



Baltimore County

Forest Sustainability Strategy

Steering Committee Final Draft

***Baltimore County Linking Communities to the Montreal
Process Criteria & Indicators Project***

November, 2005



***Baltimore County, Maryland
Department of Environmental Protection and Resource Management***

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Preface

“Moving Toward Forest Sustainability”

Through preparation and adoption of this Draft Forest Sustainability Strategy, Baltimore County is entering an environmental management arena where few if any county governments in the U.S. have ventured to date. This follows a forty-year tradition of effective growth management through the Office of Planning and nearly twenty years of environmental initiatives through the Department of Environmental Protection and Resource Management. By the year 2000, some 90% of Baltimore County’s 750,000 citizens lived inside its urban growth boundary, essentially defined in the late 1960’s, an area that occupies only one-third of the land. The rural areas of the County protected from intense urban development include productive farms, forests, and watersheds of three regional drinking water reservoirs. Baltimore County’s accomplishments were recognized in 2005 by the Consortium on Biodiversity and Land Use in the Island Press book, *Nature-Friendly Communities*. The implementation of this Strategy is intended to build upon and enhance existing programs for the protection of ecosystem services provided by the County’s forest base.

Despite past progress, the County’s Steering Committee of the *Linking Communities to the Montreal Process Criteria and Indicators* Project has found that a far broader perspective and program is critical to the future of Baltimore County’s forests and it must move forward soon. The Montreal Process, an internationally-recognized science-based framework for measuring the condition of forest resources at a national scale, emphasizes that forest sustainability includes both ecological and economic considerations. Baltimore County has served over the past few years as a national pilot to evaluate the potential for application of the Montreal Process at the local level. Working with federal, state, business, environmental, and citizen partners, the County has benefited from a fresh look at the forests that cover one-third of its landscape but for which government and the private sector invest only a fraction of that invested for management of agriculture resources and development.

As a result of population growth and long-term un-balanced stewardship and investment, forests that once covered nearly all of Baltimore County’s landscape have been reduced to one-third of their former extent. Even with State-mandated forest protection, Baltimore County continues to lose forest at the rate of several hundred acres per year due to development alone. In addition, human disturbances have accelerated the rate at which stressors are attacking the natural resilience and stability of the forest. County citizens see many trees everywhere, yet inside these increasingly-fragmented stands the basic ecological functions are threatened by edge effects including invasive and exotic species, herbivory by over-populated deer, and forest insects and diseases. The fragmented patches that remain, with an average patch size

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of about 14 acres, are being further carved up through multiple ownerships. Many new owners of the forest resource are ill prepared to manage their forests for any purpose.

The disinclination and unwillingness to understand the forest, to bring sound science to its management, and to plan for sustainability have resulted in overall “benign neglect.” Some citizens surely expect that leaving remaining forests completely untouched is the answer to this increasing fragmentation and parcelization crisis. They have come to fear “management,” a word that, for many, brings to mind a horror of buzzing chain saws and clear-cuts, resulting in the complete loss of forests to development and other consumptive uses. The reality is that the forest base has been lost not through management for forest products, but through land conversion for agricultural activities in the past and, to a lesser extent, for urban development in recent decades. As a result, fragmented forests in Baltimore County cannot sustain many of their beneficial services without careful and active management.

As productive forest land disappears from Baltimore County and forest owners increasingly choose “benign neglect” over thoughtful management, the local forest industry is dying. Even in an age of high demand for and increasing per capita consumption of forest products, including products from foreign sources, it is not proposed that the County’s forests should be harvested such that they are in a continuous state of youthful aggradation. Some forests can be producing forests; some forests can continue to evolve toward old growth cathedrals of nature, models and reminders of what was before. Forest resources represent a continuum of condition and potential use, and it is most important that current forest conditions be assessed and that management plans be prepared. These plans can balance any potential human uses of forests with existing and potential ecological functions.

In many areas, past management and natural stressors from increased edge effects following fragmentation have left less desirable and less-functional forest stands. Perhaps they lack desirable species diversity or structural diversity. Perhaps they contain too many exotic, invasive species, or perhaps they can be enhanced to encourage desirable native forest wildlife. Even if performed only for the purpose of improving forest health and providing ecological services, some silvicultural manipulation of forests may be desirable and necessary. Like a sick patient, doing nothing or letting nature take its course may mean an extended healing period, or death of the patient. If desirable environmental and economic outcomes can be determined from a realistic evaluation of conditions and potential, then society’s best knowledge and skills can be applied to effect a future of choice. Important decisions therefore need to be made for public and private forest lands about management objectives.

The Steering Committee that prepared this Strategy believes that the path out of a continuing spiral of non-sustainability - a decreasing, fragmented, and parcelized forest land base and degrading quality of our remaining forests - lies in improving education about forests and the economics of sound forest management. For it is only when a resource is understood and valued, and when managers have financial incentives and

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can yield some returns from their efforts and/or pay for management, that an active interest in the future of the resource is realized.

Forests provide an incredible range of economic benefits and this Strategy indicates that much work can and must be done to develop programs for forest economics, from developing markets for alternative forest products to protecting air quality and addressing climate change through carbon sequestration. If the 75% of forest lands in the County that are in private ownership are to remain and not be converted to non-forest, and if they are to contribute to critical ecosystem functions such as stabilizing streams, providing wildlife habitat, and protecting the drinking water supply for 90% of the County's citizens and one-third of the population of Maryland, then the County must work with the forest industry, other agencies, and its citizens to raise their awareness about forest sustainability, to assess the health of their forests, and to engage them in better stewardship.

It has been said that sustainability is not an absolute but a direction. Given the importance of Baltimore County's forest resources to air and water quality, especially for its streams, groundwater quality, and drinking water reservoirs, conservation of biological diversity, recreation, and forest products, the Steering Committee urges that the County adopt this Strategy and evaluate for implementation the recommended actions herein. The Steering Committee stands ready to continue its partnership for forest sustainability in Baltimore County.

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Forest Sustainability and the Purpose of this Strategy

The Forest Sustainability Strategy is a proactive, comprehensive and balanced approach to the management of Baltimore County's forest resources. Sustainability is defined here as "*meeting the needs of society today without diminishing the ability of future generations to meet their needs.*" This Strategy summarizes current and future management challenges for assuring that forest resources provide critical ecological services while also meeting the socio-economic needs of the County's citizens. The Strategy also identifies fifteen major issues or problem areas for forest resource management; provides some background context for current management efforts; and proposes goals, recommended actions, and work plan activities for each issue.

Intended Audience and Policy Role

While it is hoped that this Draft Strategy will be of interest to citizens concerned about the County's environmental future and forests, as well as special private organizations ranging from watershed associations to the forest industry, the primary audience of this Strategy is Baltimore County agencies and leaders, including the Planning Board, the Baltimore County Council, and the County Administration. The Strategy points the way for the County to continue its development and implementation of a more comprehensive forest management program. As the Strategy essentially represents, in total, recommended policy for forest sustainability, the Strategy could be adopted as an amendment to the Master Plan 2010, similar to the adoption in 1993 of the Department of Environmental Protection and Resource Management's (DEPRM) Groundwater Protection and Management Strategy as a Master Plan amendment.

Origins of the County's Development of a Forest Sustainability Program

For nearly two decades, the Department of Environmental Protection and Resource Management has been charged by the County Council to conserve, enhance, and perpetuate the natural resources of Baltimore County. Expanding upon County policies and regulations adopted earlier in the 1980's for resource protection, DEPRM in 1989 began implementation of enhanced regulations to limit disturbances associated with development in ecologically sensitive areas, including forested stream buffers, floodplains, wetlands and steep slopes with erodible soils. In 1992, local implementation began of the Maryland Forest Conservation Act, to reduce forest clearing during development and to promote reforestation, particularly in sensitive areas.

In addition to regulatory initiatives, in 1996 DEPRM developed a methodology for identifying ecologically important greenways, under contract to the Maryland Department of Natural Resources (MD DNR) as part of the State's Green Infrastructure

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initiative. This relationship with MD DNR led to the introduction of the County's work to officials with the USDA Forest Service's Sustainable Development program (Urban and Community Forestry). In May 2001, the USDA Forest Service invited Baltimore County to participate in their national work under the Montreal Process Criteria and Indicators project. As part of the Forest Service's work with the Communities Committee of the Seventh American Forest Congress, Baltimore County was invited to be one of three county case studies in the U.S. for the *Linking Communities to the Montreal Process Criteria and Indicators* Project. The *Linking Communities* project sought, in part, to evaluate the application at the local level of internationally-derived science-based criteria and indicators that measure forest health and sustainability. DEPRM saw this as an opportunity to bring a balanced framework to identify and address issues relevant to the sustainable management of the County's forest resources.

The Montreal Process

The 1992 Earth Summit, or United Nations Conference on Environment and Development (UNCED), called upon all nations to ensure sustainable development, including the management of forests. Following UNCED, Canada convened an International Seminar of Experts on Sustainable Development of Boreal and Temperate Forests in Montreal in 1993, to develop forest criteria and indicators. The U.S. and 12 other nations, which collectively comprise 60% of the world's forests and 90% of boreal and temperate forests, agreed to use the MP C&I as a national-level tool to measure the ecological and economic sustainability of their forests. Seven Montreal Process Criteria represent broad values of forest resources, from ecological functions to socio-economic values. Some 67 detailed data Indicators have also been developed to assess conditions and measure progress toward sustainability. The MP Criteria follow:

The Montreal Process Criteria

1. Conservation of Biological Diversity
2. Maintenance of the Productive Capacity of Forest Ecosystems
3. Maintenance of Forest Ecosystem Health and Vitality
4. Conservation and Maintenance of Soil and Water Resources
5. Maintenance of Forest Contribution to Global Carbon Cycles
6. Maintenance and Enhancement of Long-Term Multiple Socio-Economic Benefits to Meet the Needs of Societies
7. Legal, Institutional, and Economic Framework for Forest Conservation and Sustainable Management

Development of the County's Forest Sustainability Strategy

With the support of the USDA Forest Service, American Forests and Sustainable Measures, Inc., DEPRM held a day-long Sustainability Issues and Indicators Forum at Oregon Ridge Park in June of 2003. The 65 Forum attendees represented a broad

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spectrum of interests in the ecological and economic management of the County's forest resources, from both public and private sector perspectives. Major products of the Forum included the identification of 16 issues relevant to the County's forest resources, 11 goals, and 45 potential data indicators for working toward forest sustainability. Additionally, the Forum inspired the formation of a Steering Committee, which has met since July 2003, systematically utilizing the Montreal Process framework to research the identified issues and to produce this Forest Sustainability Strategy.

The 20 members of the County's Steering Committee developed a Forest Sustainability Issues Paper in December 2003 to serve as a summary of (1) the condition of the County's forest resources based on existing information, (2) issues, apparent to committee members, for the ecological and economic sustainability of forest resources, and (3) the potential for application of the Montreal Process for addressing these issues. The Issues Paper laid the groundwork for proceeding to develop this Forest Sustainability Strategy. The box on Page 4 summarizes the major issues identified by the Steering Committee.

The information available to the Steering Committee collectively points to the fact that our existing forest cover is very different from that of pre-European settlement. Not only has the extent of forest cover been reduced to one-third of the land area, but the processes that drive the health, stability, and resiliency of forests have also been altered as a result of human disturbances. The forest ecosystem that evolved in the present climatic period regulated the hydrologic cycle, resulting in a certain stability in watershed processes. As today, forested watersheds have stable stream channels, minimized export of nutrients and sediment, and structural habitat elements that support diverse and abundant wildlife populations. The forest ecosystem was dynamic and changed slowly due to relatively small and infrequent natural disturbances such as wind and ice storms and wildfire. Forests also provide for multiple air quality benefits and are important for sequestering atmospheric carbon. Although forests are naturally resilient and renewable resources, long-term human disturbances now threaten their ability to sustain critical ecosystem functions and to meet the needs of our citizens for the future.

Using the Montreal Process framework, the outcomes of the Forum, and the additional knowledge gained through research and discussion that culminated with development of the Issues Paper, the Steering Committee then determined that a forest sustainability program needed to be developed. Among the items prepared by the Steering Committee was the following Vision Statement for Forest Sustainability:

Vision Statement for Forest Sustainability

"To encourage sustainable forest resource management, the citizens, forest landowners, and state and local government agencies of Baltimore County will, through partnership and implementation of a sound stewardship ethic, seek to promote healthy and productive forests, managed with consideration for ecosystem values including clean air, clean water and biological diversity and managed to meet the social and economic needs for present and future generations."

**Key Steering Committee Findings about the Condition of
Baltimore County's Forest Resources**

1. The County's forest base, as measured by acreage of total **forest cover** and **interior forest**, is inadequate, and many forested areas are of poor quality due to past management practices.
2. The County has no program to increase or better protect forests in **reservoir source water areas**.
3. There is no program to increase forest cover as mitigation for worsening regional air quality.
4. No assessments of the **biological diversity** potential of the County's forests have been conducted and there is no County-wide plan for **conservation** of biological diversity.
5. Most of the public forest lands, which comprise one-quarter of all forests, have not been assessed for **forest health, ecological function**, or vulnerability, and there are no forest stewardship plans for any of the County or State-owned forest lands in Baltimore County.
6. Forests in the County are spatially fragmented into too many small pieces, and they are coming under an increasing number of owners, many of whom are unknowledgeable and inexperienced regarding forest management.
7. Diseases and insect pests increasingly threaten existing forests. The regenerative capacity of forests in many areas of the County has all but been eliminated due to continual browsing by a highly overpopulated white-tailed deer community.
8. The County has only about half of the desirable "urban" forest cover, and no comprehensive **urban forest** program essentially exists.
9. More effective programs are needed to educate and work with landowners, particularly farmers, to better protect streams and sensitive lands through reforestation.
10. Citizens in general and forest landowners in particular lack education about science-based forest management. Also, many citizens oppose any forest **harvesting**.
11. Incentives are needed to encourage sustainable commercial forestry. The survival of the commercial forest industry in Baltimore County is in jeopardy, and only one commercial sawmill remains in the County.
12. The amount and rate of local consumption of forest products in the County is poorly understood. Baltimore County's forests are supplying less of the local forest product needs, which are increasingly being met from foreign nations whose forest resources are less resilient and whose regulatory oversight of forest harvesting is inadequate or non-existent.
13. Landowners' options for forest management may be inordinately constrained by County policies otherwise designed to promote resource protection. While many agencies, organizations, and individuals are committed to forest sustainability, efforts are not coordinated and are inadequate compared to the magnitude of the forest resource.

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As the final product of the work of the Steering Committee to date, this Forest Sustainability Strategy document is a proposal for goals, recommended actions, and recommended assessments and data analyses for fifteen ecological and economic issues selected by the Steering Committee as the components of forest sustainability most relevant to Baltimore County. The fifteen issues identified by the Steering Committee are as follows:

Key Issues for Forest Sustainability Identified in Baltimore County

Ecological Sustainability:

1. Forest Cover Loss
2. Forest Fragmentation
3. Impacts of Forest Loss on Water Quality and Quantity, and Stream Function
4. Conservation of Biological Diversity
5. Maintaining and Increasing Forests in Key Sensitive Areas (Riparian Buffers, Recharge Areas, Reservoirs)
6. Exotic, Invasive Plant and Animal Species Invasion
7. Deer Browsing Threatens Forest Regeneration

Economic Sustainability:

8. Valuing Forest Ecosystem Services
9. Increasing the Contribution of Forests to the Reduction of Greenhouse Gases through Carbon Sequestration Market Mechanisms
10. Landowner Attitudes Toward Forest Management
11. Public Education about Forest Sciences
12. Cost and Legal Barriers to Sustainable Forest Management
13. Strengthening Markets for Local Forest Products Utilization
14. Timber Management for Sustainable Forests
15. Forest Management Plans for Publicly Owned Forests

Guiding Principles for Forest Sustainability

In addressing the list of specific ecological and economic sustainability issues in the Strategy, the Steering Committee proposes the following broad principles to guide the continuing work of Baltimore County and its partners:

Guiding Principles for Addressing Forest Sustainability Issues

1. Because forests provide critical ecosystem services such as clean air, clean water, and conservation of biodiversity, as well as provide for a range of socio-economic services, their management should not be left to “benign neglect” or chance.
2. The forest resources of Baltimore County should be managed for both their ecological and economic sustainability. The Montreal Process Criteria and Indicators framework should continue to be used for development and implementation of forest sustainability programs.
3. Forest resources are a County-wide management need and challenge. While larger forest patches located primarily in the rural areas of the County are a priority, Baltimore County needs to assure that “urban” forests and other treed areas not traditionally considered “forest” are included.
4. The forest resources of Baltimore County are increasingly threatened by multiple stressors and the County should work to address these comprehensively. Forest sustainability is vulnerable due to continued loss of forest to development; fragmentation of ownership; decline in health due to an un-managed and too numerous population of white-tailed deer; decline in forest health from an increasing number of insects, diseases and exotic and invasive species; decline in the urbanized areas of the County; and loss of productivity due to regulatory obstacles to and lack of economic incentives for sound forestry practices.
5. The County should develop and use, to the extent possible, sustainability indicators for its forest sustainability programs. Indicators should be supported by adequate assessment and monitoring of forest resources. The County should work with federal and State agencies to develop and implement a continuing Forest Health Monitoring program. Indicators should be compatible or complement, to the degree possible, those used by the State of Maryland and the USDA Forest Service in order to facilitate comparison and aggregation of data. A foundation of this Strategy and future work should be the linked outcomes: “better data, better dialogue, better decisions.”
6. Wherever possible, the County should seek to improve forest sustainability through non-regulatory means, including education, technical assistance, and financial incentives.
7. The County should work to institutionalize forest sustainability initiatives and integrate them into existing land use and environmental programs,
(continued)

Guiding Principles for Addressing Forest Sustainability Issues
(continued)

including water and air quality initiatives such as reservoir protection, watershed restoration, Total Maximum Daily Loads (TMDL's), and 8-hour ozone State Implementation Plans.

8. The Department of Environmental Protection and Resource Management (DEPRM) should continue to facilitate the participation of the parties-at-interest in an open process to implement forest sustainability. The County should continue to pursue forest sustainability in cooperation and partnership with federal and state agencies, the forest industry, environmental organizations, and citizens.
9. Baltimore County should demonstrate leadership by example and make forest sustainability a priority for management of County-owned lands.
10. DEPRM should report progress on its forest sustainability programs periodically to the County Council and to the public. DEPRM should continue to maintain program information on its website.

Highlights of the Strategy for Ecological and Economic Sustainability Issues

Recommended Goals, Actions, and Assessments/Data Analyses for the 15 Ecological and Economic Sustainability Issues are presented in Sections 2.0, 3.0, and 4.0, respectively, of the Strategy. Together, 42 Goals, 101 Actions, and 85 Assessments and Data Analyses are recommended.

The following sub-sections summarize the major themes across the Goals and Recommended Actions for the 15 major sustainability issues identified by the Steering Committee. Assessment and data analysis needs are not summarized here.

Ecological Sustainability

Issue: Forest Cover Loss – Baltimore County should partner with local, state, and federal agencies to educate landowners about the range of existing programs that provide technical assistance and tax incentives for forest retention and management, and the value of increasing forest cover for drinking water source protection. The County should review and modify, when appropriate, existing zoning and regulations to reduce forest loss, and develop simple, low-cost easement mechanisms to allow reforestation in sensitive areas on private lands when requested, utilizing County FCA mitigation funds. The County should demonstrate leadership by making forest sustainability a priority for management of County-owned forests.

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The County should also work with the USDA Forest Service, the MD DNR and the Baltimore County Forestry Board to evaluate the condition of the County's urban forests, and to address urban canopy losses with substantial increases in urban tree plantings

Issue: Forest Fragmentation – The fragmentation of forest cover produces isolated forest patches, which are more vulnerable to climatic as well as human-induced stressors than are larger forest blocks, and therefore less sustainable over time than unfragmented forest. Baltimore County should form alliances with the agencies, organizations, and the business sectors listed above to educate landowners and the general public about the deleterious impacts of fragmentation on forest health and sustainability, and to develop mechanisms for establishing forested connectors between isolated forest patches. The County should continue DEPRM's *Rural Residential Stewardship Initiative*, to help the owners of rural residential properties expand forest coverage across property lines in a community effort to counter fragmentation and forest degradation.

Issue: Effects of Forest Loss on Water Quality, Quantity, and Stream Function – In both rural and urban areas, the County should work with the Baltimore County Soil Conservation District, with conservation organizations and watershed associations to target unforested riparian areas for tree plantings and reforestation efforts to improve stream system function and stability and drinking water quality. The County should also embark on an education campaign to emphasize the role of stream side native tree species in providing food for indigenous aquatic organisms, which in turn support the larger community of fish and wildlife species of the County.

Issue: Conservation of Biological Diversity – The County should work with the USDA Forest Service to select a forest assessment methodology that can measure the degree of native biological diversity in the County's forest, compared to that in the mid-Atlantic region, and to identify the major stressors that threaten to reduce or degrade native biological diversity. The County should also work with the County Department of Education, the Maryland DNR, USDA Forest Service, US EPA, and other Montreal Process partners to prepare an educational campaign for the public and the horticultural industry about the significant ecological and economic benefits of conserving indigenous biological diversity for the long-term health and survival of the County's forests.

Issue: Maintaining and Increasing Forests in Key Sensitive Areas (Riparian Buffers, Recharge Areas, Reservoirs) – Baltimore County should work with the City of Baltimore to prepare and implement forest management plans for the reservoir reservations that have the protection and maintenance of drinking water quality as the primary objective. The County

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should also target unforested streamsides and recharge areas around the reservoirs for forest restoration and management for drinking water quality.

Issue: Exotic, Invasive Plant and Animal Species (EIPAS) Invasions – Baltimore County should urge federal control agencies to expand searches for and injunctions against the importation of EIPAS. The County should also combine the goals and objectives of management for biological diversity with EIPAS control, which are major impediments to the long-term expansion and survival of native species. The County should also conduct outreach for the public about the importance of suppressing EIPAS and the need to manage public and private landscapes for the elimination of the most egregious EIPAS.

Deer Browsing Threats to Forest Regeneration – Baltimore County should develop educational materials for County officials and the public on the serious effects of deer browsing on forest tree regeneration, the relative costs and effectiveness of alternative deer control efforts, and the probable catastrophic effects of delaying deer population control. The County should also work with the MD DNR to revise guidelines on seasonal hunting time periods and bag limits for does and bucks. Using the State Deer Management Plan as a template, the County should prepare and adopt a Baltimore County Deer Management Plan that incorporates deer population control as mechanisms for restoring forest regeneration, ecological function, and biological diversity.

Economic Sustainability

Issue: Valuing Forest Ecosystem Services – Baltimore County should work with natural resource regulators and managers in other local governments, and State and Federal agencies to identify opportunities to enhance the capability of forests to provide free ecosystem services as alternatives to committing significant funds to technologically-derived, non-sustainable environmental “fixes.”

Issue: Increasing the Contribution of Forests to the Reduction of Greenhouse Gases through Carbon Sequestration Market Mechanisms – Baltimore County should conduct County-wide assessments of carbon dioxide sources and sinks, estimating carbon sequestration opportunities under probable future land use/land cover conditions. The County should work with State and local agencies to identify eligible carbon sequestration opportunities on both public and private lands that are or will be under long-term protection, and develop marketing materials aimed at potential carbon credit “buyers.”

To meet the minimal requirements for the Federal Greenhouse Gas registry, the County should work with local and State agencies to establish uniform

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criteria and standards and adopt accounting and monitoring rules for tracking projects involving carbon credit agreements between buyers and sellers. Baltimore County should support aggregator organizations that can coordinate landowner outreach/opportunities with potential carbon funding sources.

Issue: Landowner Attitudes toward Forest Management – Baltimore County should survey public perceptions, concerns, and information needs about the acceptability of sustainable forest management. The County should develop educational outreach programs about the values and benefits of sustainable forest management, based upon survey results. The County should also seek to improve communications among forest landowners, forestry professionals, and other interested parties, encouraging balanced input into the decision-making process in the planning and implementation of management plans.

Issue: Public Education about Forest Sciences – The County should provide educational materials targeted to forest landowners' specific site attributes (e.g., forest size, stream resources, other sensitive areas, significant forest products potential) and management issues. The County should work with the local Forestry Board and the MD DNR Forest Service to create educational opportunities for forest landowners, including, for example, demonstration projects with interpretation and community meetings with foresters. The County should post educational materials about forestry on DEPRM's website, including some interactive forest management decision-making tools, and record results as a form of public polling. The County should also address emotionally-charged issues, including deer management, sustainable forestry on public lands, and balancing multiple use objectives with the public good, in educational materials and outreach efforts. The County should inform public opinion about the contribution of forestry to the local economy.

DEPRM should work with the County's Department of Education and the MD DNR Forest Service to update forestry programs to reflect new state requirements for curriculum materials, building principles of forest sustainability into all levels of science education (K-12) in the Baltimore County schools.

Issue: Cost and Legal Barriers to Sustainable Forest Management - The County should modify zoning codes as appropriate to promote forest retention and to discourage forest fragmentation. The County should partner with the MD DNR to provide technical assistance and to seek increased funding for cost-share programs for sustainable forest management; particularly, cost-sharing incentive programs to help landowners with small forest tracts to pay for the preparation and implementation of sustainable forest management plans. Working with the

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MD DNR, the County should review and modify the existing forest management plan review process, as appropriate, for potential improvements.

The County should also work with the MD DNR to create forest stand improvement and sustainable harvest demonstration areas to promote cost-sharing practices. The County should encourage and promote cooperative forest management among forest landowners. Regarding the permitting of harvesting operations, the County should re-examine and modify inappropriate and burdensome components in the permitting process that unnecessarily delay harvesting without benefiting forest sustainability. DEPRM should review properties with forest-harvest-restricted easements for potential enrollment in existing and proposed forest management or incentive programs. DEPRM should work with other government agencies and tax experts to implement tax-exemption options for forest owners conducting sustainable forest management.

DEPRM should re-examine and modify, as appropriate, stream buffer regulations to allow limited access for sustainable forest management practices, including harvesting, and only when harvesting does not disturb trees critical to stream bank and channel stability, and where the harvesting operations do not result in additional stream crossings.

Issue: Strengthening Markets for Local Forest Products Utilization – Baltimore County should conduct an educational campaign to promote local forest products markets by showing the compatibility of timber management with other landowner objectives; the financial rewards of timber production; and the economic potential for non-timber forest products, including specialty foods, spices, medicines, and native plants. The County should develop a resource guide to help build a network of forest product and services sellers and buyers. The County should help to form coalitions of landowners, to manage collective forest resources for similar objectives and to provide “economy of scale” incentives to timber harvest companies.

The County should create a database that identifies suitable facilities and opportunities for the use of biomass fuels, as well as potential suppliers of biomass fuels. The County should pursue federal and state grants to establish demonstration projects in biomass fuel utilization, particularly at County facilities. The County should develop funding and technical assistance coalitions to pursue energy development grants for facilities that could be fitted with biomass-fueled standard combustion generators or CHP generators.

Baltimore County should embark on an educational campaign to inform community leaders, the public, and elected officials about the beneficial economic impacts (direct and multiplier) of local forest products markets to

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build support for market development and other forest management financial incentives. The County should develop financial incentives to increase the purchases of local forest products by the business community, ultimately increasing the demand for local forest products.

Issue: Timber Management for Sustainable Forests – DEPRM should work with State and local foresters to define the components of a sustainable forest management plan. DEPRM should work with the MD DNR and local consulting foresters to educate forest landowners about the benefits of balancing harvesting objectives with forest sustainability in plans specifically designed to sustain the forest ecosystem structure and functional value of their forests. DEPRM should also work with the MD DNR and the forestry industry to consider changes in requirements for timber harvest management plans to better address forest sustainability. DEPRM should add a staff forester to inspect pre- and post-site conditions at harvesting operations, and to provide auxiliary (to MD DNR foresters) assistance to landowners for sustainable forest management. DEPRM should work with the MD DNR foresters and the forestry industry to increase compliance by loggers regarding timber harvest regulations and the objectives of timber harvest plans prepared by certified foresters.

Issue: Forest Management Plans for Publicly Owned Forests – DEPRM should contract with consulting foresters to develop sustainable forest management plans for all County-owned forested lands, prioritized by size, ecological value, and environmental, social, as well as economic objectives (such as providing revenue from limited harvesting to finance management activities that enhance and sustain forest ecosystem functions). As appropriate, management should include deer population control, the suppression of exotic, invasive species, and reforestation. The County should develop the institutional capacity, including staff and funding, to implement completed management plans. The County should work with State, Federal, and municipal agencies to encourage the preparation and implementation of management plans for other publicly owned forest lands within Baltimore County.

