resources and stressors in Maryland are covered briefly here as context for Maryland's watershed forestry efforts.

With 5 million people, Maryland is the fifth most densely populated state in the nation and has 41% forest cover. Maryland lacks any national forest land, although neighboring states to the south, west, and north have substantial national forests. Maryland does have state forests and parks, national park land, national wildlife refuge land, military bases, and state natural resource management areas that include significant forested areas and provide long-term forest conservation. Maryland also benefits from a close partnership with USDA Forest Service Northeastern Area State and Private Forestry, an important connection in a state where forestland is 76% privately owned. Maryland lies in the middle of the Chesapeake Bay watershed, and is heavily involved in the regional program to reduce nutrients and improve living resources in the Chesapeake.

The areas with the most extensive forests are in the mountains in the western portion of the state and on the coastal plain in southern Maryland and the lower Eastern Shore (Figure 1). Piedmont areas in the central portion of the state (Baltimore/Washington, DC, corridor and concentrations of agricultural lands) have the least forest cover. The forest products industry is the fifth largest in the state, and many small mills and secondary manufacturing facilities provide demand for wood. However, in many areas of central and southern Maryland, population density and small parcel sizes limit the likelihood of active management for any reason, even timber stand improvement, wildlife, or water quality (Figure 2).

Baltimore, Washington, DC, and several smaller communities draw substantially on surface water reservoirs for drinking water, which goes through water treatment facilities before delivery. Even outside of the reservoir systems, many areas rely on rivers and streams for drinking water sources. Many watersheds in central Maryland are substantially developed and bear the effects of land use changes in loss of function in streams.

In a recent study in Montgomery County in the Maryland Piedmont west of DC, Goetz et al. (2003) quantified the relationship between impervious surfaces, forest buffers, and forest cover (Figure 3). They found

M Furniss, C Clifton, and K Ronnenberg, eds., 2007. *Advancing the Fundamental Sciences: Proceedings of the Forest Service National Earth Sciences Conference, San Diego, CA, 18-22 October 2004*, PNW-GTR-689, Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

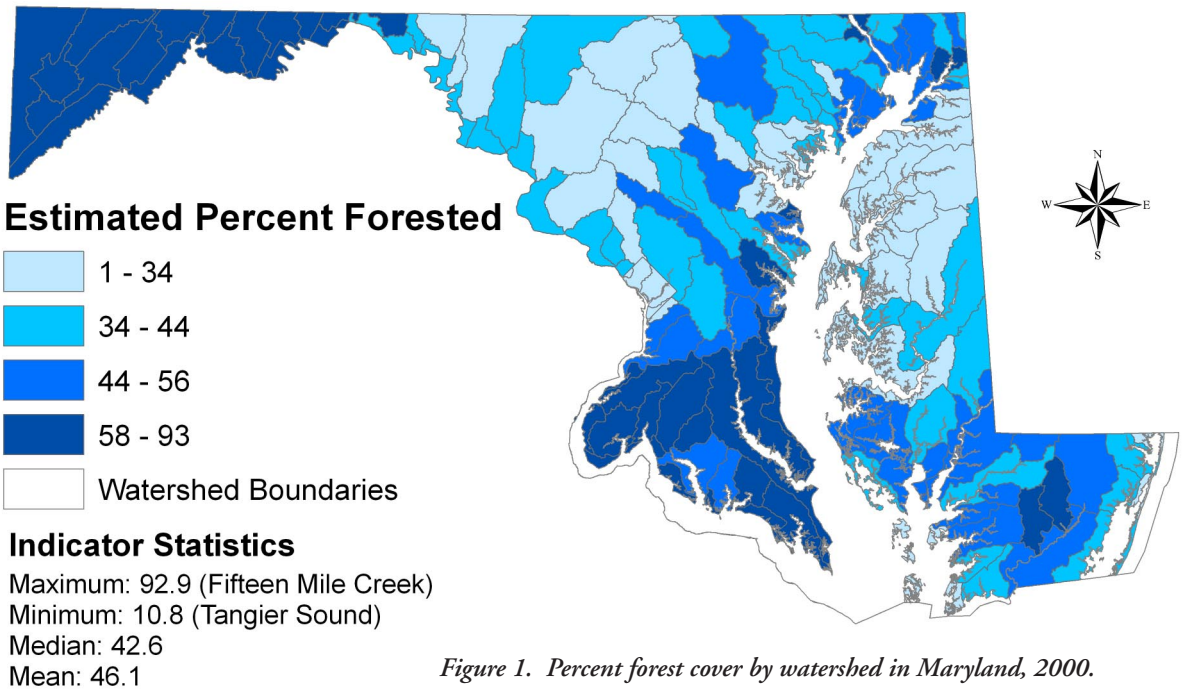
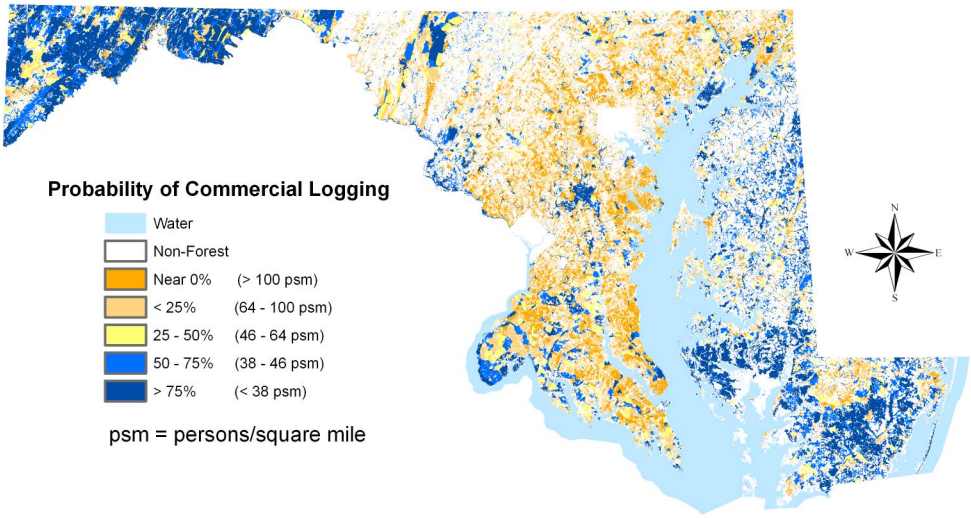


Figure 1. Percent forest cover by watershed in Maryland, 2000.

Figure 2. Probability of commercial logging of forests in Maryland as predicted from population density.



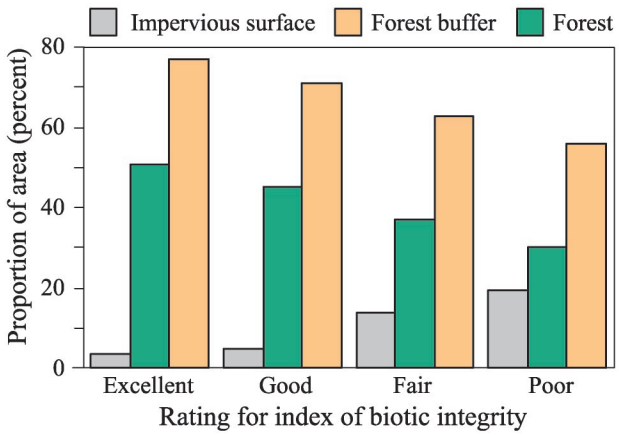


Figure 3. Percent of impervious surfaces, forest cover in watershed, and forest buffers for streams receiving excellent, good, fair, or poor ratings for an index of biotic integrity based on benthic macroinvertebrate composition.

the closest relationship to the Index of Biotic Integrity (IBI) for benthic macroinvertebrates was with impervious surface percentage, and the next closest with forest buffers. Forest cover in the entire watershed was the least closely linked but still important. In a range of watersheds from mostly rural to intensely urban, there were no streams with "excellent" IBI rankings except where watersheds had less than 6% impervious surface and more than 65% forest buffer. Even "good" IBI ratings were found only where impervious surfaces were less than 10% of the watershed and where more than 60% of the streams had forest buffers.