The County should offer site visits to managed forests for decision makers to illustrate the concepts of sustainable management, and to emphasize and interpret a range of management objectives, practices, and anticipated results over time. The County should establish demonstration forests on publicly owned forests to educate the public about sustainable management objectives and practices. The County should also provide opportunities and a process for citizen input in plan preparation and information exchange.

Baltimore County's Forest Resources

Appendix A (Section 5.0) of this Strategy presents maps and data for landscape-level

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(County-wide) forest resource conditions, based on analysis of forest cover digitized from 1995-1997 aerial photography. Using Geographic Information System (GIS) tools, forest conditions are summarized for the fourteen major watersheds of the County. Data are presented for overall forest cover distribution, interior forest area, forest ownership, forest fragmentation, forest parcelization, and riparian forest cover. Data is also presented for forest lost to development. Unavailable at this time is data on forest health or the condition of the forested areas of the County.

The following bullets highlight some of the major data on forest distribution in Baltimore County presented in Appendix A.

- forests cover about 132,800 acres or 34.2% of the County
- forests are distributed across more than 9,000 patches
- the mean forest patch is 14.58 acres; about half of these patches are < 0.25 acre
- the smallest 50% of patches comprise only 418 acres or 0.3% of the total forests
- the mean patch size is 27.2 acres for forest patches \geq 0.25 acre,
- there are 315 patches > 100 acres; they comprise 6.5% of all patches and account for nearly 82,000 acres or 62.1% of total forests there are an estimated >50,000 owners of forest patches
- 32% of forest patches have 1 owner but total only 4% of forest acres; most forest patches have dozens of owners
- 16.8% of forests, 90% of the people, and 33.6% of the land are inside the Urban-Rural Demarcation Line (URDL), the County's urban growth boundary
- 12.8% of forests are "interior," or more than 500' from a non-forest edge
- 75% of forests are privately owned
- >32,000 acres (24.6%) of forest lands are in public ownership; Publicly-owned forests comprise the largest contiguous forest blocks; the State of Maryland is the largest forest landowner in the County (14,880 acres)
- 52% of the nearly 70,000 acres of land comprising 100-foot buffer areas along the County's streams is forested; about 27.5% of all forest cover is located within riparian buffer areas
- 67% of forests on development sites that are subject to forest conservation regulations is retained; forest lost to development averages 230 acres per year

Applying the Montreal Process Criteria to Baltimore County

Appendix B (Section 6.0) provides a brief introduction to the use of sustainability indicators. Although much remains to be determined about the state of Baltimore County's forests using the Montreal Process Criteria, Appendix C (Section 7.0) summarizes some major findings and issues in Baltimore County for each of the seven

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Montreal Process Criteria, based on present understanding. This presentation follows the format of the US Forest Service's *Sustainability Assessment Highlights for the Northern US*.

Conservation of Biological Diversity

About 130,000 acres or one-third of the 385,000 acres of land in Baltimore County is forested. Forests covered the majority of the landscape before European settlement, and they were widely logged over the following 300 years.

Maintenance of Productive Capacity of Forest Ecosystems

Forests are a naturally renewable source of timber, firewood, and non-wood forest products. The climate and soils of the mid-Atlantic region are particularly well suited for the growth of forests. The productive capacity of the County's forests is critical for the maintenance of air and water quality and for providing a supply of commercial timberland. Nevertheless, the forestry industry in the County is in serious decline due to ownership fragmentation (parcelization) and changing public attitudes about timber harvesting.

Maintenance of Forest Ecosystem Health and Vitality

An assessment of the general health of the County's forest resource has not been conducted. Among the information needed are forest age and composition, trends in tree growth and mortality, tree crown condition, vulnerability to disease, and the condition of soil, water, and wildlife. Such assessments need to be conducted on a continuing, periodic basis as forests are naturally dynamic systems and change as a result of natural and human disturbances. It is safe to conclude that threats to forest health are increasing, and stressors that affect tree health include insects and pathogens, invasive plants, and air pollution.

Conservation and Maintenance of Soil and Water Resources

Forests are important to maintenance of good water quality and stable streams. Forests absorb and infiltrate precipitation, resulting in slower discharge of overland storm runoff and groundwater to streams compared to urban or agricultural land cover. In addition to regulating watershed hydrology, forested buffers help stabilize streams, reducing erosion and sedimentation that degrades water quality and aquatic resource habitat. In Baltimore County, only about 52% of the 70,000 acres or so of land that comprises potential 100-foot buffer areas along streams is forested. The percent of stream buffer areas with forest cover ranges from about 16% in the Baltimore Harbor watershed to 67% in the Liberty Reservoir watershed. Data on the biological condition of the County's streams indicates that the quantity and diversity of aquatic organisms are highest in watersheds with high percentage of forest cover.

Maintenance of Forest Contribution to Global Carbon Cycles

One of the least understood characteristics of Baltimore County's forest base is its relationship to sequestering atmospheric carbon. According to the following excerpt from the US Forest Service, Baltimore County's forests are probably

important “sinks” for harmful carbon generated by non-forest activities.

“Growing forests naturally store carbon. The age and vigor of forest vegetation affects the rate of carbon sequestration in a forest ecosystem and the overall inventory of stored carbon. Trees are about 50 percent carbon and represent the most dynamic component of the forest ecosystem carbon pool, although the largest proportion of carbon is found in the soil. In the Northern United States, hardwoods account for a greater proportion of carbon than softwoods. Changes in carbon inventory are affected by the rate of forest growth, harvest activity, and losses of forest cover due to conversion to other land uses, as well as fire or other natural disturbances. The carbon inventory in Northern U.S. forests is higher than in forests of any other region of the country. An underlying factor is that forests in the North are not harvested as heavily compared to growth as forests in the South and West. Additional carbon is stored in wood that is processed or manufactured into products. The carbon stored in forests and forest products mitigates the amount of carbon released into the atmosphere, which may help delay global climate change.”

Maintenance and Enhancement of Long-term Multiple Socio-economic Benefits to Meet the Needs of Societies

In addition to providing critical ecosystem services, forests are important for providing a range of social and economic benefits to Baltimore County. For many citizens, forests have aesthetic and even spiritual value. They are also important elements of our outdoor recreational experience. In Baltimore County, extensive forest systems are protected for public use, including the Gunpowder and Patapsco River State Parks, the Soldiers Delight Natural Environmental Area, and the Gwynnbrook Wildlife Management Area. Large County forest ownerships include the Oregon Ridge Park, Dundee-Saltpeeter Creeks Park, and Cromwell Valley Park, in addition to smaller areas such as Double Rock Park, Honeygo Park, and Northwest Area Park. An estimate of the value and use of these facilities is not available.

The value of ecosystem services provided by Baltimore County forests is estimated in excess of \$74.6 million per year, exclusive of the value of forests for water supply protection, which although certainly high has not been reliably estimated. The average value per acre of forests in 2004 for greenhouse gas and climate regulation is estimated at \$12, the value for refugium functions and wildlife conservation is estimated at \$443, and the value of aesthetic and recreational services is estimated at \$130.

The role of Baltimore County’s forest industry in the local economy has been estimated and appears to be disproportionately small compared to other resource-based industries. Based on a study conducted by Salisbury University, it is estimated that the 1999 employment impact of the County’s agricultural, seafood/aquaculture, forestry, and mining/mineral extraction industries, including

direct, indirect, and induced employment impacts, is about 16,225 jobs, which ranks the highest among Maryland counties. Of these estimated jobs, the forestry industry comprises about 1,128 jobs or 7%, with the direct employment impact estimated at 612 jobs. Forestry ranks second behind agriculture. Baltimore County's forest employment impact ranks fifth among Maryland's counties, and the direct employment impact ranks only seventh. The 1999 value added (payments made by the industry to workers, interest, profits, and indirect business taxes) of the resource-based industries in Baltimore County was estimated at more than \$426.1 million, ranking fourth among Maryland's counties. The forest industry value added to the economy is estimated at \$46.1 million, or about 10.8%. Baltimore County's value added from forestry ranks fifth among Maryland's counties and comprises about 4.6% of Maryland's forestry value added.

The forest economy of Baltimore County becomes more valuable, however, when considering the primary and secondary wood manufacturing sectors in addition to the timber management and harvesting sector. Baltimore County's "Total Industry Output", or measure of the total economic impact for all sectors, is the highest of any county in Maryland, at \$487 million (1997), due largely to the importance of the secondary manufacturing sector.

Legal, Institutional, and Economic Framework for Forest Conservation and Sustainable Management

The legal, institutional, and economic framework for sustainable forest management is complex, even for Baltimore County. Local and State governments' primary role is regulation, including protection of forest resources during the land development process at the local level pursuant to State law, and through regulation of the industry, permitting, and conservation easements at the State level. Several landowner assistance agencies exist to provide education, technical assistance, and cost-share funding for the establishment, management, and conservation of forests. Agencies include the MD Dept. of Natural Resources, the County Forestry Board, the University of Maryland Cooperative Extension Service, the USDA Forest Service, and the USDA Natural Resources Conservation Service.

The management setting also includes the forest products industry, its membership and trade organizations, consulting foresters, and others who influence the production of forest products. Overall, there needs to be a specific assessment of the legal and institutional framework for supporting sustainability and addressing a balance between public and private interests. The economic evaluation needs to include both incentives and disincentives to sustainability, and to account for non-market services provided by natural resources, which continue to be undervalued and excluded from economic forecasts. As well, the adequacy of efforts to encourage forest resource conservation needs to be addressed. Self-sufficiency in the production and consumption of forest products is not practical, but sustainability argues that we need to better account for the

degree to which we borrow from future generations' inheritance.

Baltimore County's Linking Communities Project

Appendix D (Section 8.0) of this Strategy presents background information on the origins of the County's participation in the Linking Communities to the Montreal Process Criteria & Indicators Project, including information about the 2003 Forum and the continuing work of the Steering Committee. Relevant summary information for this section is included in the beginning of this Executive Summary (pages 2-3).

Forest Resource Management Issues - Background Information

Appendix E (Section 9.0) of this Strategy presents more detailed background information, including literature sources, for each of the fifteen ecological and economic sustainability issues identified by the Steering Committee. This lengthy material is not summarized here.

Sustainable Forest Management Memorandum of Understanding

Appendix F (Section 10.0) presents the Memorandum of Understanding for Sustainable Forest Management signed on November 8, 2005 by and among Baltimore County, the USDA Forest Service, the Maryland Department of Natural Resources, and American Forests. This MOU will guide the continuing implementation of the County's forest sustainability program.

Glossary

Appendix G (Section 11.0) presents a Glossary of important terms used throughout this Strategy. Key terms are bolded where they first appear in the text, starting with the Introduction (Section 1.0).

1.0 Introduction

1.1. Purpose

This document presents a recommended Strategy whereby Baltimore County can continue to develop and implement a comprehensive program for **forest sustainability**. [Note: A glossary is provided in Appendix G for important terms that are presented in boldface.] **Sustainability** is a most important concept and so is also defined here as “*meeting the needs of society today without diminishing the ability of future generations to meet their needs.*” This Strategy summarizes current and future management challenges for assuring that **forest** resources provide critical **ecological services** while also meeting the socio-economic needs of the County’s citizens. The Strategy also identifies major issues or problem areas for **forest resource management**; provides some background context for current management efforts; and proposes goals, recommended actions, and work plan activities for each issue.

This Strategy is a beginning and is somewhat short of being a complete work plan. As a camel is described as a horse designed by a committee, this Strategy has some “bumps” in the level of completeness, detail, and consistency among what would traditionally be considered by program planners as “goals, objectives, policies, programs, and targets” linkages. Ideally, for each goal, one or more objectives would establish measurable **outcomes** with respect to quantity and time. Work plans continue to evaluate the feasibility and implementation requirements of recommended actions. These steps will require further consideration and are more the subject of internal agency work that includes determining what can be accomplished with existing staff and funding resources and what resources need to be obtained to implement new initiatives. Once Baltimore County adopts this Strategy, these additional implementation details can be developed as necessary.

Although the approach taken herein for preparation of the Strategy resulted in a product that is less formal than typical, it has resulted in a solid collaboration among parties-at-interest who have not typically worked together in Baltimore County on the broad issue of forest sustainability. The partnership that has emerged will help assure continued interest, dialogue, cooperation, and success for implementation.

The Strategy represents a larger program of recommended actions that can be guided by Baltimore County. Some actions can be undertaken by Baltimore County, and other actions should be implemented by others or by the County in partnership with other agencies, the forest industry, and citizen organizations. Also, as this Strategy has been more than a year and a half in preparation, some new projects and supportive actions have already been initiated.

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1.2. Intended Audience

While it is hoped that this Draft Strategy will be of interest to citizens concerned about the County's environmental future and **forests**, as well as special private organizations ranging from watershed associations to the forest industry, the primary audience of this Strategy is Baltimore County agencies and leaders, including the **Planning Board**, the **Baltimore County Council**, and the County Administration. The Strategy points the way for the County to continue its development and implementation of a more comprehensive **forest management** program. As the Strategy essentially represents, in total, recommended policy for forest sustainability, the Strategy could be adopted as an amendment to the **Master Plan 2010**, similar to the adoption in 1993 of the Department of Environmental Protection and Resource Management's (DEPRM) **Groundwater** Protection and Management Strategy as a Master Plan amendment.

The efforts that will emerge from the Strategy build on the partnerships established with non-County agencies and the private sector through the *Linking Communities to the Montreal Process Criteria & Indicators* project (see Appendix D), initiatives of the County Executive's **Green Renaissance** program (January 2005), and the proposed November 2005 partnership Memorandum of Understanding by and among the County, the USDA Forest Service, the Maryland Department of Natural Resources' Forest Service, and American Forests (see Appendix F).

1.3. Need for a Forest Sustainability Strategy

Details are provided elsewhere in this Strategy about the many issues for forest sustainability in Baltimore County. For introductory purposes, the "big picture" starting point is the acknowledgement that our landscape was mostly forested at the time of European settlement but has over the past 350 years been reduced to only one-third of the County's land area. The forest **ecosystem** that evolved in the present climatic period regulated the hydrologic cycle, resulting in a certain stability in watershed processes. As today, forested watersheds have stable **stream channels**, minimized export of **nutrients** and sediment, and structural habitat elements that support diverse and abundant wildlife populations. The forest ecosystem was dynamic and changed slowly due to relatively small and infrequent natural **disturbances** such as wind and ice storms and wildfire. Forests also provide for multiple air quality benefits and are important for sequestering atmospheric carbon.

Although forests are naturally resilient and renewable resources, long-term human disturbances have threatened their ability to sustain critical ecosystem functions and to meet the needs of our citizens for the future.

The County's *Forest Sustainability Issues Paper* (December 2003) identified a number of general forest conditions and program responses based on the early discussions and research of the Steering Committee. The following are the Steering Committee's "findings":

Key Steering Committee Findings about the Condition of Baltimore County's Forest Resources

1. The County's forest base, as measured by acreage of total **forest cover** and **interior forest**, is inadequate, and many forested areas are of poor quality due to past management practices.
2. The County has no program to increase or better protect forests in **reservoir source water areas**.
3. There is no program to increase forest cover as mitigation for worsening regional air quality.
4. No assessments of the **biological diversity** potential of the County's forests have been conducted and there is no County-wide plan for **conservation** of biological diversity.
5. Most of the public forest lands, which comprise one-quarter of all forests, have not been assessed for **forest health, ecological function**, or vulnerability, and there are no forest stewardship plans for any of the County or State-owned forest lands in Baltimore County.
6. Forests in the County are spatially fragmented into too many small pieces, and they are coming under an increasing number of owners, many of whom are unknowledgeable and inexperienced regarding forest management.
7. Diseases and insect pests increasingly threaten existing forests. The regenerative capacity of forests in many areas of the County has all but been eliminated due to continual browsing by a highly overpopulated white-tailed deer community.
8. The County has only about half of the desirable "urban" forest cover, and no comprehensive **urban forest** program essentially exists.
9. More effective programs are needed to educate and work with landowners, particularly farmers, to better protect streams and sensitive lands through reforestation.
10. Citizens in general and forest landowners in particular lack education about science-based forest management. Also, many citizens oppose any forest **harvesting**.
11. Incentives are needed to encourage sustainable commercial forestry. The survival of the commercial forest industry in Baltimore County is in jeopardy, and only one commercial sawmill remains in the County.
12. The amount and rate of local consumption of forest products in the County is poorly understood. Baltimore County's forests are supplying less of the local forest product needs, which are increasingly being met from foreign nations whose forest resources are less resilient and whose regulatory oversight of forest harvesting is inadequate or non-existent.
13. Landowners' options for forest management may be inordinately constrained by County policies otherwise designed to promote resource protection. While many agencies, organizations, and individuals are committed to forest sustainability, efforts are not coordinated and are inadequate compared to the magnitude of the forest resource.

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The Issues Paper further found that the threats to the County's present and future forests are accruing silently but steadily. Collectively, the result of management efforts for forest resources can be characterized as "benign neglect."

1.4. Strategy Preparation

This Strategy was developed by the Steering Committee of the Baltimore County *Linking Communities to the Montreal Process Criteria & Indicators* Project. Detailed information about the origin and nature of this project is presented in Section 8.0 (Appendix D).

The general structure of this Forest Sustainability Strategy follows the seven Montreal Process Criteria. **Criteria** 1 through 5 focus on ecological sustainability, while Criterion 6 focuses on economic sustainability. Criterion 7 focuses on legal and institutional aspects of both ecological and economic sustainability. While this Strategy treats issues specific to ecological and economic sustainability of forest resources so as to not lose focus on them, in reality these aspects of sustainability are inextricably related. As a result, the reader needs to understand that the treatment here becomes, in part, somewhat repetitive. The occasional recommendation of a specific action under several issue areas serves to reinforce the inter-connected nature of forest sustainability.

Now that the Strategy is completed and accepted by the Steering Committee and has been presented to the Administration, there should be opportunity for a broader public review and input. This will be valuable as specific recommendations in the Strategy are considered for implementation.

1.5. Vision Statement

As part of the work of the Steering Committee, the following Vision Statement was selected from several candidate statements:

"To encourage sustainable forest resource management, the citizens, forest landowners, and state and local government agencies of Baltimore County will, through partnership and implementation of a sound stewardship ethic, seek to promote healthy and productive forests, managed with consideration for ecosystem values including clean air, clean water and biological diversity and managed to meet the social and economic needs for present and future generations."

1.6. Guiding Principles

The Steering Committee proposes the following principles to guide the continuing work

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of Baltimore County for forest sustainability:

1. Because forests provide critical ecosystem services such as clean air, clean water, and conservation of biodiversity, as well as provide for a range of socio-economic services, their management should not be left to “benign neglect” or chance.
2. The forest resources of Baltimore County should be managed for both their ecological and economic sustainability. The Montreal Process Criteria and Indicators framework should continue to be used for development and implementation of forest sustainability programs.
3. Forest resources are a County-wide management need and challenge. While larger forest patches located primarily in the rural areas of the County are a priority, Baltimore County needs to assure that “urban” forests and other treed areas not traditionally considered “forest” are included.
4. The forest resources of Baltimore County are increasingly threatened by multiple **stressors** and the County should work to address these comprehensively. Forest sustainability is vulnerable due to continued loss of forest to development; fragmentation of ownership; decline in health due to an un-managed and too numerous population of white-tailed deer; decline in forest health from an increasing number of insects, diseases and exotic and **invasive species**; decline in the urbanized areas of the County; and loss of productivity due to regulatory obstacles to and lack of economic incentives for sound forestry practices.
5. The County should develop and use, to the extent possible, sustainability **indicators** for its forest sustainability programs. Indicators should be supported by adequate assessment and monitoring of forest resources. The County should work with federal and State agencies to develop and implement a continuing **Forest Health Monitoring program**. Indicators should be compatible or complement, to the degree possible, those used by the State of Maryland and the USDA Forest Service in order to facilitate comparison and aggregation of data. A foundation of this Strategy and future work should be the linked outcomes: “better data, better dialogue, better decisions.”
6. Wherever possible, the County should seek to improve forest sustainability through non-regulatory means, including education, technical assistance, and financial incentives.
7. The County should work to institutionalize forest sustainability initiatives and integrate them into existing land use and environmental programs, including water and air quality initiatives such as reservoir protection, watershed restoration, **Total Maximum Daily Loads (TMDL’s)**, and 8-hour **ozone State Implementation Plans**.

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8. The Department of Environmental Protection and Resource Management (DEPRM) should continue to facilitate the participation of the parties-at-interest in an open process to implement forest sustainability. The County should continue to pursue forest sustainability in cooperation and partnership with federal and state agencies, the forest industry, environmental organizations, and citizens.
9. Baltimore County should demonstrate leadership by example and make forest sustainability a priority for management of County-owned lands.
10. DEPRM should report progress on its forest sustainability programs periodically to the County Council and to the public. DEPRM should continue to maintain program information on its website.

2.0. Forest Sustainability Goals

The following Goals are presented for each forest resource management Issue identified by the Steering Committee. Specific Recommended Actions for these Goals are presented in Section 3.0, and Recommended Assessments and Data Analyses are presented in Section 4.0.

Ecological Sustainability:

2.1. Issue: Forest Cover Loss

- 2.1.1. Goal #1: To the extent possible, protect Baltimore County's forest resource base from further loss due to land conversion.
- 2.1.2. Goal #2: Increase forest cover on existing developed lands, including public properties, rural residential lots, and in urban communities.

2.2. Issue: Forest Fragmentation

- 2.2.1. Goal #1: Reduce forest **fragmentation** in Baltimore County to protect forest ecosystem functions and **indigenous** biological diversity, in balance with socio-economic goals.
- 2.2.2. Goal #2: Develop innovative partnerships and incentives for the re-connection of fragmented forest **patches** where possible.

2.3. Issue: Effects of Forest Loss on Water Quality and Quantity, and Stream Function

- 2.3.1. Goal #1: Increase **riparian** forest **buffers** to reduce sedimentation of streams and drinking water reservoirs, provide temperature control for streams, enhance structural elements of habitat, and to improve water quality and quantity for recreation and other beneficial uses.
- 2.3.2. Goal #2: Improve public education about the role of forests in improving soil and water quality.
- 2.3.3. Goal #3: Encourage the use of native forest species to provide a beneficial food supply for native fish populations.

2.4. Issue: Conservation of Biological Diversity

- 2.4.1. Goal #1: Protect and restore to the greatest extent possible all components of biological diversity in Baltimore County's forest ecosystem.
- 2.4.2. Goal #2: Educate landowners and provide incentives for the conservation of biological diversity.

Recommended Goals

- 2.4.3. Goal #3: Develop a County-wide Biodiversity Plan that includes a regional biodiversity context.

- 2.5. Issue: Exotic, Invasive Plant and Animal Species (EIPAS) Invasion**
 - 2.5.1. Goal #1: Reduce the competitive pressure of EIPAS on Baltimore County's **native forest communities**.
 - 2.5.2. Goal #2: Restore native biological diversity in the County's **forest-dependent** plant and animal communities.
 - 2.5.3. Goal #3: Reduce the importation and sale of the most egregious EIPAS in the County.
 - 2.5.4. Goal #4: Manage public forestlands for the protection and proliferation of native plant and animal species.
 - 2.5.5. Goal #5: Provide public education on the effects of EIPAS on native biological diversity.

- 2.6. Issue: Maintaining and Increasing Forests in Key Sensitive Areas (Riparian Buffers, Recharge Areas, Reservoirs)**
 - 2.6.1. Goal #1: Establish and maintain forest cover to the extent possible in key sensitive areas such as stream buffers, critical **groundwater recharge areas**, and **headwaters** of drinking water reservoir **watersheds**.
 - 2.6.2. Goal #2: Identify and address stressors on the retention of forests in key sensitive areas.
 - 2.6.3. Goal #3: Assure that existing forest cover in key sensitive areas is managed for sustainability through preparation and implementation of management plans.

- 2.7. Issue: Deer Browsing Threats to Forest Regeneration**
 - 2.7.1. Goal #1: Restore balance between deer populations and the **carrying capacity** of Baltimore County's forests.
 - 2.7.2. Goal #2: Reduce deer pressure on forest **regeneration**.
 - 2.7.3. Goal #3: Develop support for implementation of appropriate deer control actions.

Economic Sustainability

- 2.8. Issue: Valuing Forest Ecosystem Services**
 - 2.8.1. Goal #1: Develop policies and programs that recognize the public environmental benefits to Baltimore County of forest ecosystem

Recommended Goals

services and that offer financial incentives for retaining or enhancing these benefits. Examples include services provided by forests that reduce drinking water filtration costs, decrease regional air shed ozone levels, or result in lower incidences of heat or air quality-related health impacts.

2.9. Issue: Increasing the Contribution of Forests to the Reduction of Greenhouse Gases through Carbon Sequestration Market Mechanisms

- 2.9.1. Goal #1: Harness **carbon markets** and/or existing “**goodwill markets**” to increase and maintain forest cover and improve forest management. Use carbon payments to provide added incentives for forest retention by private forest landowners.
- 2.9.2. Goal #2: Influence the development of carbon markets such that Baltimore County forests can take advantage of them.
- 2.9.3. Goal #3: Clearly demonstrate how measures to reduce **greenhouse gas** emissions and to sequester carbon through terrestrial processes are integrated with objectives related to water quality and healthy streams, sustainable forest management, habitat and wildlife, clean air, energy production, and economic benefits.
- 2.9.4. Goal #4: Place Baltimore County in a state of “readiness” to take advantage of economic incentives related to managing carbon through natural resource management.
- 2.9.5. Goal #5: Manage public forests lands to promote **carbon sequestration** and achieve a net positive balance on **carbon storage**.
- 2.9.6. Goal #6: Understand how existing land use practices and anticipated land use change will impact the County’s **carbon balance**.

2.10. Issue: Landowner Attitudes Toward Forest Management

- 2.10.1. Goal #1: Understand why landowners find some forms of forest management acceptable while other equally beneficial forms of management are perceived as damaging to the environment.
- 2.10.2. Goal #2: Educate the public about sustainable forest management and inform public opinion. Involve landowners in the forest management process from planning through implementation.

2.11. Issue: Public Education about Forest Sciences

- 2.11.1. Goal #1: Increase the number of Baltimore County residents with knowledge about forest sciences and who will promote sustainable

Recommended Goals

forest management County, including:

- 2.11.1.1. Have all school children in the County graduate with a knowledge of forest science.
- 2.11.1.2. Have all forest landowners involved in the management of their forested acres.
- 2.11.1.3. Have the general public, including public officials, aware of the need for forest sustainability in the County.
- 2.11.1.4. Promote both the benefit of forest industries to the economy, and the benefit of forest cover to the environment.
- 2.11.1.5. Increase the confidence of the general public in forest resource science and forest management.

2.12. Issue: Cost and Legal Barriers to Sustainable Forest Management

- 2.12.1. Goal #1: Maintain and increase forest **tract** sizes, especially in those tracts considered too small to be managed by consulting foresters.
- 2.12.2. Goal #2: Increase the market value of **forest stands**, especially small stands.
- 2.12.3. Goal #3: Improve regulatory processes to reduce permit-processing work for consulting foresters.
- 2.12.4. Goal #4: Keep legal barriers to appropriate and effective forest management to a minimum.
- 2.12.5. Goal #5: Increase the number of forest tracts with implemented management plans.

2.13. Issue: Strengthening Markets for Local Forest Products Utilization

- 2.13.1. Goal #1: Increase the supply of and the demand for locally produced forest products.
- 2.13.2. Goal #2: Develop new and innovative market incentives, such as **non-timber forest products**, fishing and hunting leases, **renewable energy** markets, **green building** incentives, and environmental benefit payments.

2.14. Issue: Timber Management for Sustainable Forests

- 2.14.1. Goal #1: Improve the health and vitality of post-harvest forests in Baltimore County, including:
 - 2.14.1.1. Improve native biological diversity.
 - 2.14.1.2. Improve ecological functional capacity of forests.

Recommended Goals

2.14.1.3. Improve **resilience** by matching post-harvest **species composition** to appropriate soil types.

2.15. Issue: Forest Management Plans for Publicly Owned Forests

- 2.15.1. Goal #1: Motivate all levels of government to develop and implement management plans for publicly owned forested lands in Baltimore County.
- 2.15.2. Goal #2: Create a broad constituency to support the development and implementation of management plans for publicly owned forest lands.
- 2.15.3. Goal #3: Develop and implement forest management plans for publicly acceptable and sustainable objectives.

3.0 Recommended Actions

This section presents the Steering Committee’s Recommended Actions for each Goal identified in Section 2.0 for ecological and economic forest sustainability for Baltimore County. Necessary assessment steps and data analyses to implement these actions are presented in Section 4.0. Background information for issues that underlie these actions is presented in Section 9.0 (Appendix E).

Ecological Sustainability

3.1. Issue: Forest Cover Loss

- 3.1.1. Develop and use appropriate indicators of forest cover loss for ecological and economic sustainability.
- 3.1.2. Select high priority, unprotected private forest lands and evaluate acquisition and/or development **easement** purchase options, including the use of **MD Environmental Trust, Rural Legacy, Program Open Space, and Coastal and Estuarine Land Conservation** programs. Concentrate on opportunities to meet mutually shared objectives among State land conservation programs and Baltimore County conservation priorities.
- 3.1.3. Educate landowners about existing **MD Department of Natural Resources** (MD DNR) forest management programs that provide State tax incentives for forest retention and management, including the **Forest Conservation and Management Agreement (FCMA)** program and the Woodland Assessment Program (WAP).
- 3.1.4. Work with the MD DNR to establish the eligibility of Baltimore County under the federal **Forest Legacy program**.
- 3.1.5. Work with Baltimore City, MD DNR, the MD Department of the Environment, private landowners, and watershed associations to increase forest retention as a tool for drinking water source protection.
- 3.1.6. Work with federal and state agencies and utility companies to explore forest retention options associated with carbon market initiatives.
- 3.1.7. Work with the County Office of Planning to evaluate, and modify if appropriate, zoning regulations and guidelines to reduce forest loss.
- 3.1.8. Consider amendment of forest conservation regulatory programs to improve forest retention during land development.
- 3.1.9. Conduct regular inspections of **Forest Conservation Act** mitigation projects for compliance.
- 3.1.10. Develop simple, low-cost easement mechanisms for private

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properties to allow County FCA mitigation funds to be used for establishing forest corridor connections between high priority forest patches.

- 3.1.11. Continue DEPRM's **Rural Residential Stewardship Initiative** program to provide technical assistance, trees, and labor for increasing forest cover in existing rural residential developments.
 - 3.1.12. Continue DEPRM's **Growing Home Campaign** to provide incentives to homeowners for increasing tree cover on their properties in existing communities.
 - 3.1.13. Continue to administer the **Tree-Mendous Maryland** program to provide assistance to community associations for the planting of trees on public lands and community open spaces.
 - 3.1.14. Work with citizen-based conservation and watershed organizations to implement collaborative reforestation projects.
 - 3.1.15. Work with the USDA Forest Service to evaluate the condition and vulnerability of urban tree **canopy** in existing communities, and to implement efforts to address urban canopy losses and stressors, through the use of tools such as the **Urban Forest Effects (UFORE) model** and other "I-TreeTools" assessment programs.
- 3.2. Issue: Forest Fragmentation**
- 3.2.1. Develop simple, low-cost easement mechanisms for private properties to allow County FCA mitigation funds to be spent on establishing forest corridor connections between high priority forest patches.
 - 3.2.2. Require forest sustainability management plans for any private properties (**conservation easements**) on which public funds are received for **forest restoration** or **multiple use management**.
 - 3.2.3. Continue DEPRM's *Rural Residential Stewardship Initiative* program, to assist private citizens in the reforestation of sensitive areas on improved rural residential lots.
 - 3.2.4. Work with the Maryland DNR and the County's Forestry Board to incorporate educational materials on the long-term values and benefits of utilizing forest management techniques for suppressing invasions of **exotic species** and deer damage for conserving biological diversity into Forest Management Plans.
 - 3.2.5. Plan another Montreal Process forum focusing on forest fragmentation, its extent across Baltimore County's forests, and the County's commitment, with the **MOU** signatories, to addressing the problem of fragmentation of forested lands.

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- 3.2.6. Prepare and distribute educational information for landowners about forest fragmentation and existing programs for obtaining assistance with reforestation or tree planting.
- 3.2.7. Investigate new funding sources for County reforestation programs, such as a portion of **real estate transfer taxes**.

- 3.3. Issue: Effects of Forest Loss on Water Quality and Quantity, and Stream Function**
 - 3.3.1. Using the data analysis from 4.1.3 (below), prioritize non-forested riparian areas for reforestation in order to increase forest patch size, restore water quality and aquatic habitat, and protect stream channel stability. Prioritize establishment of trees for shading and temperature control on headwater streams.
 - 3.3.2. Work with the Baltimore County Soil Conservation District and with conservation and watershed associations to implement reforestation projects on sites prioritized for water quality benefits.
 - 3.3.3. Improve education efforts on the beneficial effects of forests for drinking water protection and aquatic habitat. Emphasize the role of native forest species as important food sources for indigenous aquatic organisms.

- 3.4. Issue: Conservation of Biological Diversity**
 - 3.4.1. Work with the USDA Forest Service to design and implement a continuing County-wide forest assessment and forest health monitoring network, using **Forest Health Monitoring (FHM)** and/or **Forest Inventory and Analysis (FIA)** protocols as appropriate. Work to secure funding for technical assistance, field collection of data, training, and data analysis.
 - 3.4.2. Utilize the assessment results from 4.1.4.1 (below) for the preparation of management plans to connect forest patches where possible, to protect and where possible restore biological diversity and function, and to suppress the deleterious pressures of deer browsing and exotic invasive species.
 - 3.4.3. Work with State and Federal agencies to offer economic incentives to private landowners for the preparation of management plans that include actions to conserve biological diversity.
 - 3.4.4. Work with the County Department of Education, MD DNR, USDA Forest Service and other Montreal Process partners, and US **EPA** staff to prepare an educational campaign for the public, local and state elected officials, and the development and **horticultural** industries about the elements of biological diversity, the significant

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ecological and economic benefits of conserving biological diversity for the quality of life in the region, and both the immediate and potential long-term implications of doing nothing to address the current threats to forest ecosystem sustainability, as identified and quantified by the forest assessments.

- 3.4.5. Prepare a County-wide Biodiversity Plan to identify and prioritize biodiversity conservation actions. Include a regional biodiversity context.
- 3.5. Issue: Maintaining and Increasing Forests in Key Sensitive Areas (Riparian Buffers, Recharge Areas, Reservoirs)**
- 3.5.1. Prepare management plans that focus on maintaining or improving the health and ecological productivity of forests in key sensitive areas across Baltimore County.
 - 3.5.2. Concentrate planting efforts on those areas that have the greatest ability to increase forest patch size and to provide water quality and other ecosystem benefits.
 - 3.5.3. Improve education efforts on the beneficial effects of forests for drinking water, recreational activities, and aquatic wildlife habitat.
- 3.6. Issue: Exotic, Invasive Plant and Animal Species (EIPAS) Invasion**
- 3.6.1. Work with Baltimore City and the State of Maryland to prepare management plans to address the individual site conditions and problem EIPAS species for the public forest lands in Baltimore County, based on biological assessments and determination of the extent of the EIPAS problem.
 - 3.6.2. Prepare an educational campaign with the following targets:
 - 3.6.2.1. Educate the public about the benefits of planting **native species** and the impact of exotic, invasive plant and animal species on the health of natural ecosystems.
 - 3.6.2.2. Educate the horticultural and pet trades about the impending threats to native communities in the continued sale of EIPAS to the public and institutions.
 - 3.6.2.3. Urge EIPAS control agencies (**APHIS**) to expand searches for and injunctions on the importation of EIPAS.
 - 3.6.2.4. Conduct educational outreach for public land managers, community associations, students and individual citizens on the importance of suppressing the further expansion of EIPAS and the need to manage public and private landscapes for the elimination of the most egregious EIPAS.

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- 3.6.3. Prepare legislation to restrict the importation and sale of the most egregious plant and animal species that have been documented to be clear threats to forest health and sustainability.
 - 3.6.4. Require Forest Conservation Act (FCA) mitigation projects to have suppression and monitoring programs for exotic, invasive plant species in mitigation plantings.
 - 3.6.5. Develop web resources for general public and other land managers on how EIPAS impact resources that the public values – from State and local parks to private gardens.
 - 3.6.6. Work with State and Federal agencies to provide technical assistance to landowners who would like to eradicate EIPAS in their forestland, including recommendations for Best Management Practices for controlling specific EIPAS.
 - 3.6.7. Work with State and local agencies and conservation organizations to plan volunteer “clean up” days for removal of invasives from specific forest tracks, on both public and private forest lands.
- 3.7. Issue: Deer Browsing Threats to Forest Regeneration**
- 3.7.1. Work with the MD DNR to revise guidelines on seasonal hunting seasons and bag limits for does and bucks.
 - 3.7.2. Develop educational materials for Baltimore County officials and the public on the effects of deer browsing on forest regeneration, and the anticipated effects of delaying deer population controls. Include information on the relative costs and effectiveness of alternative deer population control efforts.
 - 3.7.3. Begin to utilize **adaptive resource management**, based upon the best scientific data available, in the preparation of deer management plans for the County.
 - 3.7.4. Using the State Deer Management Plan as a template, incorporate strategies for restoring forest regeneration and ecological function into a County Deer Management Plan.
 - 3.7.5. Implement recommended deer control programs and monitor effects on forest regeneration.

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3.8. Issue: Valuing Forest Ecosystem Services

- 3.8.1. Collaborate with other Federal, State and local public sector entities that regulate or manage natural resources to identify opportunities where ecosystem services can substitute for technological “fixes”. As an example, work with the Maryland Department of the Environment

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to include urban forests in the next 8-hour ozone State Implementation Plan (SIP).

- 3.8.2. Identify policy or program approaches with partners that recognize the positive trade-offs of preserving and enhancing ecosystem services provided by Baltimore County forests in lieu of more expensive and non-sustainable technical approaches.

- 3.9. Issue: Increasing the Contribution of Forests to the Reduction of Greenhouse Gases through Carbon Sequestration Market Mechanisms**
 - 3.9.1. Carbon Dioxide - Greenhouse Gas Profile**
 - 3.9.1.1. Conduct County-wide assessments of carbon dioxide sources, **sinks** and sequestration opportunities and future **land use/land cover** condition.
 - 3.9.2. Developing Market Mechanisms**
 - 3.9.2.1. Supply-Side**
 - 3.9.2.1.1. Work with State and local conservation programs to identify eligible carbon sequestration opportunities on privately owned land that will be under long-term protection.
 - 3.9.2.1.2. Identify reforestation opportunities on public lands that would be eligible for claiming carbon sequestration benefits.
 - 3.9.2.1.3. Prioritize reforestation opportunities to meet other County forest sustainability objectives such as reducing fragmentation, improving water quality, and connecting forest patches.
 - 3.9.2.2. Demand-Side**
 - 3.9.2.2.1. Identify emerging carbon funding opportunities (“buyers” of carbon credits) at the local level, understanding that buyers are seeking to develop public goodwill and to meet voluntary commitments for reduced greenhouse gas emissions.
 - 3.9.3. Managing and Brokering Trades**
 - 3.9.3.1. Establish uniform criteria and standards to develop project and management agreements between buyers and sellers. This will ensure that carbon credits generated through these activities meet the minimal requirements for the Federal Greenhouse Gas registry and other emerging State and

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local carbon sequestration programs.

- 3.9.3.2. Adopt accounting and monitoring rules that can be used to track and verify projects and practices that sequester carbon, or ensure that carbon credit sponsors meet minimum Federal 1605(b) requirements.
- 3.9.3.3. Develop marketing materials specifically directed to potential “buyers” and “sellers” of carbon.
- 3.9.3.4. Support the development of **aggregator organizations** that can coordinate landowner outreach/opportunities with potential carbon funding sources.
- 3.9.3.5. Connect “buyers” with “sellers” through aggregator organizations or County staff.
- 3.9.3.6. Develop local expertise to facilitate the tracking, accounting and brokering of carbon sequestration agreements between “buyers” and “sellers” (private landowners or aggregator organizations).

3.10. Issue: Landowner Attitudes Toward Forest Management

- 3.10.1. Determine public perceptions about the acceptability of sustainable forest management practices in the local communities within Baltimore County. Identify public concerns and information needs for sustainable forest management.
- 3.10.2. Develop public education and awareness programs, based on survey results about sustainable forest management.
- 3.10.3. Improve overall communications among interested and involved parties and gather more input into the decision-making process. Provide a meaningful role for the public through the planning and implementation of management plans.

3.11. Issue: Public Education about Forest Sciences

- 3.11.1. Target specific educational materials and efforts to Baltimore County forest landowners who are faced with specific forest management issues. For example, individuals with small forest holdings would receive certain materials, individuals with important water quality forests would receive additional materials, and individuals with forest production potential would receive still other materials.
- 3.11.2. Assemble existing educational materials and post them on DEPRM’s website. Include interpretation and guidance for the materials. Ideally, include some interactive forest management decision-making tools, and record results as a form of public polling.

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- 3.11.3. Improve forestry education for **K-12**. Re-invent forestry education programs to match new state requirements for curriculum material. Build principles of forest sustainability into all levels of science education in Baltimore County schools.
 - 3.11.4. Create educational opportunities for forest landowners that address landowner needs and interests, such as demonstration projects with interpretation or community meetings with foresters.
 - 3.11.5. Evaluate the educational components and needs of all key issues of the County's *Linking Communities to the Montreal Process* project.
 - 3.11.6. Establish communication between Baltimore County and the private sector regarding the contribution of forestry to the local economy. Valuable information should be retained and compiled to inform public policy and public opinion.
 - 3.11.7. Incorporate emotional issues, such as deer management and **sustainable forestry** on public lands, into educational materials and efforts. Especially focus on decision-making and balancing multiple-use-objectives. Frame these issues in a relevant, Baltimore County context.
- 3.12. Issue: Cost and Legal Barriers to Sustainable Forest Management**
- 3.12.1. Modify zoning codes as appropriate to promote forest retention and prevent forest fragmentation.
 - 3.12.2. Advertise, promote, and increase funding and technical assistance for **cost-share programs** for forest management.
 - 3.12.3. Modify the forest harvest permitting process as appropriate to reduce the permit-processing workload of consulting foresters.
 - 3.12.4. Work with community groups to encourage and promote cooperative forest management.
 - 3.12.5. Create (and use existing) forest stand improvement and sustainable harvest demonstration areas to promote cost sharing and to educate landowners about sustainable forest harvest practices.
 - 3.12.6. Evaluate and modify, if appropriate, stream buffer regulations to permit limited access for sustainable forest management and harvesting. Any access and harvesting should not disturb trees critical to stream bank and channel stability and should not result in additional stream crossings.
 - 3.12.7. Review properties with forest-harvest-restricted easements for potential enrollment in existing and proposed forest management or incentive programs. If easement restrictions prohibit enrollment in ecologically and economically appropriate programs, consider

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amending conservation easements.

- 3.12.8. Create cost-sharing incentive programs to help landowners with small forest tracts to pay for preparation and implementation of sustainable forest management plans.
- 3.12.9. With the help of other government agencies and tax experts, implement tax-exemption options for landowners conducting sustainable forest management.
- 3.12.10. Commence dialog and partnerships with land conservancies and other environmental interest groups to develop a unified message about forest management.
- 3.12.11. Work with land conservancies and environmental interest groups to modify conservation easements to allow sustainable forest management.
- 3.12.12. Modify the existing forest management plan review process as appropriate for potential improvements. In cooperation with MD DNR and others, consider the processes used by other local jurisdictions for ideas and a comparison of the time spent by consulting foresters on permit processing.

3.13. Issue: Strengthening Markets for Local Forest Products Utilization

- 3.13.1. Develop the capacity within Baltimore County, through funding for consultants, agency staff, and/or match for grants, to develop and promote the local forest product markets identified below.
- 3.13.2. **Supply-Side**
 - 3.13.2.1. Conduct a targeted educational campaign aimed at landowners of economically important forest land. Use the Baltimore County Strategic Forest Lands Assessment to develop target priorities. Focus on the following issues:
 - 3.13.2.1.1. Compatibility of timber management with other landowner objectives.
 - 3.13.2.1.2. Financial rewards of timber production.
 - 3.13.2.1.3. Economic potential for non-timber forest products such as mushrooms, medicines and spices.
 - 3.13.2.2. Develop a resource guide for landowners that will help build a local network of buyers and sellers of forest products and services.
 - 3.13.2.3. Form coalitions of landowners interested in timber management who would manage forest resources for similar objectives and provide “**economy of scale**”

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incentives to timber harvest companies.

3.13.3. Demand-Side

- 3.13.3.1. Create a database that identifies suitable facilities and/or opportunities in Baltimore County for the use of **biomass** fuels.
- 3.13.3.2. Develop partnerships with facilities suited to utilize biomass fuels and with potential suppliers of biomass fuels. Pursue federal and state grants to support demonstration projects.
- 3.13.3.3. Promote the use of biomass energy production projects. Commit to demonstration projects at County facilities.
- 3.13.3.4. Develop funding and technical assistance coalitions to pursue energy development grants in conjunction with facilities that could be fit with biomass fueled standard combustion generators or CHP generators. Coalition members could include the private energy industry sector, US Department of Energy, US Forest Service, Chesapeake Bay Program, Beltsville Agricultural Research Center, and sewage treatment plants.
- 3.13.3.5. Educate community leaders, the public, and elected officials, on the beneficial economic impacts (direct and multiplier) of local forest products markets to build support for market development and other forest management financial incentives.
- 3.13.3.6. Develop financial incentives to increase purchases of local forest products by businesses, thereby increasing demand for local forest products.

3.14. Issue: Timber Management for Sustainable Forests

- 3.14.1. Define the components of a sustainable forest management plan.
- 3.14.2. Educate landowners about the benefits of balancing their harvesting objectives with forest sustainability in plans specifically designed to sustain the forest ecosystem structure and function of their forests.
- 3.14.3. Work with the MD DNR and the forestry industry to consider changes to requirements for timber harvest management plans in order to better address sustainability.
- 3.14.4. Add a forester to DEPRM's staff to inspect pre- and post-site conditions at harvesting sites and to provide auxiliary (to MD DNR foresters) assistance to landowners for sustainable forest management.
- 3.14.5. Work with the MD DNR and the forestry industry to increase

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compliance by loggers with regard to timber harvest regulations and the objectives of timber harvest plans prepared by certified foresters.

3.15. Issue: Forest Management Plans for Publicly Owned Forests

- 3.15.1. Contract with consulting foresters to develop sustainable forest management plans for all County-owned forested lands, prioritized by size and/or ecological value of the forested areas.
- 3.15.2. Develop the institutional capacity, including staff and funding, to implement the completed management plans.
- 3.15.3. Work with State, federal, and municipal agencies to encourage the preparation and implementation of management plans for other publicly owned forest lands within Baltimore County.
- 3.15.4. Schedule site visits to managed forests for decision makers in order to familiarize them with the concept of sustainable management. Emphasize and interpret different management objectives, practices, and results over time (forests in different stages of management).
- 3.15.5. Establish demonstration forests on publicly owned forest lands to educate the public about sustainable forest management objectives and practices.
- 3.15.6. Provide a venue and process for citizen input in plan preparation and ensure two-way flow of information.

4.0 Recommended Assessments and Data Analyses

This section presents the Steering Committee's Recommended Assessments and Data Analyses for the Recommended Actions in Section 3.0.

Ecological Sustainability

4.1. Issue: Forest Cover Loss

- 4.1.1. Determine changes in the sub-watershed **distribution** of forest cover and track forest cover loss through periodic **GIS** analyses of aerial photography acquired by the County.
- 4.1.2. Assess forest resources on unprotected forested lands for significant **ecological functions** and values.
- 4.1.3. Conduct an analysis of a representative example of development projects in the County's rural residential zones for efficacy of zoning regulations in protecting forest blocks from **parcelization**.
- 4.1.4. Augment the State review of the County's implementation of the Forest Conservation Act (FCA) Regulations to not only look at the quantity of forests cleared and retained, but also to evaluate how saved forest remnants are interconnected to each other and to off-site forest patches.

4.2. Issue: Forest Fragmentation

- 4.2.1. Analyze DEPRM and DNR data on forest patch size distribution in the County by examining the **Green Infrastructure** network map and DEPRM data.
- 4.2.2. Evaluate the contributing causes of forest fragmentation: historical competition of land for agriculture and development.
- 4.2.3. Evaluate existing programs relevant to reducing fragmentation, including regulatory, land preservation, and restoration efforts.
- 4.2.4. Evaluate threats and opportunities, including an analysis of ownership patterns in forest patches, land uses, and development trends.

4.3. Issue: Effects of Forest Loss on Water Quality and Quantity, and Stream Function

- 4.3.1. Conduct a GIS analysis of forested and non-forested riparian buffers by sub-watersheds.

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- 4.3.2. Determine the acreage of sub-watershed areas classified as highly **erodible soils** by **NRCS** that are not forested.
 - 4.3.3. Identify all shallow soils (2 – 5 meters) that are not planted in trees.
 - 4.3.4. Rank areas identified as planting sites by effectiveness in improving water quality.
 - 4.3.5. Research studies on or conduct monitoring of **surface runoff** and **storm flow** events in a sample of forested and non-forested areas to document the effectiveness of forest cover for protecting water quality and for regulating stream discharge and flooding.
 - 4.3.6. Research studies on or determine the resistance of forested and non-forested areas to drought conditions.
 - 4.3.7. Assess community outreach and education programs for effectiveness in addressing the role of forests in protecting and improving water quality.
- 4.4. Issue: Conservation of Biological Diversity**
- 4.4.1. Assess the County’s terrestrial and aquatic forest habitats for the present conditions of indigenous plant community species richness and evenness, **seral** stages, **structural heterogeneity**, forest-dependent wildlife, and significant stressors.
 - 4.4.2. Identify ecologically **mature forest** communities and **relict forest communities** that are associated with limestone valleys or other significant soils.
 - 4.4.3. Locate **hotspots** of exotic plant and animal activity, and incorporate suppression activities for these species in management plans.
- 4.5. Issue: Exotic, Invasive Plant and Animal Species (EIPAS) Invasion**
- 4.5.1. Research federal, state, and local databases for the occurrence of exotic, invasive plant and animal species in Baltimore County and Central Maryland. Search for any data on their distribution, current population sizes, year of first appearance or observation, population trends, and native species or communities most threatened by their continued expansion.
 - 4.5.2. Evaluate the probable causes of the introductions: purposeful introduction for horticultural or pet trade; purposeful as a potential biological control on other EIPAS; and inadvertent introduction associated with the distribution of goods via marine, air, rail, or truck transport.
 - 4.5.3. Evaluate the probable causes for the infestations, e.g. habitat alterations favoring the EIPAS, forest fragmentation, road and other

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public land planting projects near forest **edges**, public or private EIPAS plantings and **migrations** along waterways, and release of unwanted pets into forest fragments.

- 4.5.4. Identify existing programs to limit EIPAS immigration at both the national and local levels (USDA Animal and Plant Health Inspection Service (APHIS), USF&WS, MD DNR), and the annual costs of suppression.
 - 4.5.5. Evaluate threats to native plant and animal forest communities, e.g., species-specific broader potential for hybridization with native species.
- 4.6. Issue: Maintaining and Increasing Forests in Key Sensitive Areas (Riparian Buffers, Recharge Areas, Reservoirs)**
- 4.6.1. Evaluate the total stream mileage, reservoir buffers, and recharge areas without forested riparian zones.
 - 4.6.2. Identify possible **point source** pollution areas that drain into reservoirs and headwater sections of streams.
 - 4.6.3. Identify areas **contiguous** to forested reservoir buffers and streams that could be used for plantings to increase forest cover in these sensitive areas.
 - 4.6.4. Assess community outreach and education on the functions of forests in improving water quality.
 - 4.6.5. Research methods for control: which practices are suitable for private landowners, and which practices may require county intervention or coordinated volunteer campaigns.
- 4.7. Issue: Deer Browsing Threats to Forest Regeneration**
- 4.7.1. Research DNR records to determine the relationship between forest management and availability of, and limits on, deer for hunting.
 - 4.7.2. Research the current allowable deer harvest numbers and historical deer population trends to the time when deer were re-established as an abundant game species in the state.
 - 4.7.3. Evaluate the impact of the deer herd on native plant community **succession** and invasion of exotic, invasive plants into forest patches.

Economic Sustainability

- 4.8. Issue: Valuing Forest Ecosystem Services**

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- 4.8.1. Perform a spatial analysis of ecosystem services provided by Baltimore County forests that cover a broad range of service categories, and identify where these services provide the greatest public benefits.
 - 4.8.2. Determine which public sectors, both within and outside of County boundaries, benefit from Baltimore County's forest ecosystem services or which manage these forests for the functions they provide. For example, Baltimore City manages thousands of acres of reservoir watershed forests to protect the quality of the region's drinking water sources.
 - 4.8.3. For each service and public entity beneficiary, conduct economic cost-benefit analyses to determine what the savings and cost to the public would be under different forest canopy conditions (less, same, more).
- 4.9. Issue: Increasing the Contribution of Forests to the Reduction of Greenhouse Gases through Carbon Sequestration Market Mechanisms**
- 4.9.1. Evaluate how Baltimore County's existing forest and non-forest land contribute to **global carbon cycles**. If Baltimore County chooses to use carbon sequestration incentives as an approach for forest land retention, an evaluation of existing carbon stocks and opportunities for increasing carbon sequestration rates needs to be conducted. For carbon credits to be quantified, an evaluation of **baselines** and methods to monitor sequestration rates and track project success are essential.
 - 4.9.1.1. Quantify existing above- and below-ground carbon stocks (vegetation, roots, soil carbon, forest floor woody debris) and sequestration rates of land use types in Baltimore County to provide County-wide baselines.
 - 4.9.1.2. Identify and quantify "protected" **carbon sinks**, carbon sinks "at risk" and opportunities to enhance and protect carbon sequestration through management or reforestation.
 - 4.9.1.3. Identify methods and technologies, including **remote sensing**, that need to be in place for monitoring and tracking of carbon project sequestration rates.
 - 4.9.2. Identify terrestrial carbon sequestration practices, including timber harvesting and forest land retention, that would be eligible for carbon credits (following the Federal 1605(b) guidelines). Any activity that preserves existing carbon stocks, either in the soil or in biomass, or increases carbon storage in soils or biomass, would qualify.
 - 4.9.3. Evaluate the status of carbon credit trading and markets.

4.10. Issue: Landowner Attitudes Toward Forest Management

- 4.10.1. Establish a clearinghouse of issue papers and public surveys relating to the social acceptance of sustainable forest management. The information can be used to compare local landowner attitudes with those at regional and national scales.
- 4.10.2. Conduct a local survey of community groups and associations to formally assess the public's attitudes toward sustainable forest management practices in Baltimore County.
- 4.10.3. Survey local land managers within the County to determine their view of what constitutes the greatest obstacles to the implementation of sustainable forest management. Determine the information needs of landowners.

4.11. Issue: Public Education about Forest Sciences

- 4.11.1. Evaluate current programs for forest landowner education in the County, including:
 - 4.11.1.1. What percentage of forest landowners are involved?
 - 4.11.1.2. Do the programs meet the needs and interests of landowners?
 - 4.11.1.3. Are landowners encouraged to manage their forested acres?
- 4.11.2. Create a GIS database of forestland ownership. The database will be used to learn about forest ownership patterns in Baltimore County: number of landowners who control timber stands of economic size, **woodlot** size statistics, etc. By including property tax data, it will also be useful for directing mailings and other woodlot owner educational efforts. The data can also be intersected with other GIS databases, such as land preservation information and timber harvest data, to glean generalized information about the landowner education levels: farmers, conservationists, residentially assessed forests, etc. FCMA areas, riparian forest areas, and perhaps conservation easement restriction types can be **overlain** to determine manageable forest areas for the woodlots.
- 4.11.3. Evaluate public perception regarding controversial topics, including: deer management and forest harvesting.
- 4.11.4. Survey public and institutional landscape managers about their forest management policies and practices. Managers to be surveyed would include government agencies at all levels and institutions such as schools, camps, and churches.
- 4.11.5. Assess the awareness of the public regarding forestry's contribution

to the economy.