Within the context of extensive population and still significant forested areas, the Maryland Forest Watershed Program currently has four concentrations:

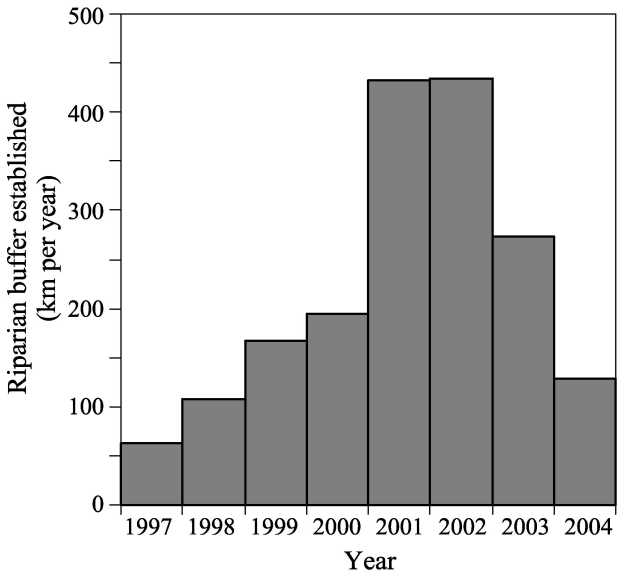
- Riparian forest buffers
- Forest management to protect drinking water reservoirs
- Watershed partnerships
- Forest harvesting Best Management Practices (BMP) assessments.

Riparian Forest Buffers

Streamside areas are an essential focus for watershed health because their influence on streams is great in comparison to their area. Forests are a preferred riparian land use because they help prevent nutrient input to streams and foster greater instream nutrient processing (Sweeney et al. 2004), in addition to providing riparian and aquatic habitat. Riparian forest buffers (RFBs) have been part of Maryland's forestry program since 1987. They became a focus in 1996, when the Chesapeake Bay goal of 3235 km (2010 miles) of new RFBs created by the year 2010 was adopted, recognizing the importance of buffers for improving water quality and habitat. Maryland committed to 965 km towards that goal. The Conservation Reserve Enhancement Program (CREP), authorized in the 1996 Farm Bill, became the major tool in expanding the rate of buffer creation. From an average of 19 km of buffer per year prior to 1996, buffer creation increased more than ten-fold (Figure 4). Expanded benefits under CREP stimulated even more increases, but later decreases in payment rates and eligibility saw rates fall off.

Maryland established 1,722 km (1,070 miles) of RFBs between 1996 and July 2004, about 2.6% of the state's riparian miles. The summaries sound simple, but the order-of-magnitude and greater increases required ramping up activities in a number of service arenas, including landowner assistance, training for resource professionals, supplying native hardwood seedlings, making planting machines available, and finding or training skilled contractors. Efforts

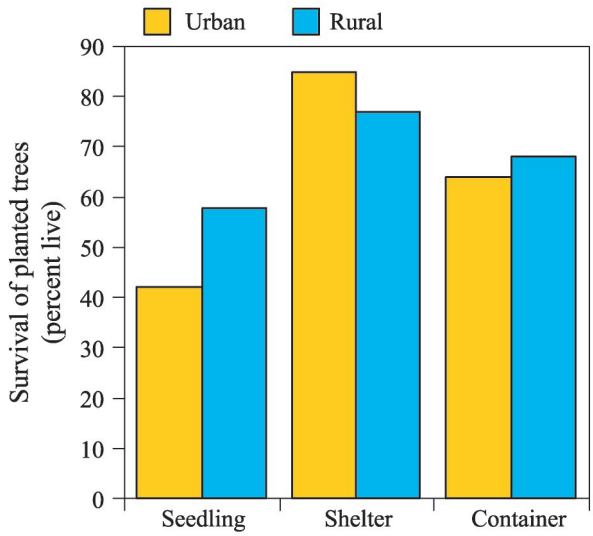
Figure 4. Kilometers per year of riparian forest buffers established in Maryland.



were also made to assess overall survival of seedlings, contribution of natural regeneration, and effect on stream and riparian functions. USDA Forest Service support was essential in expanding capabilities and funding training and buffer assessments through state grants, including the Potomac Watershed Partnership.