- 4.11.6. Research current school curricula in Baltimore County with a view to evaluating instruction and information relevant to forest sciences. Ideally, the number of pupils taught various subjects would be tallied over a period of time, and compared with other time periods. Teacher education and attitudes could also be measured as an issue assessment and used as an ongoing indicator. Existing educational resources used (websites, brochures, handouts), as well as lesson plans, could also be evaluated.
- 4.12. Issue: Cost and Legal Barriers to Sustainable Forest Management**
- 4.12.1. Determine the number, acreage, and location of forest tracts too small to produce economic returns for landowners and consulting foresters. (Size and scope of problem)
 - 4.12.2. Determine the number of hours of permit processing work per management plan spent by consulting foresters. (Measurement of regulation impact on cost barriers)
 - 4.12.3. Examine the existing regulatory framework for possible streamlining of permit processing.
 - 4.12.4. Review the existing regulatory framework of nearby jurisdictions and compare with Baltimore County. Look for reasons foresters would work preferentially in other jurisdictions.
 - 4.12.5. Determine the value of timber stands. (As value increases, the tract size and permit-processing cost barriers are reduced. As value increases, the minimum forest tract size that produces an economic return for the landowner and consulting forester drops, and the effective hourly rate increases).
 - 4.12.6. Summarize easement restrictions, map and summarize the distribution of restricted forests.
 - 4.12.7. Estimate forest harvest or other management opportunities currently denied by easement restrictions.
 - 4.12.8. Survey public perception about government's role in forest management.
- 4.13. Issue: Strengthening Markets for Local Forest Products Utilization**
- 4.13.1. **Assessing Markets** - Assessing the issue of strengthening wood products markets in Baltimore County requires an understanding of demand-side and supply-side factors that structure market development and sustainability. It is also important to recognize the **secondary economic impacts** or **multipliers** derived from these

activities in order to demonstrate how strengthening local wood products markets translates into additional economic benefits for Baltimore County citizens and County government. An understanding of how new and innovative market incentives can be developed is also needed.

4.13.2. Supply-side

4.13.2.1. Cooperate with the MD DNR in their conduct of a County-scale forest economic assessment following the Maryland DNR **Strategic Forest Lands Assessment (SFLA)** model. Results will be used to address the remainder of supply-side analyses listed below. Background on the Maryland SFLA model is available at: <http://www.dnr.state.md.us/forests/planning/sfla/index.htm>.

4.13.2.2. Identify the location and acreage of available forest land that has the potential to yield timber and other forest products.

4.13.2.3. Identify areas of economically important forest lands.

4.13.3. Demand-side

4.13.3.1. Identify sources of biomass fuels and the quantities that might be needed to support renewable energy production projects. Sources would include private landowners, particularly those with forest management plans, timber harvest operators, municipal **solid waste** facilities, and industries/business involved in wood product manufacturing.

4.13.3.2. Evaluate the potential for utilizing biomass fuels produced within the County. Identify the types of settings and facilities that would be well suited to use wood products as biomass fuel for energy production.

4.13.3.3. Determine who the existing purchasers of wood products are in the County. This assessment would include the following sectors: forest management and timber harvesting, **primary wood manufacturers** (mills, etc.), secondary wood manufacturers (furniture, etc.), and construction.

4.13.4. Beneficial Economic Impacts

4.13.4.1. Evaluate the existing beneficial economic impacts/multipliers of current wood products market activities and the potential economic impacts of utilizing locally-produced renewable energy sources, developing new markets and enhancing existing markets. As an

example of the types of economic impacts that could be assessed, income generated from the sales of biomass fuels within the County will help build the local tax base, strengthen tax revenues and provide an economic incentive to private landowners for forest land retention. Suppliers of biomass energy use local labor for cutting, hauling, chipping and delivering fuel. The biomass itself is purchased from local landowners. In addition to these direct economic boosts, users of biomass energy will pay less for energy on a **BTU** basis and be less vulnerable to the fluctuating, and often escalating, prices of **fossil fuels**. To illustrate, the net fuel cost per **MMBtu** for wood chips ranges from \$3.10 to \$5.30 compared to natural gas, which ranges from \$8.15 to \$12.50.

(<http://www.biomasscenter.org/pdfs/Wood-Chip-Heating-Guide.pdf>)

4.13.5. New and Innovative Market Incentives

4.13.5.1. Conduct an assessment of other potential forest product markets that could provide added financial incentives for forest land retention and stronger forest product markets, including:

4.13.5.1.1. Production of edible non-timber forest products, such as ferns, fruits, nuts, and shiitake, oyster and morel mushrooms.

4.13.5.1.2. Production of herbs for medicinal, flavoring or nutritional use, including wild ginseng, **pale jewelweed**, and **goldenseal**.

4.13.5.1.3. Environmental benefits payments potentials, including carbon sequestration payments, Ozone mitigation payments, and nutrient and sediment reduction payments.

4.13.5.1.4. Fishing and hunting leases.

4.13.5.1.5. Renewable energy markets.

4.13.5.1.6. Green Building Incentives.

4.14. Issue: Timber Management for Sustainable Forests

4.14.1. Analyze a representative set of timber harvest plans for Baltimore County, including:

4.14.1.1. Determine location and acreage of harvest activity during at least the last five years.

Recommended Assessments and Data Analyses

- 4.14.1.2. Determine landowner objectives.
- 4.14.1.3. Identify timber harvest methods used.
- 4.14.1.4. Identify timber harvest plans completed under either an FCMA or forest stewardship plan.
- 4.14.1.5. Determine the number of timber harvests with buffer management plans.
- 4.14.1.6. Evaluate species composition and expected basal area change from timber harvest plans, especially on larger forest patches.
- 4.14.1.7. Identify post-harvest timber regeneration methods.
- 4.14.1.8. Evaluate the sustainability of harvest patterns identified by assessment.
- 4.14.1.9. Determine the number and extent of timber harvests occurring without a sustainable forest management plan.

4.15. Issue: Forest Management Plans for Publicly Owned Forests

- 4.15.1. Develop a database and tracking system for the status of preparation and implementation of management plans for all publicly owned forest lands in Baltimore County.
- 4.15.2. For publicly owned forest lands without management plans, determine the reasons that plans have not been prepared. For plans not implemented, determine the reasons for non-implementation.
- 4.15.3. Identify County-owned forest lands that might be candidates for establishment of demonstration forests for public education and research.

5.0 Appendix A: Forest Resources Of Baltimore County – A Data Snapshot

5.1 Data and Methods of Analysis

The Montreal Process Criteria and Indicators are a tool for understanding the condition and trends of forest lands at a national level. The *National Report on Sustainable Forests – 2003* prepared by the USDA Forest Service is the first comprehensive attempt to report on forest sustainability in the United States using the MP C&I. This report represents a significant undertaking, yet several dozen of the 67 Indicators are not directly measurable at this time.

As much as Baltimore County is a pilot for use of the MP C&I under the Linking Communities project, data does not exist at the local level to use the vast majority of MP Indicators. Until the County develops data to characterize forest resources using appropriate and comparable Indicators, characterization needs to be based on relevant existing data. While many of the MP C&I describe conditions *within* forested areas, County data are better able to characterize forests *across* forested areas, or “patches.”

The sections below therefore describe Baltimore County’s forest resources at a “landscape” level. Areal sub-units used for analysis and comparison is the fourteen major MD 8-digit watersheds. These watersheds, presented in Figure 5.1, are familiar to many Baltimore County residents and include the Loch Raven, Prettyboy, and Liberty Reservoir watersheds; the Patapsco River, Deer Creek, and Little Gunpowder Falls watersheds along the western and eastern borders of the County; the Gwynns Falls and Jones Falls watersheds in the south-central portion of the County that drain into Baltimore City; and the Baltimore Harbor, Back River, Middle River, Bird River, Lower Gunpowder Falls, and Gunpowder River watersheds on the eastern side of the County that drain to tidal tributaries of the Chesapeake Bay.

The sections below provide a reasonably accurate picture of forest resources even though there are several important limitations associated with the data used. The County has a digitized forest cover layer based on 1995 to 1997 leaf-off (early spring) aerial photography. Forest areas were digitized and given unique identifiers for each forest “patch.” Patches, which range from 45 square feet to more than 4,500 acres, are contiguous forest areas broken and bounded by roads, major streams and rivers, and non-forest land cover.

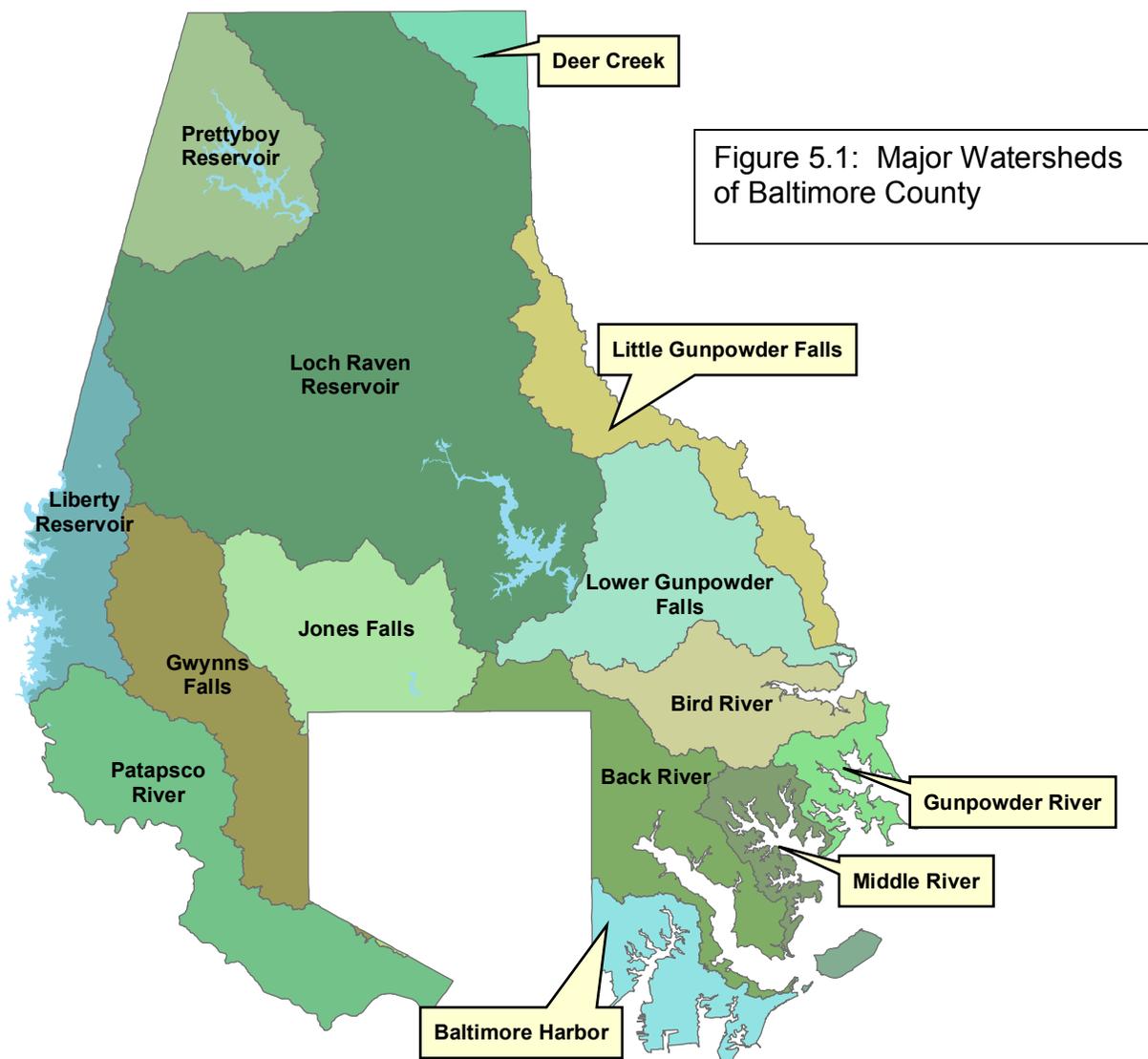
Using the County’s Geographic Information System (**GIS**), it is possible to spatially overlay the forest data with other data layers. Useful GIS data layers include **zoning**, public land ownership, conservation easements, streams and hypothetical 100-foot stream buffers, and cadastral data. The cadastral data are the geo-referenced State Assessment and Taxation records for each property parcel legally constituted in the

Appendix A: Forest Resources of Baltimore County

County. There are more than 300,000 individual property records. The cadastral data are not 100% complete but are continually updated. The data used for the analyses herein are best described as current to the year 2004.

The spatial comparison of forest cover approaching ten years old and current property records obviously introduces some inaccuracy; however, given the rate of forest cover change, especially outside the County's urban growth boundary (Urban-Rural Demarcation Line, or URDL), the data are considered to adequately capture major forest resource conditions at the landscape level.

Data totals for forest cover are also not consistent across all of the analyses that follow. This is because each GIS data layer may have minor inaccuracies, including boundaries of shape files and the loss of some data such as parcel records. Overall, the data totals are close enough to characterize forest patch and ownership conditions.



5.2 Forest Cover Distribution

Baltimore County has about 132,700 acres of forest cover, or about a third of the land area. Forests cover only 26% of the Patapsco River basin, which comprises about 30% of the County's land area and 70% of the County's population. The Gunpowder River Basin, with about 70% of the land area and 30% of the population, is 38% forested. Forest acreage is based on 1995 to 1997 digitized aerial photography.

Forest cover has been reduced historically as a result of land conversion to agriculture and urban development. As presented in Table 5.2, none of the 14 major watersheds of the County currently has greater than 50% forest cover. However, forest cover is greatest in the three reservoir watersheds (Figure 5.2). About 40% of the Loch Raven Reservoir watershed and 48% of the Liberty and Prettyboy Reservoir watersheds are forested.

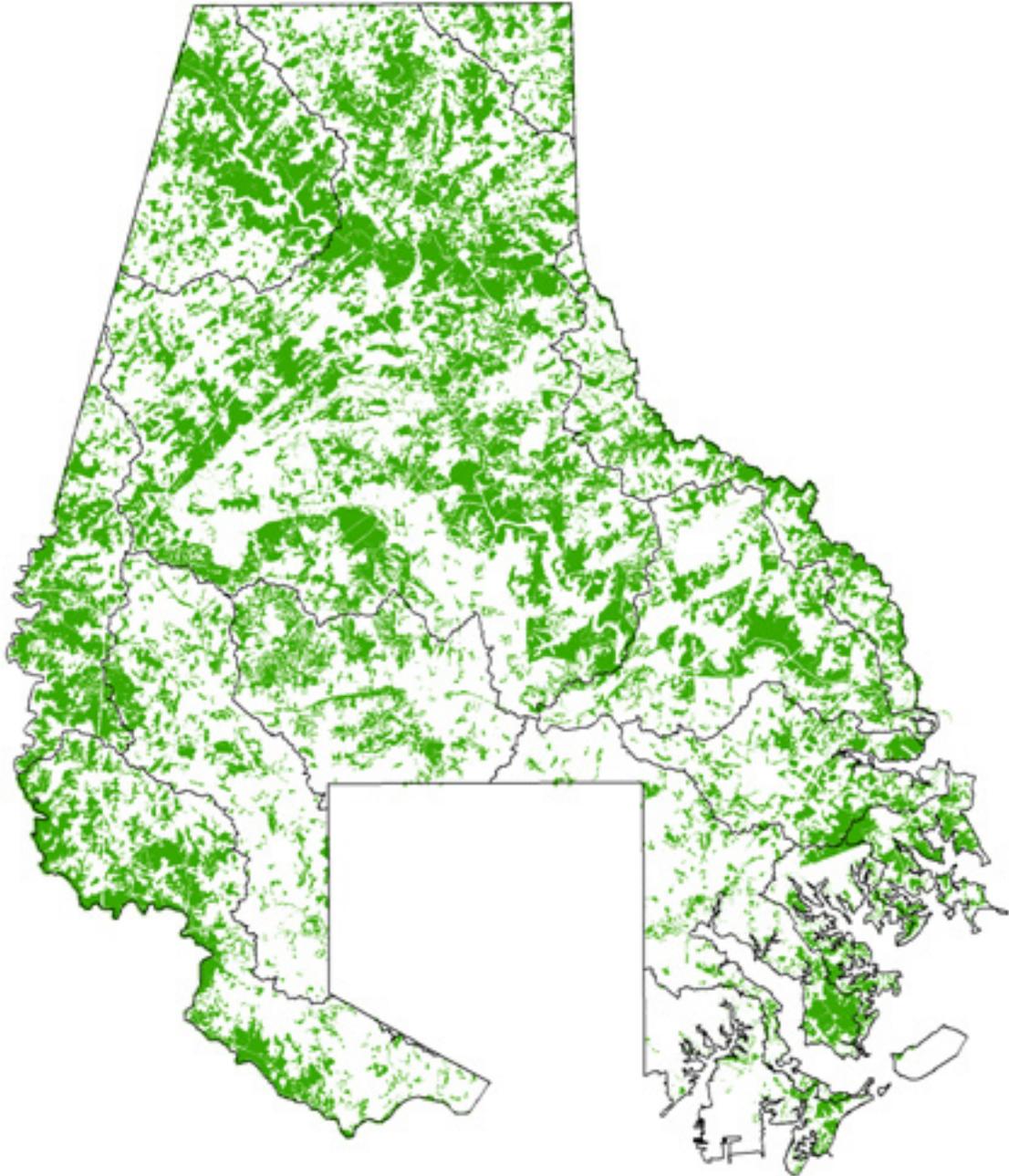
Urban watersheds generally have little significant forest cover. This is a result of long-term urbanization, most of which occurred in the County before environmental requirements for forest protection, and as a result of growth management programs that concentrated development within only one-third of the land area. The Back River, Baltimore Harbor, and Gwynns Falls watersheds each have less than 20% forest cover.

Table 5.2: Watershed and Forest Acreage, and Percent Forest Cover

Watershed	Watershed Acres	Forest Acres	% Forest
Deer Creek	7,132	2,345	32.9%
Prettyboy Reservoir	25,545	11,797	46.2%
Loch Raven Reservoir	139,554	56,409	40.4%
Little Gunpowder Falls	17,229	6,340	36.8%
Lower Gunpowder Falls	29,471	9,460	32.1%
Bird River	16,463	4,738	28.8%
Gunpowder River	6,065	2,453	40.4%
Middle River	6,520	1,789	27.4%
Liberty Reservoir	17,555	8,260	47.1%
Patapsco River	33,186	11,697	35.2%
Gwynns Falls	28,643	5,245	18.3%
Jones Falls	25,944	6,977	26.9%
Back River	23,248	4,038	17.4%
Baltimore Harbor	11,453	1,133	9.9%
Total	388,008	132,681	34.2%

Appendix A: Forest Resources of Baltimore County

Figure 5.2: Forest Cover of Baltimore County



5.3 Interior Forest

Although 34% of Baltimore County’s land area is in forest cover, only 12.8% of that is interior forest. Overall, only 4.4% of the total County land area is interior forest. Interior forest here is defined as forest beyond 500 feet from the edge of a forest patch. This is a very conservative measure, as some research uses a 300-foot edge definition. At 500 feet, interior forest areas are not influenced by light, wind, and other conditions from outside the edge of the forest patch. It can be anticipated that interior forests potentially host truly forest-dependent plants and animals.

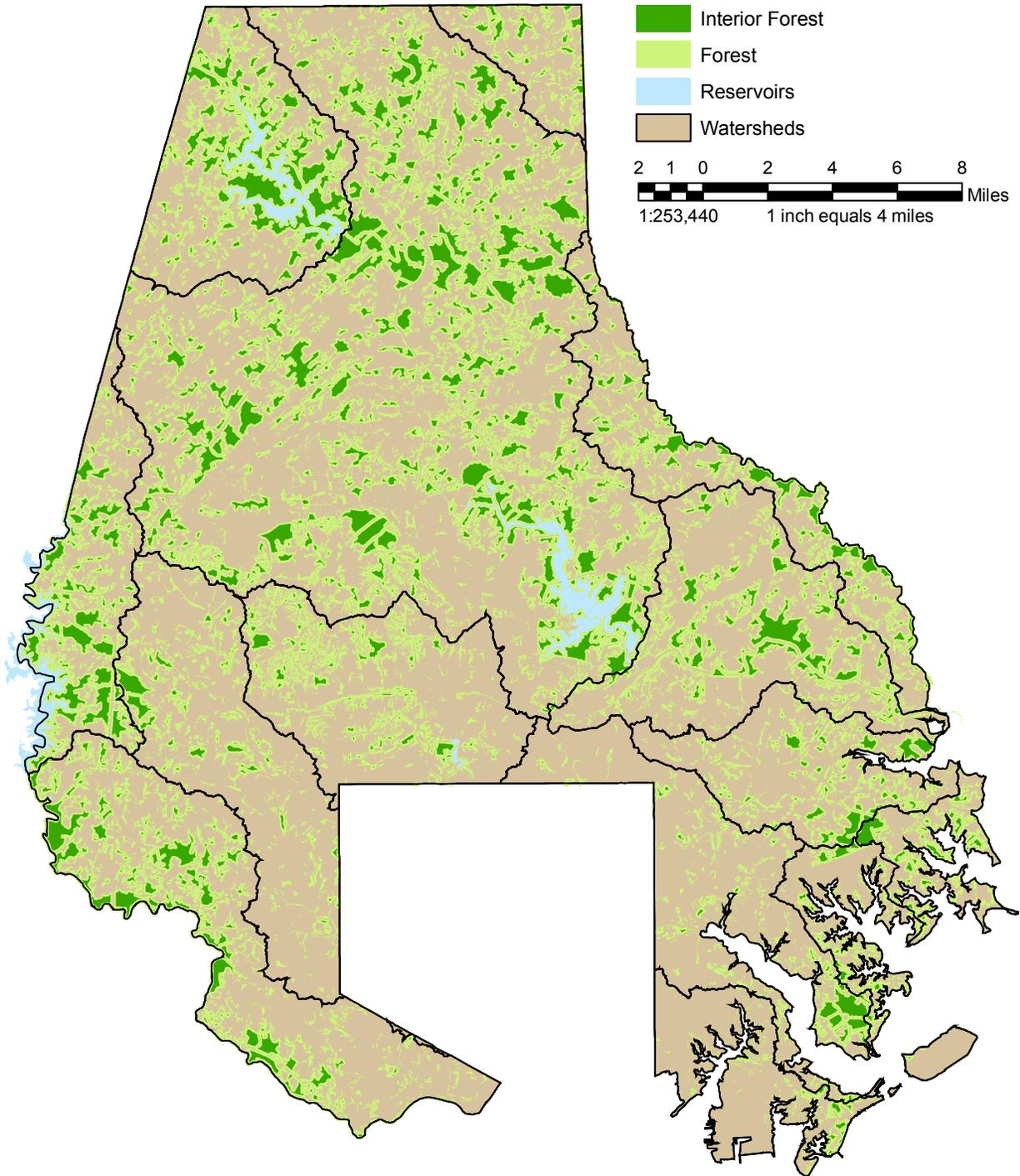
The distribution of interior forest is presented in Figure 5.3, and tabular data is presented in Table 5.3. The watersheds with the greatest percentage of interior forest are the Prettyboy and Liberty Reservoir watersheds, both with >25% interior forest. While this is expected, the Loch Raven Reservoir watershed has the lowest percentage of interior forest, at only 5%. This watershed also has the third lowest average interior forest size, at 8.2 acres, which reflects that the Loch Raven Reservoir watershed’s forests are highly fragmented with a high edge to area ratio. Overall, Baltimore County’s interior forest areas are very small, at an average interior area of only 18.1 acres. Because the County only has 315 forest patches greater than 100 acres, the prospect of retaining significant interior habitat is therefore grim. This is because a 100-acre circle with a 500-foot edge yields an interior area of only 33 acres, and even at a 300-foot edge, the interior area of a 100-acre perfectly circular patch is only 55.5 acres.

Table 5.3: Interior Forest Cover in Baltimore County

Watershed	Forest Acres	% in Forest	# Patches w Interior F	Acres of Int. Forest	Avg Acres of Int. Forest	% For. in Int. Forest
Deer Creek	2,345	32.9%	23.00	305.4	13.3	13.0%
Prettyboy Reservoir	11,797	46.2%	68.00	3,157.7	46.4	26.8%
Loch Raven Reservoir	56,409	40.4%	344.00	2,818.3	8.2	5.0%
Little Gunpowder Falls	6,340	36.8%	52.00	1,109.0	21.3	17.5%
Lower Gunpowder Falls	9,460	32.1%	72.00	1,781.1	24.7	18.8%
Bird River	4,738	28.8%	48.00	767.4	16.0	16.2%
Gunpowder River	2,453	40.4%	30.00	415.9	13.9	17.0%
Middle River	1,789	27.4%	24.00	195.0	8.1	10.9%
Liberty Reservoir	8,260	47.1%	50.00	2,138.2	42.8	25.9%
Patapsco River	11,697	35.2%	81.00	2,477.1	30.6	21.2%
Gwynns Falls	5,245	18.3%	49.00	605.8	12.4	11.6%
Jones Falls	6,977	26.9%	45.00	493.4	11.0	7.1%
Back River	4,038	17.4%	39.00	624.2	16.0	15.5%
Baltimore Harbor	1,133	9.9%	12.00	81.2	6.8	7.2%
Total	132,681	34.2%	937.00	16,969.7	18.1	12.8%

Appendix A: Forest Resources of Baltimore County

Figure 5.3: Interior Forest Cover in Baltimore County



Appendix A: Forest Resources of Baltimore County

5.4 Forest Ownership

There are two dimensions of forest ownership: public v. private ownership, and ownership by type of use, including agricultural, residential, commercial, and institutional owners. Data for these dimensions of forest ownership in Baltimore County are presented, by watershed, in Tables 5.4.1 and 5.4.2, respectively. The location of publicly owned forests in the County is presented in Figure 5.4.

More than 32,000 acres (24.6%) of Baltimore County's forest lands are in public ownership. Publicly owned forests comprise the largest contiguous forest blocks. The State of Maryland is the largest forest landowner in the County, with approximately 14,880 acres located primarily in three major State parks: the Gunpowder Falls State Park on the Little Gunpowder Falls on the Harford County border and along the (Big) Gunpowder Falls downstream of Prettyboy Reservoir, and the Patapsco River State Park along the Patapsco River on the Howard and Anne Arundel County borders. The City of Baltimore owns about 12,400 acres of forest lands surrounding the Prettyboy, Loch Raven, and Liberty Reservoirs, and Lake Roland, a former water supply reservoir now used for recreation. Baltimore County owns more than 4,760 acres of forest land, including Oregon Ridge Park, the Shapiro Property/Essex Skypark, and numerous other regional and local parks throughout the urbanized area of the County. The federal government also owns nearly 600 acres of forested land, mostly adjacent to Harford County as part of the Aberdeen Proving Grounds.

Table 5.4.1: Acres of Publicly-owned Forests by Watershed and Level of Government

Watershed	Federal	State	Balto. City	County	Total
Deer Creek	-	-	-	4	4
Prettyboy Reservoir	-	56	5,139	18	5,213
Loch Raven Reservoir	10	3,407	4,791	1,271	9,478
Little Gunpowder Falls	-	1,889	-	17	1,906
Lower Gunpowder Falls	-	2,813	164	95	3,072
Bird River	-	443	101	364	908
Gunpowder River	442	417	-	353	1,212
Middle River	-	77	-	209	286
Liberty Reservoir	-	1,260	1,665	33	2,959
Patapsco River	36	2,956	89	642	3,723
Gwynns Falls	88	842	78	544	1,552
Jones Falls	-	103	290	123	516
Back River	-	184	113	1,005	1,302
Baltimore Harbor	4	426	-	85	515
Total	580	14,873	12,429	4,763	32,646

Forest ownership by use, based on the tax assessment classification of parcels with forest cover, is hampered by an imperfect database. The cadastral (property) data layer

Appendix A: Forest Resources of Baltimore County

used for this analysis includes approximately 15% of total forest acres on parcels for which the assessment classification is described as “Unknown.” In fact, however, based on a visual scan of the location of these parcels, a large share of these acres is public land, including City-owned reservoir lands. Furthermore, as Exempt forests include publicly-owned forest lands and institutional ownerships, at least a respectable share of the “Unknown” forest use types can safely be assumed to be public as a result of comparing the 25,000 acres of Exempt forest lands in Table 5.4.2 to the 32,600+ acres of publicly-owned forests as listed in table 5.4.1.

Overall, the predominant use types are Residential and Agriculture, each accounting for about 30% of total forest acres. The percentage of forest lands assessed for Commercial and industrial use are an order of magnitude smaller than Residential and Agriculture uses.