Seedling survival was assessed using a consistent statewide method in 2000 (Pannill et al. 2001) and 2002. Survival increased from an average of 60% in 2000 to 78% in 2002, attributed to increased maintenance efforts. Natural regeneration was not consistently present, but was significant on many sites, with one-third of trees being volunteers in the 2000 survey and one-quarter in 2002, even with increasing mowing and spraying to favor planted trees. Monitoring of riparian plantings as part of the Potomac Watershed Partnership found 87% average survival through 2003. The surveys were also used to assess stressors on survival. The top three factors affecting survival were weed competition, drought, and deer browse. Weed competition was by far the greatest, with noxious or invasive species being common, but not usually dominant, on newly planted sites. Deer damage is especially problematic in the middle portion of the state, where the proportion of a third forest, a third farm, and a third developed land proves to be the recipe for large deer herds with low hunting pressure. As a result, tree shelters were commonly recommended, and proved beneficial to survival (Figure 5). Other stress factors that were less common but problematic where present were insects, beavers, voles, and mice. Particularly on urban sites, mechanical damage from weedeaters and mowers took a toll on tree survival.

Figure 5. Percent survival of planted trees in riparian forest buffers in Maryland, 2000.



FOREST MANAGEMENT FOR PROTECTION OF DRINKING WATER RESERVOIRS

Land management in watersheds draining into reservoirs used for public drinking water greatly affects water quality and treatment costs for water supply. Maryland DNR Forest Service has partnered with municipal water suppliers in developing forest management plans for lands immediately surrounding reservoirs. Baltimore City's reservoirs were established starting before the turn of the 20th century, and the landscape surrounding the water supply has changed dramatically in the 100+ years since (Figure 6). Urbanization now affects a major portion of the Loch Raven watershed. The reserved lands immediately adjacent to the watershed are now even more critical for appropriate management, as are buffer reforestation efforts along tributaries throughout the watersheds.

A comprehensive forest conservation and management system was developed for the 7,225 ha of forested lands owned by Baltimore City around its three reservoirs, based on the city's hierarchical goals of water quality, biodiversity and recreation, and emphasizing restoring forest resilience. Issues that emerged as significant for the City's primary goal of water quality included a dearth of regenerating seedlings for sustainable forests, extent of recreational use including mountain bikes and off-road vehicles (ORVs), excessive area in roads and damaged stream crossings, and forest stands currently susceptible to windthrow. The management approach includes deer exclosures on parts of regeneration cuts to demonstrate the effect of excessive deer browse, gradual stand conversion to more windfirm stand types, and management of shallow soils near nutrient sources to encourage rapid growth and nutrient uptake. A complementary watershed-wide analysis of land critical to reforest or conserve was completed, funded by USDA Forest Service. It developed better information on stream networks and forest distribution, and identified priority lands for conservation and restoration.

WATERSHED PARTNERSHIPS

Maryland forestry watershed partnerships range in scale from the Chesapeake Bay Program, covering a good part of the Mid-Atlantic region, to the Potomac Watershed

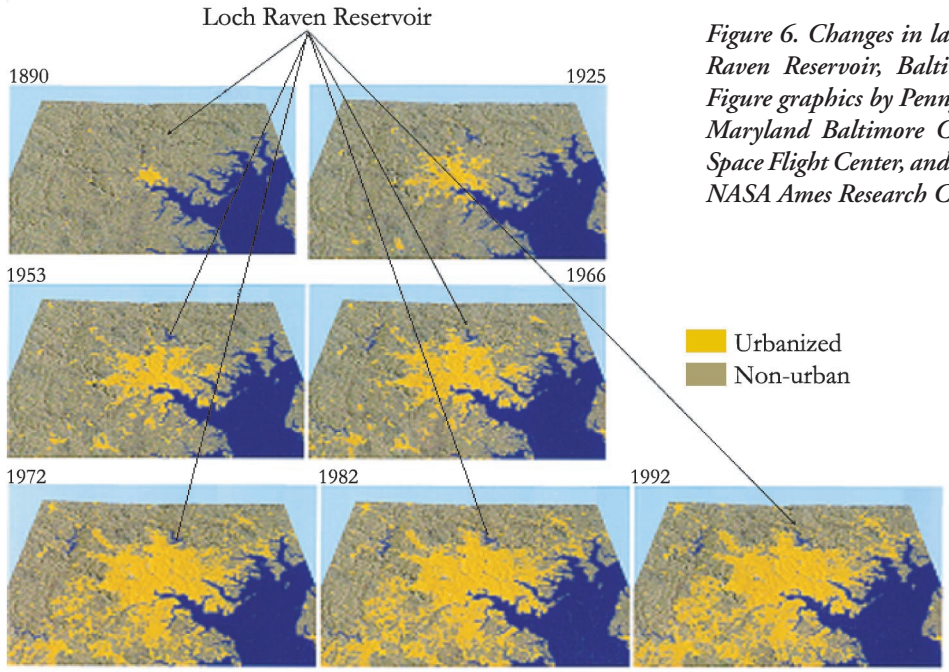


Figure 6. Changes in land use surrounding Loch Raven Reservoir, Baltimore, MD, 1890-1992. Figure graphics by Penny Masuoka, University of Maryland Baltimore Campus, NASA Goddard Space Flight Center, and William Acevedo, USGS, NASA Ames Research Center.

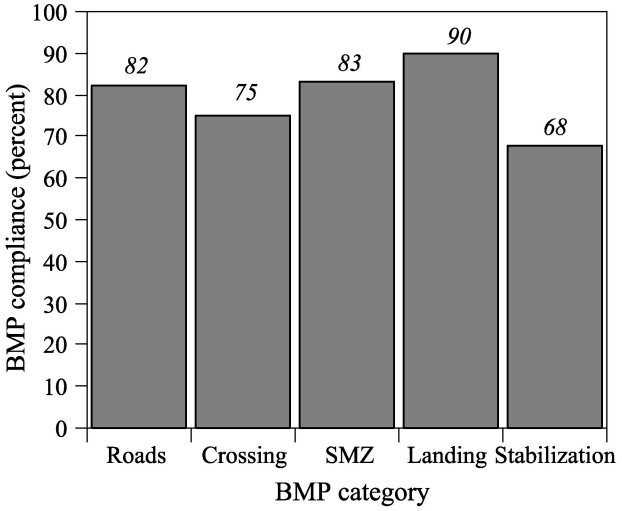
Partnership with surrounding states, and the Special Rivers Chesapeake Bay Implementation Grant, focusing on four areas within Maryland. The Potomac Watershed Partnership (PWP), used as an example here, is one of the large-scale, community-based watershed restoration efforts initiated with USDA Forest Service funding. PWP partners include Virginia Department of Forestry, Pennsylvania Department of Environmental Protection, Ducks Unlimited, George Washington/Jefferson National Forest, and Potomac Conservancy. The focus watersheds in Maryland were selected based on priority watersheds with the lowest proportion of forest buffers, using information from the state's Clean Water Action Plan. The PWP is our best effort at integrating the range of forestry services, including forest stewardship, forest fire risk reduction, monitoring of RFB survival and effectiveness, and urban forestry, on a watershed basis. It provides the focus and framework for expanding landowner services for forest stewardship and buffer restoration, coordinating monitoring of buffer restoration, minimizing risk from damaging wildfires, and increasing community forestry projects in an area of the state that has particular need for watershed improvement.