Table 5.4.2: Forest Ownership by Parcel Tax Assessment Classification

Watershed	Resid.	Agric.	Com.	Ind.	Exempt	Swamp	Unk.	Total
Deer Creek	511	1,727	5	11	3	-	88	2,345
Prettyboy Reservoir	1,901	4,380	12	1	136	-	5,367	11,797
Loch Raven Reservoir	17,084	23,654	759	598	6,250	78	7,986	56,409
Little Gunpowder Falls	1,761	2,405	20	4	1,847	0	302	6,340
Lower Gunpowder Falls	2,982	1,913	266	146	3,360	8	785	9,460
Bird River	1,449	643	169	888	1,096	19	474	4,738
Gunpowder River	485	200	46	439	974	19	292	2,453
Middle River	884	51	33	273	378	32	139	1,789
Liberty Reservoir	2,189	1,859	139	51	2,488	3	1,530	8,260
Patapsco River	4,096	1,791	230	461	3,541	69	1,509	11,697
Gwynns Falls	1,339	102	421	345	2,023	177	840	5,246
Jones Falls	4,215	592	658	52	965	14	482	6,977
Back River	1,267	104	166	384	1,587	79	451	4,038
Baltimore Harbor	139	-	91	190	639	5	70	1,133
Total	40,303	39,419	3,015	3,842	25,285	503	20,315	132,683

Notes: * Unknown is a mix of large public holdings and other, smaller private holdings.

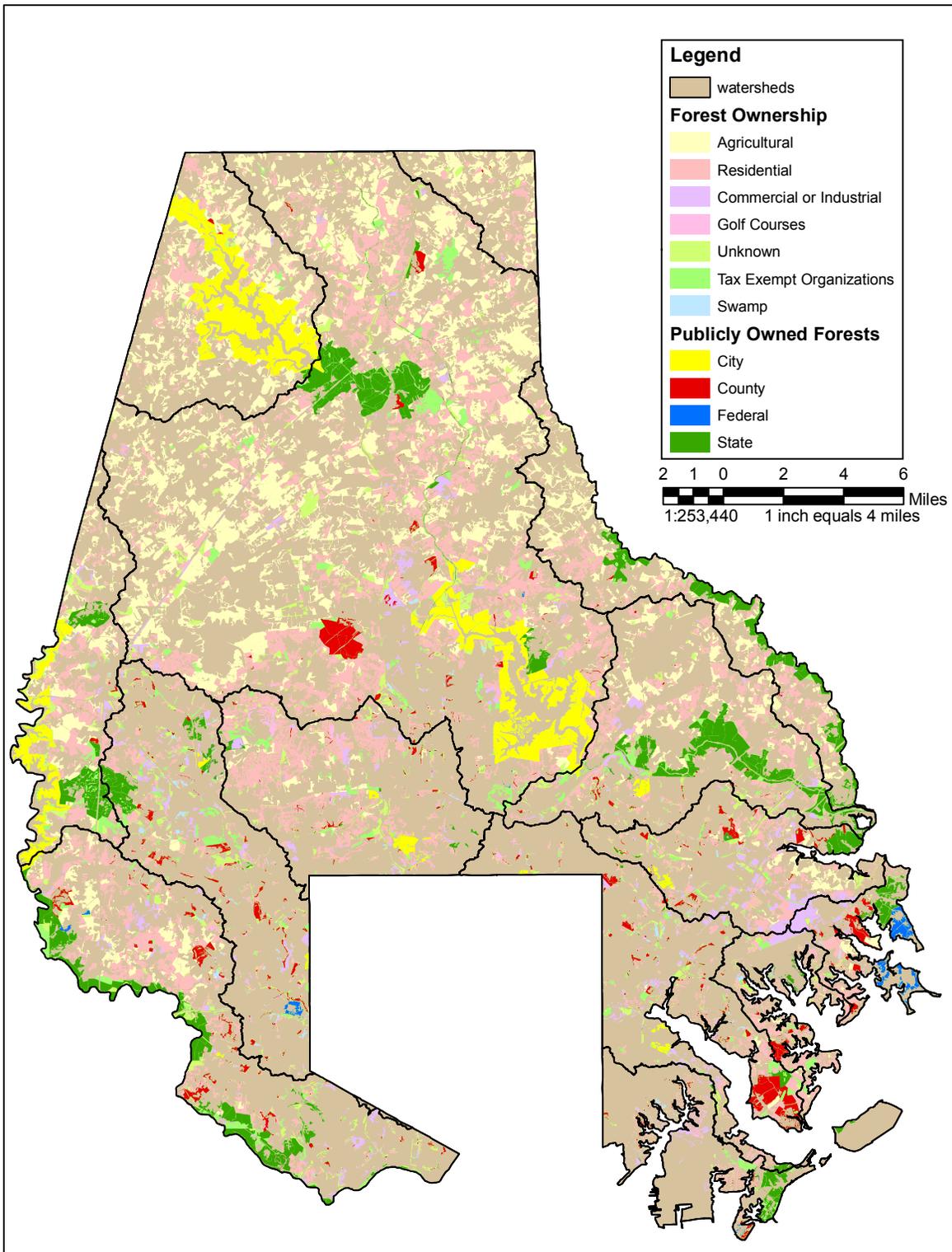
* Tax Exempt includes governments and institutional lands.

* Commercial includes golf courses

* Unk = unknown

Appendix A: Forest Resources of Baltimore County

Figure 5.4: Publicly-Owned Forest Land of Baltimore County



Appendix A: Forest Resources of Baltimore County

5.5 Forest Fragmentation

Baltimore County's forests are fragmented into more than 9,000 patches, ranging in size from 45 square feet to 4,500 acres. The mean forest patch is 14.58 acres and the median patch size is 0.44 acre. About half of these patches are < 0.25 acre and together they account for a very small percentage of the County's forest cover. For forest patches \geq 0.25 acre, the mean patch size is 27.2 acres. In Table 5.5, the distribution of forest patch sizes greater than 0.25 acre is presented, and the patch size distribution is presented in Figure 5.5. The smallest 50% of patches collectively comprise only 418 acres or 0.3% of the total forest base. The 315 patches greater than 100 acres, which comprise 6.5% of all patches, account for nearly 82,000 acres or 62.1% of the total forest base of the County.

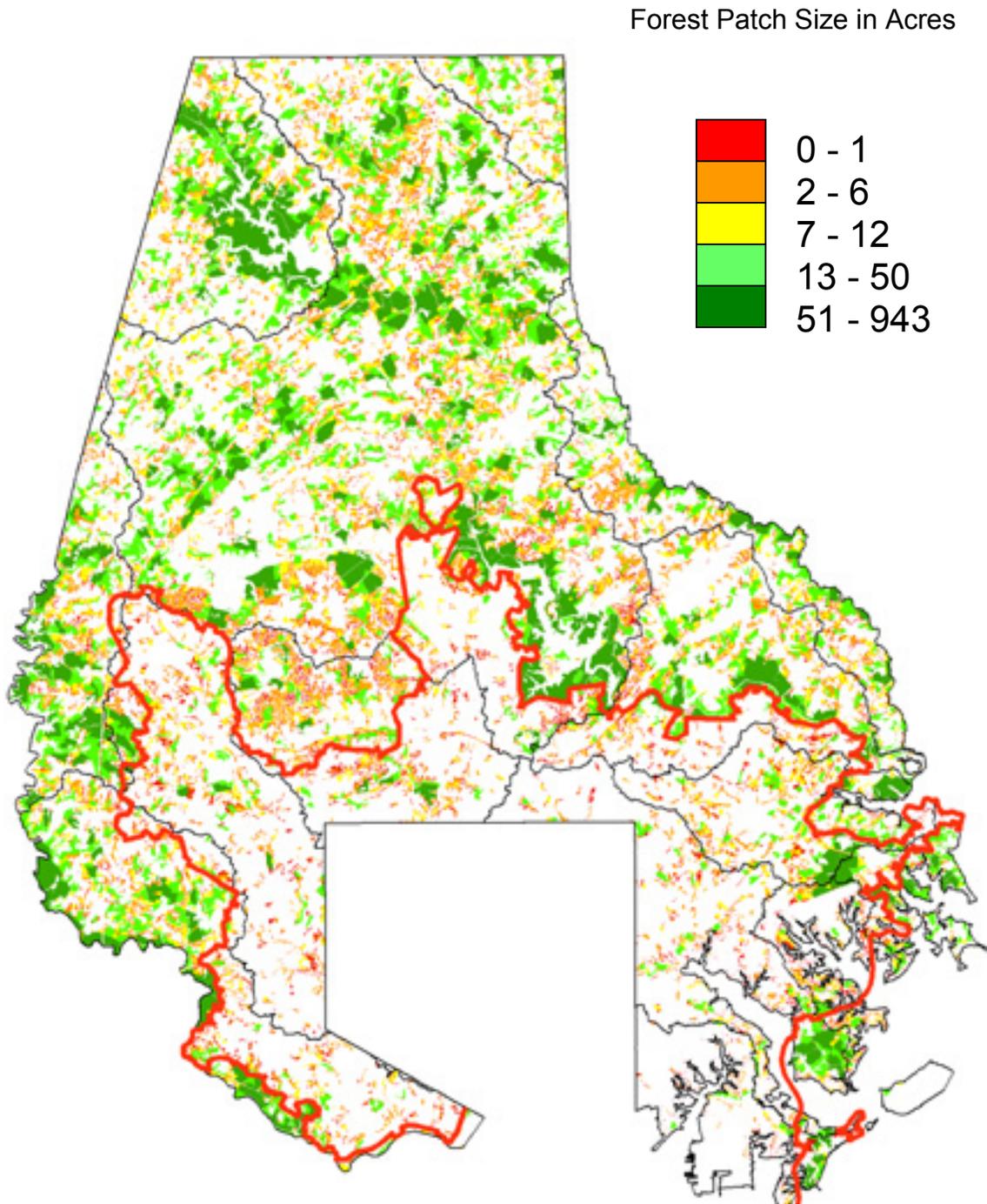
Table 5.5: Size Distribution of Forest Patches Greater than .25 Acre in Baltimore County

Patch Size (acres)	Forest Patches			
	Number	Percent	Cum. #	Cum. %
1000.00+	4	0.1%	4	0.1%
500.00-999.99	28	0.6%	32	0.7%
250.00-499.99	81	1.7%	113	2.3%
100.00-249.99	202	4.2%	315	6.5%
50.00-99.99	239	4.9%	554	11.4%
25.00-49.99	349	7.2%	903	18.6%
10.00-24.99	686	14.2%	1,589	32.8%
5.00-9.99	770	15.9%	2,359	48.7%
2.00-4.99	912	18.8%	3,271	67.5%
1.00-1.99	529	10.9%	3,800	78.5%
0.50-0.99	517	10.7%	4,317	89.1%
0.25-0.49	526	10.9%	4,843	100.0%
Total	4,843	100.0%		

Patch Size (acres)	Forest Acreage			
	Acres	Percent	Cum. Ac.	Cum. %
1000.00+	4,587	3.5%	4,587	3.5%
500.00-999.99	17,761	13.5%	22,348	17.0%
250.00-499.99	27,658	21.0%	50,006	38.0%
100.00-249.99	31,788	24.1%	81,794	62.1%
50.00-99.99	16,892	12.8%	98,686	74.9%
25.00-49.99	12,416	9.4%	111,102	84.4%
10.00-24.99	10,682	8.1%	121,784	92.5%
5.00-9.99	5,438	4.1%	127,222	96.6%
2.00-4.99	3,137	2.4%	130,359	99.0%
1.00-1.99	774	0.6%	131,133	99.6%
0.50-0.99	371	0.3%	131,504	99.9%
0.25-0.49	190	0.1%	131,694	100.0%
Total	131,694	100.0%		

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Figure 5.5: Forest Fragmentation: Distribution of Forest Patches by Size (Acres)



Appendix A: Forest Resources of Baltimore County

5.6 Forest Parcelization

Baltimore County's forests are highly fragmented into approximately 9,000 patches, and these are further fragmented by an estimated 50,000 or more owners. Using GIS, the number of forest patches with various numbers of owners was determined, as presented in Table 5.6 and Figure 5.6. Parcelization trends are presented in more detail in the Table than on the map. The data used herein differ slightly from that presented in the sections above on forest patches, because in those analysis the forest data is not intersected with the cadastral data. The differences are not significant for smaller sized patches or for total forest acres, which differs by less than 1,000 acres across all of the data presented under Section 5.0.

The data indicate that more than 2,800 patches, or nearly 32% of total forest patches, have only one owner, yet these account for only about 5,000 acres or only 4% of the total forest base. Patches with one or two owners comprise about 53% of patches but only 5.8% of forest acres. And while about 75% of patches have five or fewer owners, these account for less than 12% of forest acres. These data reveal that there are a large number of rather small forest patches that are under the control of a relatively small number of owners. In this analysis, a landowner could have parts of more than one forest patch on a parcel.

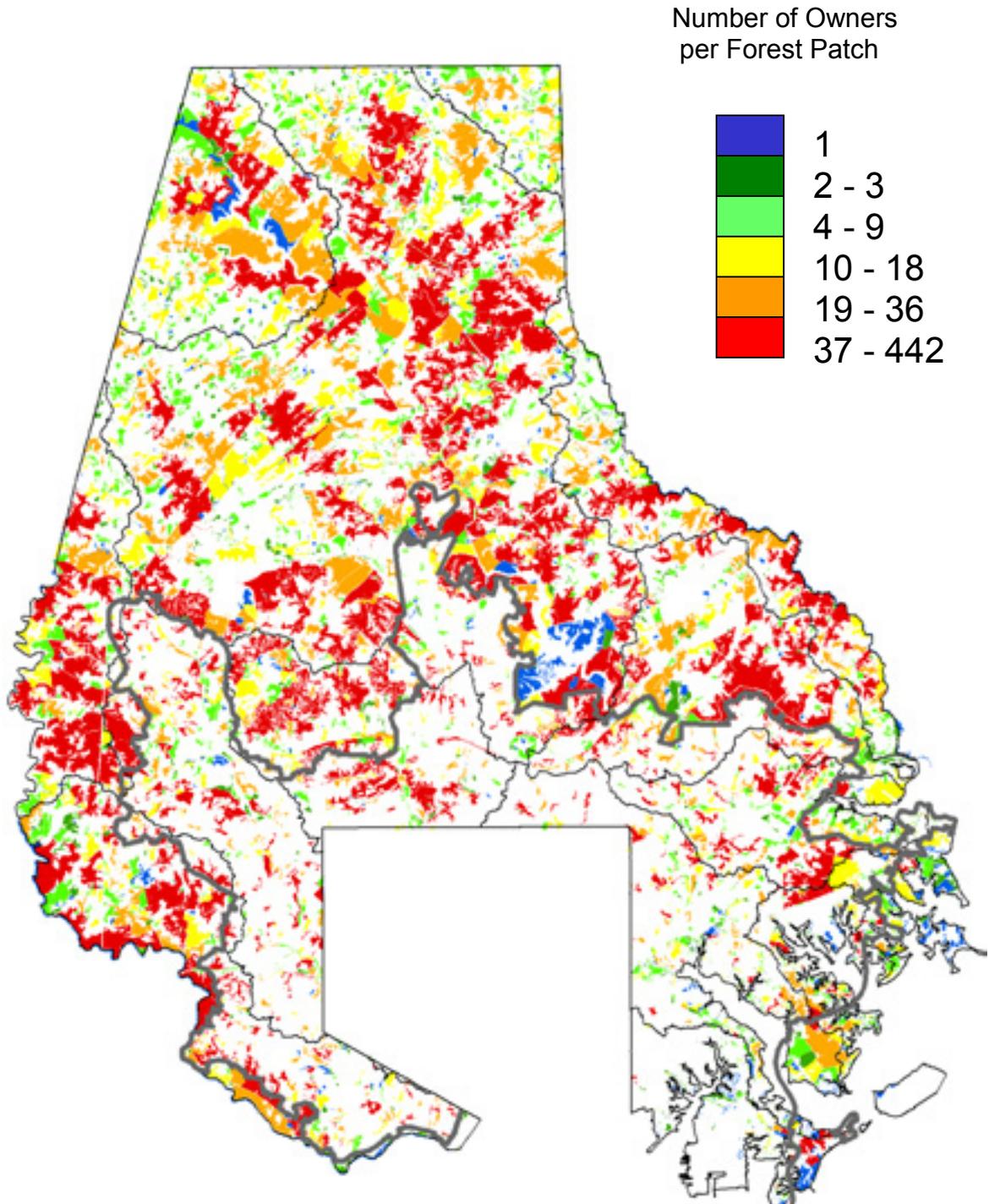
The data also reveal that there is a small number of patches with very large numbers of owners, including 14 forest patches with more than 200 owners. These account for only 0.2% of patches and 2.4% of forest acres. For most of these patches, the large number of owners is the result of "paper" lots, or older subdivision plats wherein land is separately recorded for 25 or 50-foot wide lots. These decades-old "paper" lots have never been developed, and the collective area of lots remains in forest cover.

Table 5.6: Parcelization: Number and Acreage of Forest Patches by Number of Owners

Number of Owners	# of Patches	% of Patches	# of Acres	% of Acres	Cumulative			
					# Patches	% Patches	# Acres	% Acres
1	2,831	31.6%	5,085	3.9%	2,831	31.6%	5,085	3.9%
2	1,933	21.6%	2,539	1.9%	4,764	53.2%	7,624	5.8%
3	975	10.9%	2,791	2.1%	5,739	64.1%	10,415	7.9%
4	588	6.6%	3,031	2.3%	6,327	70.7%	13,446	10.2%
5	361	4.0%	2,023	1.5%	6,688	74.7%	15,469	11.7%
6-10	829	9.3%	11,661	8.8%	7,517	83.9%	27,130	20.6%
11-20	600	6.7%	19,146	14.5%	8,117	90.6%	46,276	35.1%
21-50	543	6.1%	37,017	28.1%	8,660	96.7%	83,293	63.1%
51-100	197	2.2%	28,581	21.7%	8,857	98.9%	111,874	84.8%
101-150	60	0.7%	10,591	8.0%	8,917	99.6%	122,465	92.8%
151-200	24	0.3%	6,281	4.8%	8,941	99.8%	128,746	97.6%
201-442	14	0.2%	3,202	2.4%	8,955	100.0%	131,948	100.0%
Total	8,955	100.0%	131,948	100.0%				

Appendix A: Forest Resources of Baltimore County

Figure 5.6: Forest Land Parcelization: Number of Owners per Forest Patch



5.7 Riparian Forests

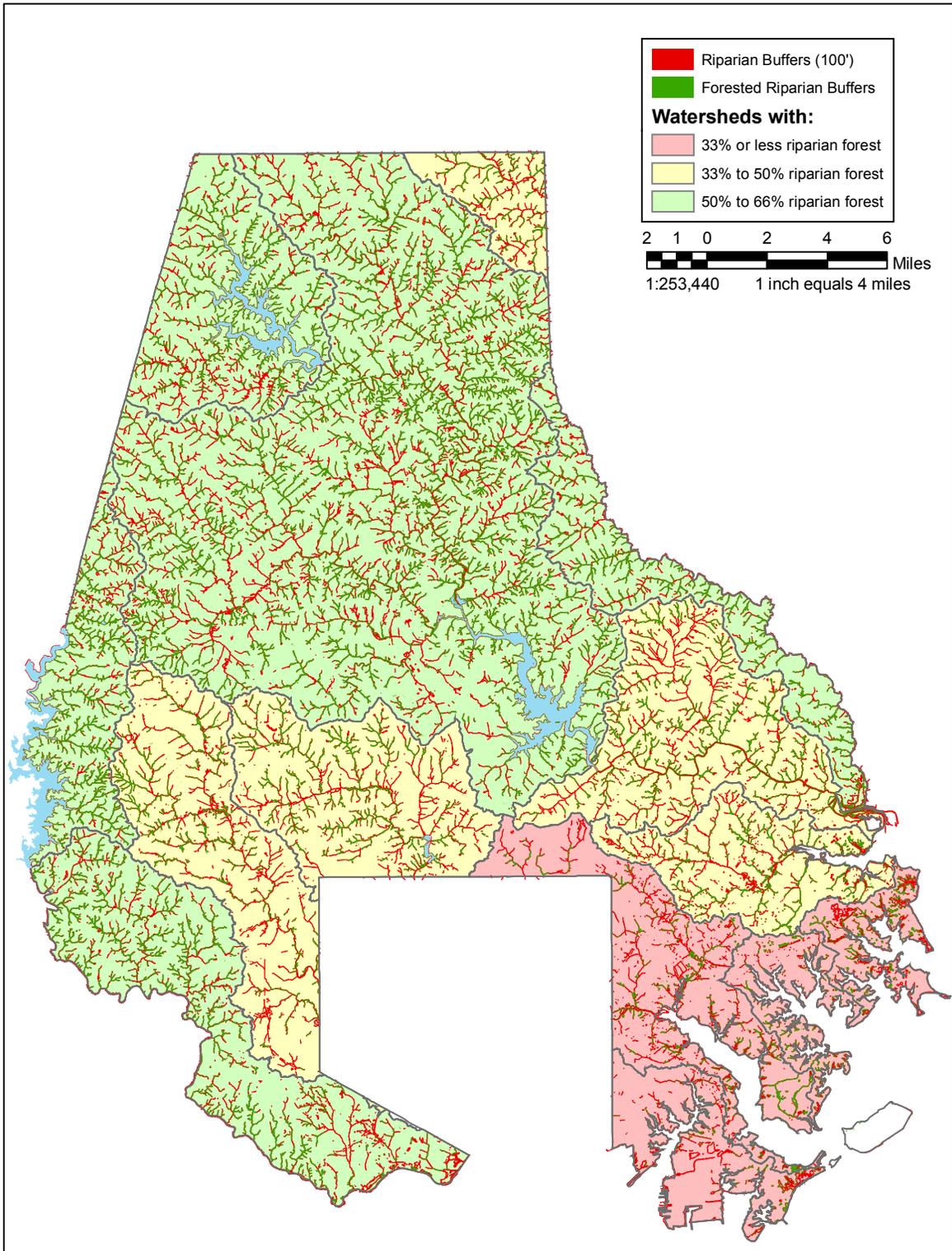
Regardless of the total percentage of land in a watershed that is in forest cover, the most important characteristic of forest cover for water quality is forest cover along streams. For this analysis, a hypothetical 100-foot buffer on all streams in Baltimore County was determined, and the presence or absence of forest cover within the buffer was calculated. Overall, about 52% of the nearly 70,000 acres of land comprising 100-foot buffer areas along the County’s streams is forested. Also, about 27.5% of all forest cover in the County is located within riparian buffer areas. Riparian cover is at least 30% for all watersheds except the Baltimore Harbor. The Liberty Reservoir and Little Gunpowder Falls watersheds have greater than 60% forest cover along stream buffers.

Table 5.7: Riparian Forests

Watershed	# Riparian Buffer Areas	Total Acres Riparian Buffer	# Riparian Forest Areas	Acres Riparian Forest	% Riparian Buffers w Forest
Deer Creek	15	1,191	390	566	47.5%
Prettyboy Reservoir	20	5,091	2,278	2,899	56.9%
Loch Raven Reservoir	227	26,400	10,369	15,682	59.4%
Little Gunpowder Falls	46	3,130	1,288	1,932	61.7%
Lower Gunpowder Falls	100	5,199	1,364	2,449	47.1%
Bird River	176	2,847	1,142	1,294	45.4%
Gunpowder River	69	1,802	999	591	32.8%
Middle River	79	1,218	1,869	404	33.2%
Liberty Reservoir	48	3,795	1,182	2,534	66.8%
Patapsco River	143	5,874	1,830	3,225	54.9%
Gwynns Falls	110	3,854	1,494	1,620	42.0%
Jones Falls	98	3,945	1,402	1,945	49.3%
Back River	219	3,649	2,152	1,147	31.4%
Baltimore Harbor	79	1,730	1,320	274	15.8%
Total	1,429	69,724	29,079	36,562	52.4%

Appendix A: Forest Resources of Baltimore County

Figure 5.7: Distribution of Forests in Riparian Buffers



Appendix A: Forest Resources of Baltimore County

5.8 Forest Loss to Development

Since implementation of the County's Forest Conservation Act in 1993, nearly 800 development projects have been subject to the FCA regulations (through 2003). More than 7,400 acres or about one-half of the 15,200 development site acres subject to the FCA were forested. The FCA regulations have protected 4,950 acres (67%) of the existing forest acres on site, and 2,270 acres (31%) have been cleared. Cleared forests average more than 220 acres per year. Fees-in-lieu of mitigation have been paid by developers for about 43 acres of cleared forest (through 2002). Hundreds of acres are also harvested each year for non-development purposes under the FCA's Declaration of Intent provisions; however, most of these areas regenerate and continue to grow as forest. In Table 5.8, the acreage of forest retained and cleared for land development projects are presented.

Table 5.9: Forest Acres Retained and Cleared Pursuant to the Forest Conservation Act

Year	# of Projects	Net Tract (acres)	Existing Forest		Retained Forest		Cleared Forest	
			Acres	%	Acres	%	Acres	%
1993-94	118	1,567.0	739.6	47.2%	545.9	73.8%	166.1	22.5%
1995	71	1,208.2	756.6	62.6%	483.4	63.9%	165.8	21.9%
1996	108	2,439.9	1,157.8	47.5%	779.8	67.4%	368.0	31.8%
1997	65	1,601.5	884.9	55.3%	635.1	71.8%	245.6	27.8%
1998	67	1,247.3	607.4	48.7%	416.3	68.5%	190.7	31.4%
1999	66	1,400.8	502.2	35.9%	364.9	72.7%	132.7	26.4%
2000	77	1,665.1	923.1	55.4%	572.6	62.0%	328.1	35.5%
2001	40	723.0	357.2	49.4%	229.8	64.3%	124.6	34.9%
2002	72	1,817.1	812.7	44.7%	486.1	59.8%	317.9	39.1%
2003	88	1,531.0	666.0	43.5%	433.7	65.1%	228.4	34.3%
Total	772	15,201.0	7,407.4	48.7%	4,947.6	66.8%	2,268.0	30.6%

6.0 Appendix B: Sustainability Indicators

6.1. Introduction

In its simplest sense, sustainability is the idea of meeting the needs of society today without reducing the ability of future generations to meet their needs. Sustainability doesn't just happen on its own but is the result of deliberate management.

Sustainability, as incorporated into the Montreal Process Criteria and Indicators framework and as structured herein, has two components:

- **ecological sustainability**, whereby healthy forests readily regenerate in response to both natural and human disturbances, and continue to function to provide clean air, clean water, and habitat for diverse species; and
- **economic sustainability**, whereby forests are managed as a renewable resource to contribute forest products in recognition that we are a highly-consumptive society.

6.2. Indicators

Environmental management programs, including those for forest sustainability, make use of indicators in a similar manner to the use of indicators for economics and other components of modern society. Indicators are a communication tool. They help measure and simplify complex processes and conditions. Indicators are useful for management as they help to characterize existing conditions and trends, often toward defined management objectives.

There are several important characteristics of good indicators. Good indicators are:

- neutral in value
- relevant to the intended issues and values
- easy to understand
- measurable and based on good science
- not thresholds, but help explain resource condition or status.

6.3. Using Indicators

Baltimore County's efforts for forest sustainability are designed to use indicators. The framework adopted is the Montreal Process Criteria and Indicators, explained in Section 7.0. The reason that indicators are being used and need to be used to a greater degree is that they provide science-based, objective means to evaluate baseline conditions, identify trends, and track progress toward established goals, especially for long-term management programs.

7.0 Appendix C: Montreal Process Criteria and Indicators

7.1. Introduction

The Montreal Process is known to many as a framework for science-based Criteria and Indicators for forest sustainability. Seven Montreal Process Criteria represent broad values of forest resources, from ecological functions to socio-economic values. Some 67 detailed data Indicators have also been developed to assess conditions and measure progress toward sustainability. The following is a summary of the origins of the Montreal Process (Excerpt from Montreal Process website):

*“The 1992 Earth Summit, or United Nations Conference on Environment and Development (UNCED), called upon all nations to ensure sustainable development, including the management of all types of forests. The summit produced a Statement of Forest Principles, conventions on biodiversity, climate change and desertification, and a plan of action for the 21st century called Agenda 21, all of which have implications for forest management. Following UNCED, Canada convened an International Seminar of Experts on Sustainable Development of Boreal and Temperate Forests. This seminar, held in Montréal in 1993 and sponsored by the Conference on Security and Cooperation in Europe (CSCE), focused specifically on criteria and indicators and how they can help define and measure progress towards sustainable development of forests. European countries decided to work as a region under the framework of the Ministerial Conference on the Protection of Forests in Europe. Subsequently, an initiative was launched among non-European temperate and boreal countries to develop and implement internationally agreed criteria and indicators for sustainable forest management. The Montréal Process began in June 1994, in Geneva, with the first meeting of the Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and **Boreal Forests.**”*

7.2. Montreal Process Criteria

1. Conservation of Biological Diversity
2. Maintenance of the Productive Capacity of Forest Ecosystems
3. Maintenance of Forest Ecosystem Health and Vitality
4. Conservation and Maintenance of Soil and Water Resources
5. Maintenance of Forest Contribution to Global Carbon Cycles
6. Maintenance and Enhancement of Long-term Multiple Socio-economic Benefits to Meets the Needs of Societies
7. Legal, Institutional, and Economic Framework for Forest Conservation and Sustainable Management

7.3. Applying the Montreal Process Criteria to Baltimore County

Much remains to be determined about the state of Baltimore County's forests using the Montreal Process Criteria. However, the following summary, following the format of the recent US Forest Service's *Sustainability Assessment Highlights for the Northern US*, presents some major findings and issues in Baltimore County for each of the seven Montreal Process Criteria, based on present understanding.