Examples of projects that draw on the synergy of multiple partners focused on mutual objectives, include the Growing Native project, a volunteer seed collection that also spreads the message about need for watershed restoration, and a recent conservation landscaping project that pulled together information on rain gardens (vegetated infiltration areas), native plants, and fire-resistant landscaping. The partnership helps expand horizons and focus resources on common goals.

HARVESTING BMP ASSESSMENT

Forests provide one of the least-polluting land uses in the watershed, a circumstance that relies on appropriate use of BMPs during periodic harvesting. Maryland is cooperating with Northeastern Area State and Private Forestry on a regional assessment of harvesting BMPs developed by Maine Forest Service. The regional protocol allows comparison across state lines and focuses on sediment delivery pathways and quantifiable measures. Maryland will be doing 80 samples statewide, with the samples being defined from stream crossings as called for in the protocol. Maryland is particularly interested in this approach to harvesting BMP assessment because it could be used to support Total Maximum Daily Load development (rather than assigning disproportionately large sediment sources to poorly documented timber harvesting), and Chesapeake Bay Program nutrient reduction modeling and tracking.

Figure 7. Implementation rates for forest harvesting BMPs in Maryland, 1995.



Maryland has completed previous studies on BMP use, for effectiveness and implementation rates. A paired watershed study with a one-year calibration period was conducted from 1995 to 1999 in the Piedmont physiographic province (Pannill et al. 2000). It assessed effects of forest harvesting using standard state BMPs on stream benthos, temperature, and suspended sediment, none of which were found to differ significantly following harvest. For BMPs to work as intended to protect water quality, they have to be widely applied. Maryland did a statewide survey of BMP implementation in 1994, and found an average 82% application rate, with the steeper western portions of the state having greater difficulty in maintaining BMP compliance (Figure 7). The 2004-2005 assessment will update statewide BMP implementation rates.

SUMMARY

Forests play an important role in watershed health throughout Maryland. The Maryland Department of Natural Resources Forest Service has worked cooperatively with USDA Forest Service State and Private Forestry to develop a forest watershed program that emphasizes using forests and forestry to improve watershed condition. The state has made significant advances in riparian forest buffer restoration and forest watershed management approaches for drinking water reservoirs. Maryland is using and assisting with the development of a regional harvesting BMP assessment protocol that may prove useful for state water quality modeling and Chesapeake Bay reporting. Watershed partnerships at several different scales are being used effectively to increase coordination and focus

attention on geographic areas and activity types that improve watershed health. These advances have occurred during a time of shrinking state budgets and staff. The leadership, technical assistance, training coordination, and financial support of Northeastern Area State and Private Forestry have been critical to expanding the state's program in watershed forestry and increasing the use of forestry as a solution to non-point source pollution.

LITERATURE CITED

Goetz, SJ, RK Wright, AJ Smith, E Zinecker, and E Schaub. 2003. IKONOS imagery for resource management: Tree cover, impervious surfaces, and riparian buffer analyses in the mid-Atlantic region. *Remote Sensing of the Environment* 88(2003): 195-208.

Pannill, PD, AB Hairston-Strang, CE Bare, and DE Robbins. 2001. Riparian forest buffer survival and success in Maryland. FWHS-FS-01-01. Annapolis, MD: Maryland Department of Natural Resources. 50 p. *http://www.dnr.state.md.us/forests/publications*.

Pannill, PD, JL McCoy, SE O'Ney, CE Bare, NL Primrose, and SE Bowen. 2000. Evaluating the effectiveness of Maryland's best management practices for forest harvest operations. FWHS-FS-00-01. Annapolis, MD: MD Dept. of Natural Resources. 32 p. http://www.dnr.state.md.us/forests/publications.

Sweeney, BW, TL Bott, JK Jackson, LA Kaplan, JD Newbold, LJ Standley, WC Hession, and RJ Horwitz. 2004. Riparian deforestation, stream narrowing, and loss of stream ecosystem services. *Proceedings of the National Academy of Sciences of the United States of America* 101(39): 14132-14137.