7.3.1. Conservation of Biological Diversity

About 130,000 acres or one-third of the 385,000 acres of land in Baltimore County is forested. Forests virtually covered the entire landscape before European settlement, and they were widely logged over the following 300 years. Forest cover in the County has actually increased in extent slightly over the past century. In 1929, the County's forest base was estimated at 25%. Forest and woodland communities, characterized primarily by mixed hardwoods with oak-hickory dominance, are important components of the biological diversity of the County. Long-term changes in dominant species have been driven primarily by disease, such as the loss of the American chestnut in the 1930's. True "old growth" forest is not known to exist in Baltimore County; however, the acreage of mature forest is increasing and a significant portion of our forests is reaching 80 to 100 years. The County's forests include a small number of naturally rare vegetative communities, such as the pine barrens at Soldiers Delight and Bare Hills. A significant amount of "urban" forest covers the southern third of the County. No assessments of the biodiversity of Baltimore County's forest communities have been conducted. Loss of habitat remains a threat in areas zoned for development. Due to a high degree of forest fragmentation and edge conditions, forest communities are at risk from invasion by an increasing number of exotic species of plants, insects, and animals. Land preservation programs are successful but are not focused on biodiversity conservation, either from a prioritization criterion or assessment perspective.

7.3.2. Maintenance of Productive Capacity of Forest Ecosystems

Forests are a naturally renewable source of timber, firewood, and non-wood forest products. The climate and soils of the mid-Atlantic region are particularly well suited for the growth of forests. The productive capacity of the County's forests is critical for the maintenance of air and water quality and for providing a supply of commercial timberland. Nevertheless, the forestry industry in the County is in serious decline due to ownership fragmentation (parcelization) and changing public attitudes about timber harvesting. The dynamics of the commercial forest industry are not well understood outside the industry and there is essentially no interaction between the County and the private sector regarding the contribution of forestry to the local economy. Forest management practices that enhance timber productivity are made known to landowners through technical assistance programs of the MD Dept. of Natural Resources and to a lesser extent by the University of Maryland

Cooperative Extension Service. There is little evidence that the 75% of the County's forest lands that are privately owned are being deliberately managed for any purpose. It is generally unknown whether the majority of private forest landowners intend to harvest timber on their land. Although some data on the volume of growing stock and the ratio of growth to removals is available to State foresters, such information is not used by others as part of the County's resource management programs. Information on the supply, growth, and removals of non-timber forest products are not known to be available.

7.3.3. Maintenance of Forest Ecosystem Health and Vitality

An assessment of the general health of the County's forest resource has not been conducted. Among the information needed are forest age and composition, trends in tree growth and mortality, tree crown condition, vulnerability to disease, and the condition of soil, water, and wildlife. Such assessments need to be conducted on a continuing, periodic basis as forests are naturally dynamic systems and change as a result of natural and human disturbances. It is safe to conclude that threats to forest health are increasing, and stressors that affect tree health include insects and pathogens, invasive plants, and air pollution. Attention has been focused recently on the growing number of insect pests and diseases, and a large number of our well-represented hardwood species including oaks, ash, dogwood, and maple are threatened. The recent assessment of the City's reservoir lands by the MD DNR concluded that the regenerative capacity of the City's forests is highly vulnerable because of elevated white-tailed deer populations. Baltimore County's Animal Control program is recovering an increasing number of deer "road kills," which are now averaging more than 900 per year. A 2003 survey of communities near the Loch Raven Reservoir, conducted by the Watershed Protection Coalition, revealed that auto accidents and property damage from deer are major problems. Climatic disturbances, including drought, fire, damage from wind and ice, and air pollution appear to be more frequent disturbances. Overall, forests are considered to be at greater risk because of combinations of these stressors, such as drought and forest pests.

7.3.4. Conservation and Maintenance of Soil and Water Resources

Forests are important to maintenance of good water quality and stable streams. Forests absorb and infiltrate precipitation, resulting in slower discharge of overland storm runoff and groundwater to streams compared to urban or agricultural land cover. In addition to regulating watershed **hydrology**, forested buffers help stabilize streams, reducing erosion and sedimentation that degrades water quality and **aquatic resource habitat**. In Baltimore County, only about 47% of the 50,000 acres or so of land that comprises potential 100-foot buffer areas along streams is forested. The percent of stream buffer areas with forest cover ranges from about 12% in the Baltimore Harbor watershed to 69% in the Liberty Reservoir watershed. Data on the biological condition of the County's streams indicates that the quantity and diversity of aquatic organisms are highest in watersheds with high percentage

of forest cover.

7.3.5. Maintenance of Forest Contribution to Global Carbon Cycles

One of the least understood characteristics of Baltimore County's forest base is its relationship to sequestering atmospheric carbon. According to the following excerpt from the US Forest Service, Baltimore County's forests are probably important "sinks" for harmful carbon generated by non-forest activities.

*"Growing forests naturally store carbon. The age and vigor of forest vegetation affects the rate of carbon sequestration in a forest ecosystem and the overall inventory of stored carbon. Trees are about 50 percent carbon and represent the most dynamic component of the forest ecosystem **carbon pool**, although the largest proportion of carbon is found in the soil. In the Northern United States, hardwoods account for a greater proportion of carbon than softwoods. Changes in carbon inventory are affected by the rate of forest growth, harvest activity, and losses of forest cover due to conversion to other land uses, as well as fire or other natural disturbances. The carbon inventory in Northern U.S. forests is higher than in forests of any other region of the country. An underlying factor is that forests in the North are not harvested as heavily compared to growth as forests in the South and West. Additional carbon is stored in wood that is processed or manufactured into products. The carbon stored in forests and forest products mitigates the amount of carbon released into the atmosphere, which may help delay global climate change."*

7.3.6. Maintenance and Enhancement of Long-term Multiple Socio-economic Benefits to Meet the Needs of Societies

In addition to providing critical ecosystem services, forests are important for providing a range of social and economic benefits to Baltimore County. For many citizens, forests have aesthetic and even spiritual value. They are also important elements of our outdoor recreational experience. In Baltimore County, extensive forest systems are protected for public use, including the Gunpowder and Patapsco River State Parks, the Soldiers Delight Natural Environmental Area, and the Gwynnbrook Wildlife Management Area. Large County forest ownerships include the Oregon Ridge Park, Dundee-Salt peter Creeks Park, and Cromwell Valley Park, in addition to smaller areas such as Double Rock Park, Honeygo Park, and Northwest Area Park. An estimate of the value and use of these facilities is not available. The role of Baltimore County's forest industry in the local economy has been estimated and appears to be disproportionately small compared to other resource-based industries. Based on a study conducted by the Salisbury University's Business, Economic, and Community Outreach Network (BEACON) for the FORVM for Rural Maryland, it is estimated that the 1999 employment impact of agricultural, seafood/**aquaculture**, forestry, and mining/mineral extraction industries, including direct, indirect, and induced employment impacts, is about 16,225 jobs, which ranks the highest among

Maryland counties. Of these estimated jobs, the forestry industry comprises about 1,128 jobs or 7%, with the direct employment impact estimated at 612 jobs. Forestry ranks second behind agriculture but is only slightly larger than the employment impact of the mining industry. Baltimore County's forest employment impact ranks fifth among Maryland's counties, and the direct employment impact ranks only seventh. The 1999 value added (payments made by the industry to workers, interest, profits, and indirect business taxes) of the resource-based industries in Baltimore County was estimated at more than \$426.1 million, ranking fourth among Maryland's counties. The forest industry value added to the economy is estimated at \$46.1 million, or about 10.8%. Baltimore County's value added from forestry ranks fifth among Maryland's counties and comprises about 4.6% of Maryland's forestry value added. According to the US Forest Service, *"Both total wood product consumption and consumption per capita are increasing, despite increased wood use efficiency. The Northern United States leads the Nation in paper recycling, but recycled fiber is still underutilized."*

7.3.7. Legal, Institutional, and Economic Framework for Forest Conservation and Sustainable Management

The legal, institutional, and economic framework for sustainable forest management is complex, even for Baltimore County. Local and State governments' primary role is regulation, including protection of forest resources during the land development process at the local level pursuant to State law, and through regulation of the industry, permitting, and conservation easements at the State level. Several landowner assistance agencies exist to provide education, technical assistance, and cost-share funding for the establishment, management, and conservation of forests. Agencies include the MD Dept. of Natural Resources, the County Forestry Board, the University of Maryland Cooperative Extension Service, the USDA Forest Service, and the USDA Natural Resources Conservation Service. The management setting also includes the forest products industry, its membership and trade organizations, consulting foresters, and others who influence the production of forest products. Overall, there needs to be a specific assessment of the legal and institutional framework for supporting sustainability and addressing a balance between public and private interests. The economic evaluation needs to include both incentives and disincentives to sustainability, and to account for non-market services provided by natural resources, which continue to be undervalued and excluded from economic forecasts. As well, the adequacy of efforts to encourage forest resource conservation needs to be addressed. Self-sufficiency in the production and consumption of forest products is not practical, but sustainability argues that we need to better account for the degree to which we borrow from future generations' inheritance.

8.0 Appendix D: Baltimore County *Linking Communities to the Montreal Process Criteria & Indicators Project*

8.1. Origins of the Linking Communities Project

In the mid-1990's, Baltimore County DEPRM conducted research under contract to the MD Department of Natural Resources on methods for identifying ecological greenways as part of the State's early Green Infrastructure efforts. Following Baltimore County's participation with DNR in May 2001 in a national pilot training course for Green Infrastructure, officials with the USDA Forest Service's National Sustainable Development program in Washington began discussions with the County about participating in the national Montreal Process project as a third U.S. case study for the *Linking Communities to the Montreal Process Criteria & Indicators Project*. The other case study communities are Wallowa County, OR and Gogebic County, MI, which are about five times and two times larger than Baltimore County, respectively, and which both have forest-dependent economies. Baltimore County is representative of many other communities in the U.S. where forest resources have been in competition with urban and agricultural land uses and where forest management is under pressure because of conflicts between resource utilization and resource protection.

The purpose of the *Linking Communities Project* was for Baltimore County to evaluate the use of the Montreal Process Criteria and Indicators (MP C&I) as a framework for sustainable forest resource management. The Project moved forward in May 2002 when DEPRM was visited by the Forest Service's MP consultants, American Forests in Washington, and Sustainable Measures, Inc, of Massachusetts. Working with Sustainable Measures, DEPRM determined that, because of the broad scope of the MP C&I, the amount of data potentially needed to adequately use forest indicators, and the complexity of underlying issues for managing forest resources in the County, the project would be successful only if it were conducted with a broad representation of interests in the issues. Following a "short listing" of potential issues and participants, it was decided that the first step in using the Montreal Process C&I was to formally engage these interests in a group effort to identify management issues from their perspectives.

8.2. Forest Sustainability Issues and Indicators Forum

A Forest Sustainability Issues and Indicators Forum was held at Oregon Ridge Park on June 10, 2003. Logistical support was provided by the USDA Forest Service and American Forests, and the event was facilitated by Sustainable Measures. More than 65 people representing the major parties-at-interest in forest resource management in the County were invited and attended. The organizations represented included:

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American Forests
Baltimore City Dept. of Planning
Baltimore County DEPRM
Baltimore County Dept. of Public Works
Baltimore County Dept. of Recreation & Parks
Baltimore County Office of Planning
Baltimore County Forestry Board
Baltimore County Soil Conservation District
Biohabitats, Inc.
consulting ecologists
consulting foresters
Edrich Lumber Co.
Friends of Patapsco Valley and Heritage Greenway
Gaylord Brooks Realty Co.
Glatfelter Pulp Wood Co.
Gunpowder Valley Conservancy
Johns Hopkins University
KCI Technologies, Inc.
MAR-LEN Forestry
MD Dept. of Agriculture
MD Dept. of Natural Resources
Parks and People Foundation
Parkton Woodland Services
President's Council on Environmental Quality
Sustainable Measures, Inc.
USDA Forest Service
USDA Natural Resources Conservation Service
US Environmental Protection Agency
US Geological Survey
University of Maryland Cooperative Extension Service
Watershed Protection Coalition, Inc.

The Forum included background presentations on sustainability, the Montreal Process, and community indicators. It engaged participants in a mixed-group “**carousel**” process to identify and prioritize the important forest management issues in Baltimore County for each of the seven Montreal Process Criteria. A total of 16 issues were identified.

The second part of the Forum focused on identifying goals and identifying and prioritizing potential data indicators for the issues that were identified earlier. A total of 11 goals and 44 potential data indicators were identified.

8.3. Steering Committee

As a result of the Forum, there was considerable interest among participants in working to address the issues and to develop data indicators to measure change in resource

Appendix D: Background for Forest Issues in Baltimore County

conditions and management progress. A Steering Committee was convened by DEPRM, open to all who participated in the Forum and others who have since expressed interest. Starting in July 2003, the Steering Committee met monthly or bi-monthly. Nearly 20 individuals participated in the Steering Committee, and others have contributed feedback. In addition, several agencies are working with DEPRM staff to evaluate assessment methods and develop potential data indicators. Outreach was also made for parties identified at the Forum as not present but recommended for participation.

The Steering Committee has debated the need and justification for active management of forests as a consequence of past forestry practices. In particular, the limitations of using “natural disturbance” approaches to forest resource management were discussed and debated. The Committee discussed regeneration, aggrading forests, and even- and uneven-aged forest structure. The Committee members visited sustainable forestry operations conducted by the Glatfelter Pulp Wood Company for the City of Hanover, PA’s municipal drinking water reservoir. Presentations were also provided to the Committee on two recent forest resource management planning efforts: the *Maryland Strategic Forest Lands Assessment*, and the *Comprehensive Forest Conservation Plan for Long-term Watershed Protection on the City of Baltimore’s Reservoirs*. The Committee also received presentations about The Conservation Fund’s *State of the Chesapeake Forests Report* and the MD DNR *Assessment Protocol for Monitoring for Timber Harvest Operations*.

The Steering Committee decided that they did not want to invest a lot of work addressing the details of issues identified for the County’s Linking Communities Project without securing a commitment early in the process from the County for forest sustainability. The group discussed the preparation of a “white paper” or “issues paper” to present to our local elected officials to begin a dialogue about the need for embracing forest sustainability and for using the Montreal Process as a framework. This Issues Paper, including a draft Resolution for consideration of the County Council, was prepared in December 2003. Several sections of the Issues Paper have been incorporated into this Draft Strategy.

As the Steering Committee made progress in early 2004 with outlining the development of this Draft Forest Sustainability Strategy, DEPRM secured the support of the County Executive for moving forward with the work under the Department’s resource management program. A new initiative was designed to complement adoption of the Executive’s *Renaissance* program for community conservation and revitalization. Termed *Green Renaissance*, the new initiative was presented as a broad-based enhancement of two key existing programs, land preservation and watershed management/restoration, as well as the introduction of the forest sustainability component. The Green Renaissance initiative was announced by the County Executive in January 2005 at a meeting of the County’s Planning Board, and a special presentation was made on the Linking Communities to the Montreal Process Criteria and Indicators Project as the first Green Renaissance component.

9.0 Appendix E: Background for Forest Issues in Baltimore County

9.1. Forest Cover Loss

Currently, the forest cover in Baltimore County is about 34%, divided into more than 9,000 patches, of which only 315 are ≥ 100 acres. Despite the County's efforts to protect the forest base by establishing **Resource Conservation Zones**, and despite implementation of the State-mandated Forest Conservation Act (FCA) and Regulations, Baltimore County continues to lose, on average, more than 200 acres of forest each year to development. In addition, even though the County retains an annual average of 67% of forests on development sites in the implementation of the FCA regulations, the retained forest typically undergoes some degree of fragmentation.

Even though the annual forest loss may seem small, the cumulative loss and continuing fragmentation of the County's forest resource base has serious implications for sustaining the critical ecological services of forests, which include the maintenance of water quality and stream system stability, the control of flooding, and the conservation of soils.

Forest parcelization also affects the degree to which forest patches can yield ecological, aesthetic, and economic benefits to forestland owners. The mean forest patch size in the County is now 14.58 acres. Small forest patches have greater risks for being invaded by exotic, invasive plant and animal species (see EIPAS section below). Small patches typically have reduced regenerative capacity because of competition from weeds and heavy deer browsing. These disturbances change the appearance and may also alter the ecological functions of fragments. The objectives of forest management plans directed toward water quality and stream protection, habitat protection, the conservation of biological diversity, aesthetics, and the harvesting of forest products are all increasingly hampered by the decreasing size of the forest resource. Most importantly for the entire community, forest parcelization works directly against forest ecosystem sustainability.

Source:

SAF 2005. *Loss of Forest Land*. A Position Statement of the Society of American Foresters

9.2. Forest Fragmentation

At any time, the composition, structure, vigor and regenerative capacity of a forest is like a still frame in the ecosystem's continuing reaction to past and present disturbances.

Appendix E: Background for Forest Issues in Baltimore County

Based upon their severity, duration, and frequency, disturbances can renew biological diversity and vigor, or degrade ecosystem function. Fragmentation is a disturbance that operates on multiple scales. In the Eastern **Deciduous** Forests, non-catastrophic canopy breaks caused by storms, fire, tree death due to insects or diseases, or the selective harvesting of mature trees are temporary fragmentation disturbances that create light gaps for renewing the forest canopy. Gap regeneration, natural or applied, is part of the disturbance regime that restores and reinvigorates forest communities (Oliver and Larson, 1990; Runkle, 1981).

Fragmentation that converts large blocks of forest to non-forest land uses can be likened to a catastrophic disturbance of long duration with few opportunities for recovery. Fragmentation not only reduces overall forest cover, but also divides the forest resource into isolated patches. Because forest patch isolation increases the edge to interior ratio of the forest area, a greater number of trees are exposed to edge conditions. Typically, these include increases in light, air and soil surface temperatures along with concomitant decreases in humidity and soil moisture, greater exposure to **desiccation** and structural damage from wind, and pollution from surrounding land uses.

Forest patch size and shape contribute to determining the vulnerability of the forest to the impacts of fragmentation. When forest trees that are adapted to the conditions of the interior become exposed to newly created edge conditions, they often become stressed and lose vigor and resistance to insect infestations and diseases. Declining trees in edges allow increased opportunities for edge plant communities to extend farther into the patch. Because edge plant communities tend to have a higher proportion of exotic, invasive plant species, forest patches can undergo significant changes in community composition. Smaller or linear forest patches can be overwhelmed by weedy, exotic species, virtually eliminating the pre-fragmentation plant community, as often happens in urban environments.

Discussions about forest fragmentation typically focus upon the loss of habitat for forest-dependent animals, and the implications of habitat destruction on population viability (**dispersal** efforts) and biological diversity (Lynch and Whigham, 1984; Robbins et al, 1989). However, forest fragmentation also threatens the sustainability of the forest itself and, by extension, all of the ecological functions and services of the forest ecosystem, including the socio-economic benefits that maintain a good quality of life for human communities, as well as sustainable habitats for wildlife.

The current condition of forests in Baltimore County is representative of much of the eastern forests as the product of forest responses to waves of human stresses superimposed upon the natural disturbance regime to satisfy the needs of a growing nation. The 1790 U.S. population of 4 million doubled by 1810, and by 1880, rose to 50 million. Between 1810 and 1867, 5 billion cords of wood were harvested on about 200,000 square miles of woodlands for fuel, the majority of it going to railroads, industrial furnaces, and steamboats. Another 25,000 square miles were cut for residences, bridges, wagons, waterwheels, and other household objects. (Perlin,

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1989).

Between 1850 and 1860, 31,250 square miles of forestland were also cleared for agriculture. The pace of clearing and cutting accelerated from 1600 square miles a year in 1835 to 7,000 by 1855 (Perlin, 1989). Typically timber harvesting is a less drastic disturbance than clearing for non-forest uses, which affords little opportunity for forest regeneration. However, in the 1910 publication, *The Plant Life of Maryland*, State Forester F.W. Besley wrote that yearly timber growth had declined to only a third of the existing annual consumption. He regretted that early logging operations had persistently culled the largest trees of the most valuable species from the forest, leaving regeneration to stump sprouts and defective trees, many of which succumbed to the frequent fires that followed harvesting. The impacts of imprudent timber extraction and frequent fires after harvesting allowed less commercially valuable species to proliferate in the decimated forests. Forest cover in Maryland was reduced from 95% at the time of Settlement to as low as 11% (in Carroll County), and no significant representatives of the pre-Settlement original forest were left standing. Baltimore County forest cover was reported to be 29% (Shreve et al, 1910).

Today, the County's forest cover has increased to 34% of highly fragmented forest. This increase is largely the result of the decline in agricultural production over the past 50 years, accompanied by the decentralization of metropolitan centers during suburbanization. Unabated, forest fragmentation has, and will continue to, erode forest functions, habitats, and biological diversity, from the species population and community level to the processes that drive regeneration and sustainability.

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9.3. Effects of Forest Loss on Water Quality and Quantity and Stream Function

Forests play a critical role in protecting water quality in streams, and ultimately the Chesapeake Bay. Both woody and herbaceous vegetation in forest ecosystems exert significant control on the movement of water throughout watersheds. Forest vegetation, litter and downed debris act as barriers to surface water flow during storms, reducing the force of swiftly flowing water, as well as soil erosion and soil loss to streams. This ecological service alone has profound effects on the geomorphologic stability of forested stream systems (Rosgen, 1996; Sweeney, 1992). Forests also control the chemistry of precipitation from its passage through the canopy to the groundwater flow, capturing pollutants, enriching the through-fall with minerals and organic carbon, and tightly controlling the geological and biological soil/water reactions that bring groundwater to the streams (Likens and Bormann, 1995).

Paraphrasing Kovalchik and Elmore (1992) in Davis et al (1996), some of the hydrologic consequences of forest loss include:

- Soil compaction, loss of infiltration capacity, and increased soil erosion;
- Heightened peak storm flow and reduced summer flow in streams;
- Greater stream flow rates, which scour banks, deepen channels and disconnect stream flow from adjacent floodplains;
- Erosion impacts on stream banks, increased loss of vegetation cover;
- Increased silt deposition on streambeds, which interferes with fish spawning and invertebrate reproduction; and
- Increased water temperature and algal growth, as streamside trees fall on unstable banks, which also degrades habitat conditions for aquatic organisms.

The ecological services of both upland and riparian forests include maintaining adequate populations of **primary producers** and consumers, which supply food and shelter for communities at higher **trophic levels** (Sweeney, 1992). Forest loss, not only in riparian areas but also across watershed landscapes, threatens aquatic and terrestrial communities and the maintenance of function and biological diversity in the forest ecosystem.

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9.4. Conservation of Biological Diversity

Biological diversity at multiple scales, from regional landscape to natural communities to populations, species, genetic components, and ecosystem processes is the machinery of sustainability in ecosystems (Noss, 1989). The maintenance of all of the components of biological diversity is essential to the continuation of vigorous, resilient forest ecosystems, and their capacity to react positively to natural and anthropogenic disturbances.

Section 9.2 above on Fragmentation provides a brief description of the impacts that the early American colonists had on Eastern forests. A 17th Century narrative (1633 – 1684) on the richness of Maryland's **fauna** lists, along with the mammals found today, the large mammals, deer, elk, bison, and their predators, wolves, bears, and mountain lions (Hall, ed., 1910). All but the deer were **extirpated** from the State and the region, as the forest habitats were consumed in the 19th Century; the deer followed shortly. Pre-1753 lists of Maryland plants serve as a reference inventory for the species richness of the State, although the effort was concentrated on Coastal Plain communities (Reveal et al, 1987a and b; Broome et al, 1987). Today, the Maryland DNR lists 455 plant species and 152 animal species in a category of extirpated, endangered, or threatened for the State (MD DNR).

Beyond the loss of plants and large animal species, mass consumption of the forests over a short period disrupted the natural disturbance regime, adding wildfire as a frequent perturbation, and altered soils, micro-environments, and natural community structure. It is safe to assume that ecosystem processes were also seriously affected, the effects of which are being expressed in the regenerated forests of the present. As human-induced forest fragmentation may be the most significant stressor on the forests of the region, biological diversity is the most essential component for ecosystem stability

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and resilience.

Literature Cited and References:

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Hall, Clayton Colman, ed. Narratives of Early Maryland (1633 – 1684). New York: Barnes and Noble, 1910.

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Noss, Reed F. "Indicators for Monitoring Biodiversity: a Hierarchical Approach." *Conservation Biology* 4.4 (1989): 355 – 364.

Reveal, James, R., et al. "Botanical Explorations and Discoveries in Colonial Maryland: An introduction." *Huntia* 7 (1987a): 1 –3.

Reveal, James R., et al. "The Identification of Pre-1753 Polynomials and Collections of Vascular Plants from the British Colony of Maryland." *Huntia*: 7 (1987b): 91 – 208.

9.5. Exotic, Invasive Plant and Animal Species (EIPAS) Invasion

Maryland joins other states in the mid-Atlantic region as unwilling hosts to hundreds of exotic, invasive species. Currently, the Maryland Invasive Species Council lists more than 70 species of plants, animals, and other organisms that have proliferated to the point of becoming species of concern. Some bear watching because of their impacts on agriculture, and others for their effects on the health and vigor of native species and wild habitats. Five species are also concerns because of their potential to impact human and animal health and safety. Pest categories include the following: 37 plant species, 6 vertebrates, 9 insect species, 15 other invertebrate species, and 7 **fungal** and **bacterial** pathogens (www.mdinvasivesp.org/invasive_species_md.html).

There have been many pathways of purposeful or inadvertent introduction. Some of the more visible EIPAS in the plant category were imported as horticultural finds. Examples include Norway Maple and Tree of Heaven, both of which gained huge popularity for their rapid growth and deep shade characteristics. Unfortunately, these traits also allowed these species to spread throughout the landscape in vacant lots as well as forest patches. Japanese Honeysuckle and Oriental Bittersweet, considered 19th Century garden gems, now strangle shrubs and young forest trees that have escaped deer browsing. Multiflora Rose, imported for erosion control, and Autumn Olive, one of many plants introduced for game wildlife food plantings, now proliferate through fields and open forests, suppressing the regeneration of native species.

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In the herbaceous community, numerous EIPAS species compete for habitat with declining native forest floor plants. Some of the most egregious examples in this category are Garlic Mustard, Japanese Stilt Grass, Japanese Knotweed, Mile-a-Minute, and Lesser Celandine. The majority of the other pest plants are noxious thistles that have negative effects not only on agriculture (www.aphis.usda.gov) but also upon the regeneration potential of trees in reforestation projects. These species represent a handful of the exotic, invasive taxa that have been reported for the State. Hundreds of others are not as noticeable but, from the standpoint of forest sustainability, have the potential to be deadly.

These organisms are the insects, **viruses**, bacteria, and fungi that can attack healthy trees and other woody plants, as well as those that have become stressed by the changing environmental conditions that accompany fragmentation (see Section 9.2 on Forest Fragmentation). Examples include the **Chestnut Blight**, Gypsy Moth, Hemlock Woolly Adelgid, Emerald Ash Borer, and Pine Shoot Beetle.

The Chestnut Blight has had the most catastrophic impact on the Eastern Deciduous Forest. This fungal pathogen was found on American Chestnut trees in New York City in 1904. Apparently, the organism had been introduced previously on horticultural Asian chestnut nursery stock, which acted as hosts, without themselves succumbing to the blight (www.caes.state.ct.us/FactSheetFiles/PlantPathology/fspp008f.htm). Within three decades, the organism had caused the loss of tens of thousands of native American Chestnut trees, as it made its way south. The blight wreaked havoc not only on habitat quality and food supply for the region's wildlife, but also on commerce for the loss of valuable timber. It also impacted the educational and recreational value of state parks and forests from the New York point of entry to the Carolinas. The forests, including those in Maryland, are still recovering from the disaster.

More recently, the expansion to Maryland of the Hemlock Woolly Adelgid, first discovered in Virginia in the early 1950's, and the Pine Shoot Beetle, detected in Cleveland in 1992, pose serious threats to the sustainability of the state's forest trees. Additionally, Maryland is maintaining a vigilant watch for the Emerald Ash Borer, newly reported in Michigan in 2002 and thought to have arrived in the United States in packing crate wood from Asia. The watch list also includes the formidable Sudden Oak Death fungal pathogen or "ramorum blight," believed to have gained entry in California but transported east in the horticultural stock of at least ten species (See www.fs.fed.us/fhp/index for individual pest species.)

Less notorious, and not on the Maryland Invasive Species Council lists are exotic, earthworm species. Their original introduction in the late 1800's and early 1900's may have been through the importation of potted horticultural plants from Europe and Asia, as well as in discarded ballast from ships. However, the recent and continuing introduction of these pest species is due to the sale of exotic worm species as composting agents and the dumping of unused bait worms in the landscape (www.dnr.state.mn.us/invasives/terrestrialanimals/earthworms/index.html).

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By their voracious feeding behaviors, some of these annelid species rapidly break down forest floor litter, depleting organic matter in the organic soil horizon, changing the Carbon:Nitrogen ratio, loading the soils with labile nitrogen and increasing opportunities for erosion of the bare soils and nitrogen leaching (Burtelow et al, 1998). The burrowing behaviors of other exotic species tend to facilitate the mixing of soil horizons, and the alteration of soil pH. The impacts of exotic worm species on soil function may include changes in the soil microbial communities, as well as in patterns of nutrient cycling, which could have serious implications for the composition, structure, and functional values of invaded forests (Bohlen et al., 2003).

Literature Cited:

Bohlen, P.J., P.M. Groffman, T.J. Fahey, M.C. Fisk, E. Suarez, D.M. Pelletier, and R.T. Fahey. 2004. Ecosystem consequences of exotic earthworm invasion of north temperate forests. *Ecosystems* 7:1 12.

Burtelow, A.E., P.J. Bohlen, and P.M. Groffman. 1998. Influence of exotic earthworm invasion on soil organic matter, microbial biomass and denitrification potential in forest soils of the northeastern United States. *Applied Soil Ecology* 9: 197-202.

9.6. Maintaining and Increasing Forests in Key Sensitive Areas (Riparian Buffers, Recharge Areas, Reservoirs)

See Section 9.3, "Effects of Forest Loss on Water Quality and Quantity and Stream Function."

9.7. Deer Browsing Threats to Forest Regeneration

There are no pre-Settlement records for the size of the deer herd in Maryland. However, the 2+ million Native Americans of the pre-Colonial era are known to have harvested deer for food, clothing, and tools at an annual rate of 4.6 to 6.4 million (McCabe et al, 1984). This pressure, coupled with that of the deer's natural predators, wolves and mountain lions, apparently kept the deer herd in abundant, but not unmanageable, numbers.

Settlement introduced a new predator into the mix when Colonists joined the hunt. In recognition of the value of deer as a natural resource, the Maryland legislature passed a law in 1729 that set date limits on the taking of deer (MD DNR, 1998). Even so, the 19th Century saw uncontrollable deer harvesting. That pressure, coupled with massive clearing and tree harvesting, destroyed much of the deer habitat, and deer numbers plummeted. So great was the loss that in 1914 deer had to be restocked in the State, and deer habitat refuges were established to provide game for sports hunting.

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Currently, the deer population in Maryland is soaring. Since the 1960s, suburbanization has created new food supplies of fertilized, highly-nutritious garden plants. That resource, coupled with the absence of the deer's natural predators and a reduction in the popularity of sport hunting in urbanizing areas, has allowed deer populations to soar.

Public sentiment against culling the deer herd has made the situation worse. Demands for control via contraception have proved to be unrealistic, on the basis of both effectiveness and cost. Also, venison from deer that have been exposed to contraceptives is currently not approved for human consumption, a requirement otherwise for disposal of venison from controlled hunts. Deer population increase is becoming a concern for public safety, as animals infested with **Lyme disease**-carrying ticks are abundant on both public and private properties, and as collisions with vehicles increase. As alarming as these conditions are for the social welfare, the ecological implications of a continuing, unregulated herd are greater, because intense deer browsing pressure is seriously retarding forest regeneration. A DNR study of forest health for the City of Baltimore reservoir lands revealed that deer browsing has prevented forest regeneration on some 80% of areas studied.

Literature Cited:

Maryland Department of Natural Resources. Charting the Course for Deer Management in Maryland: A Management Plan for White-tailed Deer in Maryland. 1998.

9.8. Valuing Forest Ecosystem Services

The goods and services produced by Baltimore County forests offer many benefits to Maryland's citizens. These ecosystem services are critical for maintaining clean and safe drinking water, controlling flood damage, cleansing the air of pollutants, sustaining healthy and diverse plant and animal populations, and providing many other public benefits that are important to the quality of life and Maryland's economy. In some instances, goods produced by forests and other ecosystems are valued directly through market-based mechanisms, such as the income derived from timber harvests or crop production. However, there are many other ecosystem goods and services that do not currently have a market value, but which do have clear benefits to society.

Understanding and articulating these non-market values and translating these values into economic benefits underscores the magnitude of critical, but often disregarded, public benefits of forestland. This issue directly relates to the Criterion 7 of the Montreal Process, the Legal, Institutional, and Economic Framework for Forest Conservation and Sustainable Management. Approaches for valuing the goods and services of forests should be included in policy discussion about user fees and incentive programs as a means to recognize the true value of forests and to leverage these values to promote forestland retention.

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The non-market goods and services can be valued through a variety of means, such as the amount of money a person is willing to pay to get a particular good or service (e.g., flood control and protection of property) or the avoided cost of performing a service through natural processes rather than through technical approaches (e.g., water filtration and purification services). A way to approximate the economic importance of Baltimore County forests is to use estimates derived from other studies and transfer these values to similar, yet unstudied, forested areas. By transferring these value estimates, a sense of the relative magnitude and importance of ecosystem services can be stated, without having to conduct expensive and time consuming economic analyses. Based on the research of Wilson et al. (2004) for the State of Maryland, estimates are derived for the economic value of Baltimore County forests, which is further subdivided into service categories. Service categories are described below and follow the definition of Wilson et al. (2004):

Gas and Climate Regulation: “Life on earth exists within a narrow band of chemical balance in the atmosphere and oceans, and alterations in that balance can have positive or negative impacts on natural and economic processes. Biotic and abiotic processes and components of natural and semi-natural ecosystems influence this chemical balance in many ways including the CO₂/O₂ balance, maintenance of the ozone-layer (O₃), and regulation of SO_x levels.”

Water Regulation and Supply: “The availability of fresh and clean water is essential to life, and is one of humanities’ most valuable natural assets. When water supplies fail, water must be imported from elsewhere at great expense, must be more extensively treated (as in the case of low stream flows or well levels), or must be produced using more expensive means (such as desalinization). Forest and its underlying soil, and wetlands, play an important role in ensuring that rainwater is stored and released gradually, rather than allowed to immediately flow downstream as runoff.”

Habitat Refugium and Wildlife Conservation: “Contiguous patches of landscape with sufficient area to hold naturally functioning ecosystems support a diversity of plant and animal life. As patch size decreases, and as patches of habitat become more isolated, population sizes can decrease below the threshold needed to maintain genetic variation, withstand stochastic events and population oscillations, and meet social requirements like breeding and migration. Large contiguous habitat blocks, such as forest or wetland, thus function as critical population sources for dispersing plant and animal species that humans value (aesthetic value or functional value).”

Recreation: “Intact natural ecosystems that attract people who fish, hunt, hike, canoe or kayak, bring direct economic benefits to the areas surrounding those natural areas. People’s willingness to pay for local meals and lodging, and to travel, are economic indicators of the value they place on natural areas.”

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Aesthetic and Amenity: “Real estate values, and therefore tax revenues, often increase when a house is located near protected open space. The difference in real estate value reflects people’s willingness to pay for the aesthetic and recreational value of open space. People are also often willing to pay to maintain or preserve the integrity of a natural site to protect the perceived beauty and quality of that site.”

The ecosystem services provided by Baltimore County forests total over \$74.6 million on an annual basis, as presented in Table 9.8 (Wilson et al. 2004). The assessment does not capture all ecosystem services provided by Baltimore County forests. Only those services that have been evaluated through peer-reviewed studies and are applicable to forestland are quantified in the table below. As discussed below, this assessment does not include water supply protection, which is expected to add significantly to the value of ecosystem services of Baltimore County’s forests. The estimate in Table 9.8 should therefore not be treated as a precise dollar value.

Table 9.8: Economic Value of Ecosystem Services of Baltimore County Forestland

Ecosystem Service	U.S. 2004 Dollars per year	
	Average per Acre*	Total
Gas and Climate Regulation	12	1,560,000
Refugium Function and Wildlife Conservation	443	57,590,000
Aesthetic and Recreational	130	16,900,000
Total Economic Value of Baltimore County Forests per Year for Selected Services		\$ 74,646,000
* Average values derived from all relevant studies addressing ecosystem service valuation that are appropriately designed for value transfer applications.		

There have been some instances where non-market ecosystem services have achieved such a high level of recognition and worth that they have been translated into a financially backed commodity. An example is New York City’s efforts to protect its water supply.

A Case Study – Protecting New York City’s Water Supply

New York City water consumption totals over 1.4 gallons of water a day. Rather than spending billions of dollars on filtration systems, New York City has taken advantage of the natural filtration services provided by upstate New York’s Catskill/Delaware watershed, the source of most of the City’s drinking water (Rand Organization, 2005). Faced with the future cost of building a new filtration plant at \$6 billion, along with operating costs of \$300 million per year, the City chose to invest in the protection of its watershed. To avoid future degradation of the water supply, and maintain the watershed’s water cleansing services, the City set a goal of conserving, through acquisition and easement, 355,000 acres of

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land in the Catskill/Delaware watershed over a 10 year period of time. The goal is backed by a \$250 million commitment by the City. In addition to preserving existing water quality function of lands in the watershed, the City is also sharing the costs of implementing agricultural, forest and stream Best Management Practices (BMPs) for the purposes of protecting and enhancing water quality services.

Similar scenarios could be envisioned for the protection of Baltimore County watersheds that supply drinking water to one third of the population in Maryland. If the costs of future water treatment facilities could be avoided by ensuring no decrease in the water filtration functions of water supply forestland, then these avoided costs could be used to finance more forestland conservation and restoration.

Another potential opportunity on the horizon centers on the air quality benefits urban forests provide, particularly the reduction of ozone levels. The State of Maryland is currently revising its 8-hour ozone State Implementation Plan (SIP) for 2010. This plan, which is required by the Clean Air Act, outlines the mandatory and voluntary actions the State will undertake in order to ensure that 8-hour ozone levels are in compliance with national air quality standards. For the first time, the State will consider the incorporation of urban tree canopy as a voluntary control measure in the SIP. This requires that current baselines conditions be met, in addition to forecasted increases in forest canopy cover. Including urban forest canopy cover in the SIP provides a formalized recognition of the urban air quality benefits of trees, sets goals for increasing regional forest canopy cover and lays the foundation for financing the maintenance and increase of forest canopy cover. These concepts, along with those discussed in the Issue “Increasing the Contribution of Forests to the Reduction of Greenhouse Gases through Carbon Sequestration”, offer multiple opportunities to leverage financial incentives to support forest sustainability initiatives through the recognition of critical ecosystems services provided by forestland.

Literature Cited:

Rand Organization. New York City Depends on Natural Water Filtration. 2005.
<http://www.rand.org/scitech/stpi/ourfuture/NaturesServices/sec1_watershed.html>.

Wilson, Matthew A., Robert Costanza, and Austin Troy. The EcoValue Project. 2004.
Retrieved from the University of Vermont EcoValue Web site:
<http://ecovalue.uvm.edu>

9.9. Increasing the Contribution of Forests to the Reduction of Greenhouse Gases through Carbon Sequestration Market Mechanisms

There is strong scientific consensus that the world’s climate is warming and that this is a result of increased emissions of greenhouse gases, such as CO₂, through fossil fuel combustion, various industrial activities, and deforestation (Pew Center on Global

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Climate Change). Along with rising temperatures, more intense storm events and periods of prolonged drought are anticipated. Baltimore County's forest lands, agricultural base, coastal zones, urban areas, and human populations will be impacted by climate change. Rising sea level threatens coastal environmental and developed resources through increased flooding and storm erosion damage. Heat-induced health impacts, such as heat stress and smog-induced respiratory illnesses, will become more severe in Baltimore County's urbanized area. Higher temperatures and changes in precipitation will directly affect tree growth and survival. The distribution and abundance of pests and **herbivores**, fire frequency, erosion and decomposition will also affect the characteristics of Baltimore County forests. The combined effects of these changing factors could lead to rapid species changes and shifts in the distribution of the County's forest communities. Lags in the dispersal and recruitment of other native species suitable to these evolving site conditions could promote the establishment of more invasive or exotic species and could decrease biodiversity. Shifts in forest composition and distribution could also lead to watershed-scale hydrologic changes, such as decreased filtering and moderation of stream flow.

Forest management, retention, reforestation, and wood products utilization are important mechanisms for reducing atmospheric greenhouse gases, which may help moderate global climate change. Through terrestrial carbon sequestration, forests remove CO₂ from the atmosphere and store it for long periods of time in woody tissue, roots, and soil organic matter and in the form of wood products. In addition, using wood products as a source of renewable energy can reduce fossil fuel combustion, resulting in a decrease of greenhouse gas emissions. Either existing or emerging market incentives can be further developed to provide economic incentives for terrestrial carbon sequestration and renewable energy utilization. Renewable energy market incentives and opportunities are addressed in more detail in the "Strengthening Markets for Local Forest Products Utilization" section (9.13), leaving the emphasis on terrestrial carbon sequestration to this section.

"Carbon credits" generated from carbon sequestration activities are beginning to have true economic value within the State, regionally and internationally. Many private companies, particularly those in the energy sector, are seeking partners and opportunities to fund reforestation projects as a voluntary approach for offsetting their emissions of CO₂ and other greenhouse gases. Recognizing the important contributions that Baltimore County forests provide to global carbon cycles and developing innovative incentive programs to increase these contributions directly relates to Criterion 5 of the Montreal Process C&I, "Maintenance of Forest Contribution to Global Carbon Cycles." However, this issue cuts broadly across other Criteria because it emphasizes reforestation, sustainable management for healthy, productive forests, wood products utilization, and forest retention.

Baltimore County can take advantage of the growing economic value of carbon to promote sustainable forests. In order to pursue these incentives, an understanding of the local funding ("buyer") opportunities and the necessary expertise that should be developed are needed. The remainder of this background paper provides some

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fundamental background information and should be referenced when evaluating the specific recommended actions presented in Section 3.0.

There are emerging funding opportunities at the local level that can be evaluated to provide financial incentives for planting and retaining trees on the landscape in exchange for carbon credits. Within Maryland, opportunities are developing that will promote forest restoration funding in return for carbon credits. At present, Constellation Energy, a national producer of electricity and a regional electricity distributor through its subsidiary, Baltimore Gas and Electric Company, has partnered with the Alliance for the Chesapeake Bay (non-profit organization) for the purpose of funding carbon sequestration projects. The projects are intended to occur on privately-owned land that is under permanent easement, which ensures that the carbon remains sequestered in perpetuity. Some of these projects will be developed within Baltimore County. It is likely that more opportunities of this nature will arise and could be solicited from other major greenhouse gas emitters in the region. The funding assistance generated from these “carbon deals” could be used to leverage additional funding for forestland retention programs, in addition to reforestation projects. The example set by this unique partnership will pave the way for other similar agreements.

In evaluating potential funding opportunities, it is important to recognize that the incentives of the buying or funding organizations are motivated by a variety of objectives, none of which, at least in Maryland, are mandatory or regulated. The most common objectives are to generate public goodwill by focusing efforts on improving environmental conditions and to demonstrate voluntary commitments toward reducing greenhouse gas emissions. Many companies that emit large amounts of greenhouse gases have developed corporate greenhouse gas reduction strategies and, in some cases, have voluntarily set greenhouse gas reduction goals. Although the amount of carbon that can be sequestered biologically is fairly low, compared to the amounts emitted, biological sequestration is a low-cost reduction approach compared to other mitigation strategies. In addition, the other co-benefits of carbon sequestration projects, such as improvements to air, soil and water quality, biodiversity, wildlife habitat, and forest products utilization, make these projects environmentally friendly and score well on the corporate public relations report card. Other compelling objectives include the desire to help establish the rules for greenhouse gas reduction projects. Several states now have either mandatory caps on the greenhouse gas emissions of power plants or will be developing regulatory requirements in the near future (Northeast States Regional Greenhouse Gas Initiative and Registry). It is believed that state-led regulatory caps are likely to become more common in the future and may even be established as a national policy.

The role of “aggregator organizations” can be a useful mechanism to lump individual landowner practices that sequester carbon into a marketable commodity. In certain states, aggregator organizations have developed that gather the carbon credits generated by many individual actions into a common pool and make these credits available to willing buyers. In Baltimore County, carbon management practices are likely to occur on small scales and through the actions of many individuals. It is feasible

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to consider that an aggregation of these efforts could produce enough carbon credits to be attractive to large buyers of carbon credits and developing international and national markets. Aggregator organizations currently operate in Montana (forest lands) and in Iowa and Indiana (both working with agricultural communities).

In order to take advantage of carbon sequestration initiatives, local expertise should be developed to help private landowners and aggregator organizations monitor and track carbon sequestration gains or to enter into carbon sequestration agreements with potential carbon credit buyers. Landowners that enter into carbon sequestration agreements, or begin to manage or restore their resources to achieve carbon sequestration benefits, need a source of expert information and guidance to ensure that these efforts are successful. There are a variety of accounting methods and tools that are used to quantify carbon credits. Certain criteria need to be met for different classes of carbon sequestration projects to allow these credits to be traded in various market settings or registered with the U.S. Department of Energy 1605(b) Federal registry. Landowners need a good understanding of these issues before they enter into carbon sequestration agreements that will necessarily impose restrictions on how the project and, therefore, their land resources, are managed.

Timber harvesting is compatible with the generation of carbon sequestration practices, as long as the land units are kept under active forest land management. Forest management and wood products utilization, such as logging practices that promote soil carbon retention, restoration (converting Virginia pine to hardwoods), extended **rotation** periods and production of long-lived wood manufactured products, can result in an overall increase of carbon sequestration over baseline conditions.

Forest land retention is also eligible, particularly if management actions, such as easements, demonstrate that the forest land in question would have been converted had retention not taken place.

Markets, trading mechanisms and regulatory market incentives are emerging across the United States and internationally. Opportunities may develop to participate in these market and trading systems. Guidelines established for Baltimore County projects should allow integration with these existing systems. With the ratification of the **Kyoto Protocol** by Russia, the international agreement will go into effect. This will require that all ratifying countries meet their greenhouse gas reduction goals, thus providing the regulatory incentives needed to fuel a strong market. The **European Union** carbon market is scheduled to kick-off in 2005 and has stated that it will consider trades with non-Kyoto countries.

Nationally, markets and regulatory incentives are appearing at regional and state-wide levels. The **Chicago Climate Exchange**, focused in the Great Lakes region, is a trading mechanism for buyers and sellers of carbon credits. The buyers are companies who have voluntarily committed to set reductions of greenhouse gas emissions. In the Northeastern US, 6 northeastern states and Canada have set regional greenhouse gas

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reduction goals and are developing a registry to support a greenhouse gas cap and trade market. Maryland is currently participating as an observer.

9.10. Landowner Attitudes Toward Forest Management

Some of the major obstacles to protecting and improving our forests are ambivalent and negative attitudes among landowners. Landowners are the primary decision makers in forest stewardship, as the forests of Baltimore County are 75% privately owned. Our forest resources – including soil, water, air quality, recreation, wildlife, and forest products – will continue to decline if landowners do not realize the importance and positive impacts of careful forest management and accept forest management as necessary and beneficial. Forest ownership means responsibility for management, and “do nothing” is often an irresponsible management decision.

9.11. Public Education about Forest Sciences

If landowners know little about forest sciences, including forest processes, forest management practices, and potential forest products, they will be unprepared to make civically-responsible decisions when managing their forests. Poor management decisions, ranging from inappropriate harvesting to “benign neglect”, can damage the productive capacity of forests, ecosystem health and vitality, conservation of soil and water, multiple socio-economic benefits, and biological diversity. In addition, inadequate education may reduce public awareness of forest issues, resulting in low public support for sustainable forest management initiatives, such as carbon credit and biomass fuel programs. In addition, lack of education can result in public decisions based on emotional responses to issues such as deer and invasive species management. Education is therefore an issue central to both the ecological and economic sustainability of forest resources. As Baltimore County’s population becomes more urbanized, knowledge of forest sciences among citizens is likely to continue to decline, and this issue will increase in importance.

9.12. Cost and Legal Barriers to Sustainable Forest Management

Many costs of forest product harvesting are constant; however, landowner and forest industry incomes derived from harvesting decreases as the size of the harvest decreases. Therefore, as forest tracts become smaller and fragmented, the profit margin of forest harvests declines for both the landowner and the forestry industry. At a point, there is no profit to be made from a harvest, yet foresters, loggers, and arborists must charge a fee to landowners for their management services. When this occurs, interest in managing these small forests declines among landowners, foresters, and the forestry industry. Cost barriers are therefore a major reason that small, fragmented forest tracts go unmanaged. In Baltimore County, forest tract size continues to decline

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owing to patch fragmentation and parcelization. As a result of increasing cost barriers, the ability of landowners to be good stewards of their forests through good forest management is threatened.

Another barrier to forest management is government regulation. More paperwork and permit processing results in more time spent by foresters on each job, which means a lower effective hourly rate. As a result, contracting foresters cannot justify writing plans for small tracts in high-regulation jurisdictions, and many contracting foresters avoid such counties altogether. Small forest tract size and time-consuming paperwork may prevent sustainable forest management in many of Baltimore County's forests.

Conservation easements protect many County forests from conversion to other land cover types. Unfortunately, some of these easements also limit forest management options. These easements are generated through development regulations (forest conservation areas and forest stream buffers) and voluntary conservation easement programs (land conservancies). The kind of easements at issue restrict, in perpetuity, the range of socio-economic benefits these forests can provide. Such perpetual restrictions are shortsighted given that optimal forest benefits can change over time. For example, in a particular stand, wildlife may be the most important forest benefit today, but in the future, carbon sequestration or energy production may be more important. As well, once the threat of land conversion from forest to non-forest is addressed, there is little scientific basis for restricting sustainable forest management of un-developable forest areas. Restrictions on forest management written into otherwise beneficial conservation easements represent another barrier to sound forest management in Baltimore County.

9.13. Strengthening Markets for Local Forest Products Utilization

Timber harvests and wood processing facilities, such as sawmills and pulp mills, are not major economic factors in Baltimore County. However, the incentives and reasons to manage forests for sustainability are driven by opportunities for **silviculture**. Boiled down to a simple relationship, the idea of "No Markets, No Management" (S. Koehn, DNR FS) bears serious consideration and needs to be evaluated as an important component of Baltimore County's Forest Sustainability Initiative. Not only do market forces encourage the active management of forest land, but they also serve as financial incentives to maintain land in a forested condition. The traditional timber management, harvesting, and wood products industry in Baltimore County needs to be evaluated in order to identify opportunities to more directly tie locally-produced timber supplies to local wood product manufacturers (see summary below on Baltimore County's "traditional" Timber Management, Harvesting and Wood Manufacturing Industry). Factors that influence demand for local forest products and those that reflect the supply or availability of locally-produced forests products need to be evaluated and strengthened. Developing new or innovative markets that offer financial incentives to local buyers and sellers of forest products will strengthen the County's forest products industries and the local supply of inputs to fuel these industries. Added financial

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incentives for private forest land owners will boost the likelihood of increasing the retention rate and sustainable management of these forests in the County. Examples of emerging market opportunities could include Green Building incentives, hunting and fishing leases, renewable energy development and carbon sequestration payments.

Particular attention should be focused on the development of renewable energy markets. In 2004, Governor Ehrlich signed into law SB 869, the Renewable Energy Portfolio Standard and Credit Trading Act, which requires Maryland utilities to increase the amount of renewable energy, including biomass, to 7.5% by 2014. Currently, Maryland gets less than one percent of its electricity from renewable energy sources. The use of wood products for energy production would have a direct economic stimulus on the local wood products industry, creating more incentives for landowner retention and sustainable management of forest lands. The use of renewables also provides greenhouse gas benefits. Greenhouse gas reductions are realized when biomass energy production reduces the consumption of fossil fuels and, thus, results in a net decrease of carbon dioxide emissions. "Carbon credits" generated from these activities may provide additional economic value within the State, regionally and internationally. These benefits will be realized by the industries using biomass fuel and can serve to increase demand for locally produced wood products.

Suppliers of biomass energy use local labor for cutting, hauling, chipping and delivering fuel. The biomass itself is purchased from local landowners. In addition to these direct economic boosts, users of biomass energy will pay less for energy on a BTU basis and be less vulnerable to the fluctuating, and often escalating, prices of fossil fuels. To illustrate, the net fuel cost per MMBtu for wood chips ranges from \$3.10 to \$5.30, compared to natural gas, which ranges from \$8.15 to \$12.50.

<http://www.biomasscenter.org/pdfs/Wood-Chip-Heating-Guide.pdf>

Over the past several decades, wood-fired heating plants have been deployed in schools, hospitals, government building and businesses. Using wood energy is an attractive option because it is a renewable, locally-produced energy source and is generally the least expensive fuel available. In general, institutional, commercial and light industrial heating systems are best suited to the use of wood chips or similar biomass fuels. Examples include schools, colleges, hospitals, public building, hotels and motels, commercial buildings, greenhouses, large-scale agricultural operations and manufacturing plants. Typically, facilities using this type of wood products utilization for energy and heat production are referred to as **Combined Heat and Power (CHP)** facilities. Maryland's Renewable Energy Portfolio Standard and Credit Trading Act provides **market demand** for another emerging buyer of biomass fuel products. Utilities may be interested in purchasing energy produced from wood generating powering plants. Baltimore County can take advantage of this opportunity by investigating the economic incentives offered by the State to encourage the development of renewable energy projects.

Baltimore County can also take advantage of new and innovative forest products that could provide added financial incentives for forest land retention and stronger forest

Appendix E: Background for Forest Issues in Baltimore County

product markets. These include:

Production of edible non-timber forest products, such as ferns, fruits, nuts, and shiitake, oyster and morel mushrooms. In 1999, wholesale market prices for shiitake ranged from \$4 to \$8 per pound and growers generally received between \$4 to \$6 per pound for fresh, well-formed mushrooms.

(<<http://www.naturalresources.umd.edu/Pages/Shiitake.htm>>)

Production of herbs for medicinal, flavoring or nutritional use. Wild **ginseng** sells for over \$300 a pound and the market demand in Asia for wild roots far outpaces supply. Forest land owners can cultivate naturalized populations of ginseng on the forest floor and manage/harvest in such a way that the population can be perpetually self-sustaining and provide income for many decades.

(<<http://www.ext.vt.edu/pubs/forestry/354-312/354-312.html>>)

Other examples include pale jewelweed (*Impatiens padilla*), which is used for treating skin irritations, and goldenseal (*Hydrastis Canadensis*), which has anti-inflammatory properties.

(<<http://www.cce.cornell.edu/scnyag/forestfarming/botanicals.htm>>)

Environmental benefits payments – although these services performed by Baltimore County forests currently do not provide added financial incentives to landowners, these are opportunities that could be realized in the foreseeable future:

Carbon sequestration payments (refer to section 8.9).

Ozone mitigation payments - Increasing tree cover in the Baltimore region could have a positive effect on reducing ozone concentrations. Currently the Baltimore region has **non-attainment status**. Considerations are underway to include increases in tree cover as a voluntary reduction strategy in the State's 8-hour air quality State Implementation Plan (SIP).

Nutrient reduction payments - Forests and forest management practices reduce nutrient and sediment pollution to the State's waterways and the Chesapeake Bay. Entities required to reduce nutrients and sediments through permitted discharges or land management activities may opt to purchase nutrient credits in order to meet their goal and regulated discharge levels.

Fishing and hunting leases.

Green Building Incentives - Financial incentives are offered to developers and construction companies that utilize locally-produced construction material.

A Profile of Baltimore County's "Traditional" Timber Management, Harvesting and Wood Manufacturing Industry

Maryland's Forest Products Industry can be divided into three main sectors as

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defined by the U.S.D.A. Forest Service (Hilchey and Kay). The *Timber Management and Harvesting* sector includes activities related to tree production, harvesting and transport of logs. The processing of logs and related products into lumber, veneer, plywood, pulp, turpentine and other products occurs within the *Primary Wood Manufacturing* sector. The *Secondary Wood Manufacturing* sector converts the products of the primary manufacturers into finished products, such as furniture, toys, containers, etc.

Each of these three sectors has certain spatial relationships to the timber source. Obviously, timber management and harvesting activities are directly tied to forest land. Across Maryland, the economic activity generated from timber management is greatest in the rural eastern shore and western Maryland counties. The primary wood manufacturing sector, generally regarded as the saw, chip and pulp mills, are also closely spatially related to their sourcing areas. When transportation costs are minimized from source areas to mill areas, greater profits are realized. At great enough distances from a given mill, transportation costs exceeds income and those sourcing areas are no longer viable. Generally, more mills are found closer to timber sources and occur more frequently in Maryland's more forested rural counties. However, the secondary wood manufacturing industries, which rely on source material provided by mills, provide a value-added component to the finished wood products that make long-distance transportation costs much more feasible. Therefore, these "finishing" industries are not dependent on close proximity with material sources and often occur more frequently in urbanized counties.

One measure to evaluate the degree of economic activity associated with each sector is through "*Total Industry Output*". Total industry output is the total amount of revenue each sector of the industry generates annually. Across the State, Baltimore County generates the greatest industry output when all three timber management and wood products sectors are considered together. In 1997, total industry output in Baltimore County for the forestry industry totaled over \$487 million. However, most of these revenues are derived from the secondary wood manufacturing industry. To illustrate, Baltimore County generated just over \$2 million in the timber management and harvesting sector, which represents about 1% of the total industry output produced by this sector Statewide. Almost \$48 million were produced through primary wood manufacturing activities in the County, representing nearly 7% of this sector's Statewide industry output. Secondary wood manufacturing activities dominate the total forestry industry's activities in Baltimore County. Over \$437 million were generated through these activities, which comprises over 34% of this sector's revenues Statewide.

The economic profile of Baltimore County's forestry industry may offer some insights into how the industry could be managed or influenced to bring a closer link between timber production and forest land retention on forest lands in Baltimore County and the very robust secondary wood manufacturing activities. At its essence, this is a supply and demand issue. A County-wide analysis of available mill suppliers for existing wood products manufacturers would be an initial step.

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Supply gaps could then be identified and evaluated to gauge whether promoting new mill development to service known supply needs would be feasible. A critical element in this would be locally-available timber products, which is at the core of this issue. However, small-scale economic development may be possible. An additional approach may be to encourage secondary wood manufacturing industries to buy locally. This could be paired with business tax or other financial incentives. A result would be to increase the demand for locally-provided wood products and, hopefully, drive up the availability and willingness of private landowners to supply these raw materials.

9.14. Timber Management for Sustainable Forests

Traditionally, landowner goals and objectives have directed the types and extent of timber harvest operations on private lands. Because the concept of forest ecosystem sustainability was not typically understood or accepted by the public until the second half of the 20th Century, timber harvest plans often favored the regeneration of commercially valuable forest species and products over the conservation of forest ecosystem functions and processes. Consulting foresters could encourage but could not require timber harvests that included forest ecosystem protection. Forest responses to traditional landowner objectives have influenced the community composition, health and vitality of the County's forests. As such, these activities are relevant to the Montreal Process Criteria listed in Section 7.0 above, and are also relevant to developing forest landowner educational programs about the importance of preparing sustainable management plans for ecosystem protection in timber harvest operations.

Section 9.2 above on Forest Fragmentation contains a brief discussion of the influence of un-restrained timber harvesting in the 19th Century on the region's forests, and the reaction of Maryland's first State Forester, Fred W. Besley, to the degraded condition of the remaining forests. Besley's installation as State Forester in 1906 was only one of many actions taken by Maryland to restore forest health and productivity in a nationally-evolving conservation movement.

Several important laws were passed in Maryland in the early 20th Century, including - a - law to establish a State Board of Forestry in 1906, primarily to control wildfires; a state forest tree nursery in 1914; and the first comprehensive state forest inventory, executed by Besley and reported in 1916 (MD DNR, 2003). In a 1909 report, the Maryland Conservation Commission recognized the ecological services of forests, characterizing them as an indirect benefit along with forest products that contribute to the significant value of the State's forest resources. In the 1940's, the Maryland Forest Division was established to provide technical assistance to woodland owners in achieving the dual goals of forest harvesting and forest regeneration (MD DNR, 2003). By the 1950's, the concept of multiple use management for the protection of water quality, wildlife habitat and recreation benefits, in addition to forest product value, influenced the State's forestry programs (MD DNR web)www.dnr.state.md.us/forests/aghistory.html).

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Today, under the umbrella of the Forest Stewardship Program, the Maryland DNR Forest Service offers numerous technical and financial assistance programs to help non-industrial forestland owners to practice responsible forestry while sustaining critical forest ecosystem functions (Koehn et al, 2003). All of these evolving ethics have contributed to the concept of forest ecosystem sustainability. For Baltimore County and the State of Maryland, these programs are especially important, because about 75% of the forest resource is in private, non-commercial ownership.

The present condition of the County's forests reflects the attitudes and behaviors of forestland owners over the last 200 years. The concept of sustainability for all forest ecosystem services was not a major consideration in timber harvest plans until the second half of the 20th Century, and is still dependent upon the goals and objectives of the landowner. Maryland has made great progress in developing programs to assist private forestland owners in including the protection of forest ecosystem functions in forestry operations. However, State and consulting foresters can only encourage forest sustainability in harvest plan goals and objectives, and management plans prepared by foresters are not required for timber harvest operations. The long-term effects of early forestry on the region's forests, coupled with the current trends in continuing fragmentation and forest parcelization, make the need for sustainable forest management plans critical for the forests of the future.

Literature Cited:

Conservation Commission of Maryland. Report for 1908 – 1909. 1909.

Koehn, Steven W, and the State Forest Stewardship Coordinating Committee. Maryland DNR Forest Service: Forest Stewardship Program. 2003.

Maryland Department of Natural Resources. The Importance of Maryland's Forest: Yesterday, Today and Tomorrow. 2003.

MD DNR. Maryland's First Forestry Law: A Brief History of the Forest Service. www.dnr.state.md.us/forests/aghistorical.html

9.15. Forest Management Plans for Publicly Owned Forests

Despite being important owners of large tracts of forested lands, local, State and federal governments in Baltimore County have not implemented many forest management plans. Although plans may have been developed, factors such as budget constraints, citizen opposition, and general disinterest have prevented implementation. Setting positive examples for citizen landowners is a function of good government. By preparing and implementing forest management plans, governments can improve the social, economic, and environmental benefits of their forest holdings. At the same time, governments can educate citizen landowners and lead citizens by example to healthy, sustainable forests.

10.0 Appendix F: Memorandum of Understanding

Note: The following Memorandum of Understanding is proposed to be signed on November 8, 2005. The final format will be modified in accordance with requirements for grants and agreements used by the USDA Forest Service. The MOU provides for the continuing partnership among the signatories for development and implementation of the Forest Sustainability Strategy for Baltimore County.

**MEMORANDUM OF UNDERSTANDING
BY AND AMONG
THE USDA FOREST SERVICE,
THE MARYLAND DEPARTMENT OF NATURAL RESOURCES,
AMERICAN FORESTS,
AND BALTIMORE COUNTY, MARYLAND
FOR
SUSTAINABLE FOREST MANAGEMENT**

THIS MEMORANDUM OF UNDERSTANDING is made as of this eighth day of November 2005 by and among the USDA Forest Service (hereinafter referred to as "Forest Service"), the Maryland Department of Natural Resources (hereinafter referred to as "MD DNR"), American Forests, and Baltimore County, Maryland, a body corporate and politic of the State of Maryland (hereinafter referred to as "Baltimore County" or the "County"), or collectively referred to as the "parties."

A. PURPOSE: The purpose of this Memorandum of Understanding is to provide a framework for cooperation on critical ecosystem services from forests for the: protection and maintenance of air and water quality, biodiversity, working lands and open space. The framework also provides for multiple social (including cultural and institutional) and economic needs; watershed management tools for helping address water resource issues and as a market element for managing carbon. The parties recognize that the ability to sustain and enhance the ecosystem services provided by forests will play an increasing role in restoring and maintaining the health of the Chesapeake Bay and its watershed, of which Baltimore County is a part. This cooperation serves the mutual interest of the parties and the public.

B. PARTIES: The USDA Forest Service is a federal land and resource management agency whose mission is to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations.

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MD DNR manages state forest resources and restores, manages, and protects Maryland's trees, forests and forested ecosystems to sustain our natural resources and connect people to the land.

Baltimore County manages, protects, and enhances the natural resources of Baltimore County and the health of its citizens through the application of environmental and public health laws, principles, and practices.

American Forests is a national non-profit citizens' conservation organization focused on protecting, restoring, and maintaining forests for healthy ecosystems and communities and has coordinated a national community-focused effort on criteria and indicators for sustainable forest management at the county level.

C. STATEMENT OF MUTUAL BENEFIT AND INTERESTS: The parties recognize the loss of forest, loss of ecological function, forest fragmentation and ownership parcelization, and increased threats to sustainability from invasive species, forest pests and diseases, and other stressors. The parties hereto have worked cooperatively to increase the amount of forestland, improve forested areas, including the restoration, protection and maintenance of riparian forests and to promote sound land use policies through resource management programs including the Chesapeake Bay Program. MD DNR and the County have worked cooperatively on the State's Strategic Forest Land Assessment to identify priority forests for both their ecological and economic functions and are working to apply the State's Green Infrastructure assessment to the County and to support Green Infrastructure training for community leaders.

The parties hereto have embraced forest sustainability as a framework for providing ecosystem services and meeting other environmental, social, and economic needs of citizens today without diminishing these forest benefits for future generations.

D. NOW THEREFORE, THE PARTIES TO THIS MEMORANDUM OF UNDERSTANDING, in consideration of the mutual covenants set forth herein, and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, hereto agree as follows:

1. FOREST SERVICE SHALL:

- a) Provide assistance to the County for implementation of its forest sustainability program that includes providing the results of priority research; assisting in the analysis of forest assessment and monitoring data; assisting in the development of implementation programs; identifying potential sources of funding and collaborative ventures; and working with other organizations and policymakers including regional and national policymakers and practitioners as appropriate to demonstrate local approaches to forest sustainability.
- b) Share the lessons learned from the County's forest sustainability program through regional and national venues including but not limited to meetings

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and other events of the national Roundtable on Sustainable Forests hosted by Forest Service in collaboration with others. As appropriate, integrate this work with national and regional forest sustainability programs and the Chesapeake Bay Watershed Forestry Program.

- c) Assist the County in communication, education, and implementation activities about forest sustainability and foster partnerships with others.

2. MD DNR SHALL:

- a) Provide assistance and coordination for implementing the County's forest sustainability program, including identification and conduct of priority research; collection and analysis of forest assessment and monitoring data; development of implementation programs; identification of potential sources of funding; and documentation and sharing of the County project with other local governments, organizations, and regional and national policymakers as appropriate to demonstrate local approaches to forest sustainability.
- b) In addition, MD DNR shall support the County in its preparation of a "forest sustainability report" every two years outlining progress and establishing priorities for future actions, in its efforts to incorporate indicators as appropriate to document progress, and to continue to share the lessons learned through regional and national venues including but not limited to the Roundtable on Sustainable Forests.
- c) Finally, MD DNR shall support the County in communication, education, and implementation activities with landowners and other citizens about forest sustainability and to develop partnerships with the City of Baltimore and adjacent counties, citizen-based watershed organizations, community associations and civic organizations, schools and universities, and others.

3. BALTIMORE COUNTY SHALL:

- d) Implement the County's forest sustainability program, including identification and conduct of priority research; collection and analysis of forest assessment and monitoring data; development of implementation programs; identification of potential sources of funding; and documentation and sharing of the County project with other local governments, organizations, and regional and national policymakers as appropriate to demonstrate local approaches to forest sustainability.
- e) Prepare a "forest sustainability report" every two years outlining progress and establishing priorities for future actions, in its efforts to incorporate indicators as appropriate to document progress, and to continue to share the lessons learned through regional and national venues including but not limited to the Roundtable on Sustainable Forests.
- f) Work with the other parties on communication, education, and implementation activities with landowners and other citizens about forest sustainability and develop partnerships with the City of Baltimore and

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adjacent counties, citizen-based watershed organizations, community associations and civic organizations, schools and universities, and others.

4. AMERICAN FORESTS SHALL:

- g) Provide assistance and coordination in sharing the County project with other local governments, organizations, and regional and national policymakers as appropriate to demonstrate local approaches to forest sustainability.
- h) Support the County in its efforts to continue to share the lessons learned through regional and national venues including but not limited to the Roundtable on Sustainable Forests.
- i) Work with other the parties on communication, education, and implementation activities with landowners and other citizens about forest sustainability, and develop partnerships with the City of Baltimore and adjacent counties, citizen-based watershed organizations, community associations and civic organizations, schools and universities, and others.

E. IT IS MUTUALLY AGREED AND UNDERSTOOD BY ALL PARTIES THAT This Memorandum of Understanding constitutes the entire and full understanding of the parties hereto and may only be modified through a written amendment agreed to be the parties.

The Recitals are incorporated herein.

This Memorandum of Understanding shall be governed by and construed under the laws of the United States of America and the laws of the State of Maryland.

- 1. FREEDOM OF INFORMATION ACT (FOIA) and Public Information Act (PIA). Any information furnished to the Forest Service under this instrument is subject to the Freedom of Information Act (5 U.S.C. 552). Any information furnished to MD DNR and/or the County is subject to the Maryland Public Information Act (Section 10-601 et. seq. of the State Government Article of the Maryland annotated Code).
- 2. MODIFICATION. Modifications within the scope of the instrument shall be made by mutual consent of the parties, by the issuance of a written modification, signed and dated by all parties, prior to any changes being performed.
- 3. PARTICIPATION IN SIMILAR ACTIVITIES. This instrument in no way restricts the Forest Service or the Cooperator(s) from participating in similar activities with other public or private agencies, organizations, and individuals.
- 4. COMMENCEMENT/EXPIRATION DATE. This instrument is executed as of the date of the last signature and is effective through the thirty first day of December 2009 at which time it will expire unless extended by written amendment.

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5. **TERMINATION.** Any of the parties, in writing, may terminate the instrument in whole, or in part, at any time before the date of expiration. Each party shall be responsible for its own expenses in carrying out its obligations under this Memorandum of Understanding.
6. **PRINCIPAL CONTACT.** The principal contacts for this instrument are:

Forest Service Project Contact	American Forests Project Contact
Susan Mockenhaupt	Gerald J. Gray
National Program Manager, Urban & Community Forestry	Vice President for Policy
Phone: 202-205-1007	Phone: 202-737-1944 x217
FAX: 202-690-5792	FAX: 202-737-2457
E-Mail: smockenhaupt @fs.fed.us	E-Mail: ggray@amfor.org
Forest Service Administrative Contact	American Forests Administrative Contact
(same)	(same)
Phone:	Phone:
FAX:	FAX:
E-Mail:	E-Mail:

Maryland DNR Project Contact	Baltimore County Project Contact
Jeff Horan	Donald Outen,
Chief, Forest Resource Planning & Analysis	Natural Resource Manager
Phone: 410-260-8520	Phone: 410-887-4488 ext 238
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E-Mail: jhoran@dnr.state.md.us	E-Mail: douten@co.ba.md.us
Maryland DNR Administrative Contact	Baltimore County Administrative Contact
(same)	Robert P. Schleigh
	Supervisor of Finance & Administration
Phone:	Phone: 410-887-3514
FAX:	FAX: 410-887-3510
E-Mail:	E-Mail: rschleigh@co.ba.md.us

7. **NON-FUND OBLIGATING DOCUMENT.** This instrument is neither a fiscal nor a funds obligation document. Any endeavor or transfer of anything of value involving reimbursement or contribution of funds between the parties to this instrument will be handled in accordance with applicable laws, regulations, and procedures including those for government procurement and printing. Such endeavors will be outlined in separate agreements that shall be made in writing by representatives of the parties and shall be independently authorized by appropriate statutory authority. This instrument

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does not provide such authority. Specifically, this instrument does not establish authority for noncompetitive award to any of the parties hereto of any contract or other agreement. Any contract or agreement for training or other services must fully comply with all applicable requirements for competition.

8. **AUTHORIZED REPRESENTATIVES.** By signature, each party hereto certifies that the individuals listed in this document are representatives of such party and are authorized to act in their respective areas for matters related to this agreement.

IN WITNESS WHEREOF, the parties hereto have executed this agreement as of the last written date below.

USDA FOREST SERVICE

BALTIMORE COUNTY, MARYLAND

Sally Collins, Associate Chief

By:

James T. Smith, Jr., County Executive

MARYLAND DNR

AMERICAN FORESTS

By:

Steven W. Koehn, State Forester

By:

Deborah Gangloff, Executive Director

11.0 Appendix G: Forest Strategy Glossary

This section defines key terms used in the Draft Strategy report. At the end of most definitions, a source code is provided in parentheses. The source list is presented at the end of the glossary.

adaptive resource management - A type of natural resource management that implies making decisions as part of an on-going process. Monitoring the results of actions will provide a flow of information that may indicate the need to change a course of action. Scientific findings and the needs of society may also indicate the need to adapt resource management to new information. (4)

aggregator organizations - Organizations that can coordinate landowner outreach/opportunities with potential carbon funding sources. For most private landowners, the amounts of carbon sequestered are too small to interest markets, so there must be an **aggregator organization** that can assemble groups of small practices to offer in a portfolio to the market. This must be possible without imposing significant reporting or other transaction costs that could dampen market participation.

APHIS – Animal and Plant Health Inspection Service, US Department of Agriculture

aquaculture - The controlled rearing of fish or shellfish by people or corporations who own the harvestable product, often involving the capture of the eggs or young of a species from wild sources, followed by rearing more intensively than possible in nature. (15)

aquatic resource habitat - Habitat where a variety of marine flora and fauna occur for long periods throughout the year. Examples include lakes, rivers, bogs, ponds and potential underwater diving areas. (14)

bacteria - Group of single-cell micro-organisms, the smallest of the living organisms. Some are vital to sustain life, while others are responsible for causing highly dangerous human diseases, such as anthrax, tetanus and tuberculosis. Bacteria are found everywhere, in the soil, water and air. (7)

Baltimore County Council - The County Council is the County elected legislative body, and it is vested with all law-making power granted by its Charter and by the General Assembly of Maryland. As the final fiscal authority of Baltimore County, the County Council is responsible for adopting an annual balanced budget capable of financing the operations of county government for the fiscal year. (11)

baseline - Information collected to provide a standard against which future measurements can be compared. (14)

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biological diversity - The variety of life. There are commonly five levels of biodiversity: genetic diversity referring to the genetic variation within a species; species diversity referring to the variety of species in an area; community or ecosystem diversity; landscape diversity; and regional diversity referring to the species, communities, ecosystems or landscapes within a specific geographic region. Each level of biodiversity has three different components: compositional, structural, and functional elements, which include the number of ecological processes, such as disturbance regimes, roles played by species within communities, and nutrient cycling within the ecosystem. (54)

biomass - The total mass of living organisms in a given area or volume. Forest biomass consists primarily of above-ground and below-ground tree components (stems, branches, leaves, and roots); other woody vegetation; and mosses, lichens, and herbs. Animal biomass typically comprises only a very small portion of total forest biomass. (17)

boreal forest - The northern hemisphere, circumpolar, tundra forest type consisting primarily of black spruce and white spruce with balsam fir, birch and aspen. (7)

BTU - The British thermal unit (BTU or Btu) is a non-metric unit of energy, used in the United States and, to a lesser extent, the UK (where it is generally only used for heating systems). The SI unit is the joule (J), which is used by most other countries. A BTU is defined as the amount of heat required to raise the temperature of one pound avoirdupois of water by one degree Fahrenheit; specifying the temperature range over which this happens leads to a number of slightly different BTU values, varying over a range of about 0.5%. (16)

buffer- A land area that is designated to block or absorb unwanted impacts to the area beyond the buffer. Riparian forest buffers can protect stream systems and aquatic organisms from sediment runoff and other pollutants from the adjacent landscape. Buffer strips along a trail could block views that may be undesirable. Buffers may be set aside next to wildlife habitat to reduce abrupt change to the habitat. (4)

canopy- The top layer of a forest formed naturally by the leaves and branches of trees and other plants. (29)

carbon balance - The concentration of carbon released into the atmosphere compared to the amounts stored in the oceans, soil and vegetation. (14)

carbon market - In geopolitics or economics, carbon trading is a practice that allows one country to offset its effective carbon dioxide emissions by investing in reforestation and "clean energy" in another less-developed country. According to the British Broadcasting Corporation, the European Union as of late 2004 was "pioneering" carbon trading. Also according to the Corporation, Shell had as of late 2004 been active in carbon trading. (16)

carbon pool - A system having the capacity to accumulate or release carbon.

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Examples of carbon pools are forest biomass, wood products, soils, and the atmosphere. (17)

carbon sequestration - The uptake and storage of carbon. Trees and plants, for example, absorb carbon dioxide, release the oxygen and store the carbon. (7)

carbon sink - Forests and other ecosystems that absorb carbon, thereby removing it from the atmosphere and offsetting CO₂ emissions. The Kyoto Protocol allows certain human-induced sinks activities undertaken since 1990 to be counted towards Annex I Parties' emission targets. (7)

carbon storage - Carbon storage can take place above ground and below ground. Trees store carbon above ground, while carbon enters the soil through trees below ground. It is more difficult to measure below ground storage of carbon than above ground storage. Factors including soil and water quality, the climate and types of trees will determine if more carbon can be stored above ground or below ground. Soil disturbance is also a strong factor in the loss of carbon into the atmosphere (Carbon flux- when carbon is released from where it is stored. Each year about 8 billion metric tons of carbon is released into the atmosphere through deforestation and the use of fossil fuels. The majority of this carbon dioxide is removed from the atmosphere by plants or the ocean, but a significant portion remains airborne. (18)

carousel process - A structured brainstorming session. Small groups of participants respond to several questions posted on charts around the meeting room. Each group spends time brainstorming about each question, rotating around the room until each group has an opportunity to address every question.

carrying capacity - The maximum number of individuals of a wildlife species that an area can support during the most unfavorable time of the year. (6)

Chestnut Blight - A fungal disease, *Cryphonectria parasitica* (formerly *Endothia parasitica*) that was accidentally introduced to the United States around 1900-1908, either in imported chestnut lumber or in imported chestnut trees, and by 1940, mature American chestnut trees had been made virtually extinct by the disease. The blight appears to have been introduced from either China or Japan. Japanese and some Chinese chestnut trees are resistant to the fungus: they may be infected, but the blight does not usually kill them. Despite the devastation the blight caused to the American Chestnut tree, the root collar and root system of the tree are fairly resistant to the blight, so a large number of small American Chestnut trees still exist as shoots from existing root bases. However, the shoots are seldom able to grow enough to reproduce before the blight attacks them. (16)

Chicago Climate Exchange (CCX) - A system for trading greenhouse gas emissions. Members of the Exchange commit to reduce their greenhouse gas emissions by 2006, the last year of the pilot program. The Exchange claims to have the following two objectives: firstly, build "institutions and skills needed to cost-effectively manage greenhouse gas emissions"; secondly, influence "the debate on appropriate acting for

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managing the risk of global climate change". The Trading System has the following three parts.

1. The Trading Platform is a marketplace for executing trades among Registry Account Holders.
2. The Clearing and Settlement Platform processes all transaction information.
3. The Registry is the official database for Carbon Financial Instruments owned by Registry Account Holders. (16)

combined heat and power (CHP) - The consecutive generation of useful thermal and electric energy from the same fuel source.

composition - The biological and physical components of an ecosystem. Composition could include water, minerals, trees, snags, wildlife, soil, microorganisms, and certain plant species. (4)

conservation – The protection, improvement, and wise use of natural resources according to principles that will assure utilization of the resource to obtain the highest economic and/or social benefits. (5)

conservation easement - An easement restricting a landowner to land uses that are compatible with long-term conservation and environmental values. (8)

contiguous - Something that is sharing an edge or boundary with something else. (16)

cost-share programs - A subsidization, by different governmental agencies and some private industries, of site preparation, reforestation, timber stand improvement, wildlife and fisheries management, and water quality expenses. (19)

criteria (plural of Criterion) - A category of conditions or process by which sustainable forest management can be assessed. A criterion is characterized by a set of related indicators, which are monitored periodically to assess change (Montreal Process, 1995). (13)

deciduous - Shedding or losing leaves annually; the opposite of evergreen. Trees such as maple, ash, cherry, and larch are deciduous. (28)

desiccation - The state of extreme dryness, or the process of extreme drying. It is an extreme form of dehydration. (16)

dispersal - The movement of organisms to new locations, away from their parents. For example, dandelions disperse using seeds that catch the wind, while thistles will disperse by catching in the fur of a passing mammal. Animals tend to have an excellent capacity for dispersal, because they typically are able to walk, fly or swim to a new location. (29)

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distribution - 1.) The spatial arrangement of organisms in a defined area- which fall into one of three categories: clumped, uniform, or random. 2.) the geographic area in which a species naturally occurs *Syn: range*. 3.) in a statistical sense, it is the total observed (or estimated) frequency of occurrence for the studied subject (or statistic).

disturbance - Any event or series of events that disrupt ecosystem, community, or population structure and alters the physical environment. (8)

easement - A right held by one person to make specific, limited use of land owned by another person. An easement is granted by the owner of the property for the convenience, or ease, of the person using the property. Common easements include the right to pass across the property, the right to construct and maintain a roadway across the property, the right to construct a pipeline under the land, or a power line over the land. Easements for party walls that share a common foundation, are common in town house and condominium developments. (22)

ecological function or ecosystem function - An intrinsic ecosystem characteristic related to the set of conditions and processes whereby an ecosystem maintains its integrity (ex: primary productivity, food chain, biogeochemical cycles, etc.). Ecosystem functions include such processes as decomposition, production, nutrient cycling, or fluxes of nutrients and energy. (24)

ecological services or ecosystem services - Valuable services provided by natural systems. Examples of ecological services include flood control, air purification, and climate control. (23)

economy of scale - Lower costs arising from the expansion of production. Typically these are due to large concentrations of population and economic activity. Larger markets allow wider choice and a greater range of specialist services. (27)

ecosystem - A community of plants, animals, and microorganisms that are linked by energy and nutrient flows and that interact with each other and with the physical environment. Rain forests, deserts, coral reefs, grasslands, and a rotting log are all examples of ecosystems. (23)

edge - The boundary between two ecological communities, for example, field and woodland. Edges provide wildlife habitat. Consideration of an edge can reduce the impact of a timber harvest. (28)

EIPAS - Exotic, Invasive Plant and Animal Species.

EPA - Environmental Protection Agency.

erodible soils - Soils that wash away easily, especially under conditions where stormwater runoff is inadequately controlled. Silt and sediment are washed into nearby streams, thereby degrading water quality. (25)

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European Union - A union of twenty-five independent states based on the European Communities and founded to enhance political, economic and social co-operation. European Union countries are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom of Great Britain and Northern Ireland, Cyprus (Greek part), the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia.

exotic (introduced) species - Any species growing or living outside its natural range of occurrence. Normally, this refers to species purposely or accidentally introduced into countries or regions they do not historically occur. (13)

extirpated - Local extinction; a species or subspecies disappearing from a locality or region without becoming extinct throughout its range. (1)

fauna -The animal life of an area. (4)

FCA (Forest Conservation Act) - The main purpose of the Maryland Forest Conservation Act (Natural Resources Article Section 5-1601 through 5-1613) enacted in 1991 was to minimize the loss of Maryland's forest resources during land development by making the identification and protection of forests and other sensitive areas an integral part of the site planning process. Identification of priority areas prior to development makes their retention possible. Of primary interest are areas adjacent to streams or wetlands, those on steep or erodible soils or those within or adjacent to large contiguous blocks of forest or wildlife corridors. Although the Maryland DNR Forest Service administers the FCA, it is implemented on a local level. Gaining approval of the required Forest Conservation Plan (development of more than one acre) may require long-term protection of included priority areas or planting/replanting (afforestation or reforestation) a sensitive area off-site.

forest - A vegetation type dominated by trees. Many definitions of the term forest are used throughout the world, but for the purposes of the Kyoto Protocol, a nation must choose to define a forest as being any land area covering at least 0.05-1.0 ha that has at least 10-30% tree crown cover, and trees that have the potential to reach 2-5 m height at maturity. (17)

Forest Conservation and Management Agreement (FCMA) program - The program is a legal agreement between the landowner and the Department of Natural Resources and is recorded in the land records of the county in which the property is located. The landowner agrees to manage their forest land according to a management plan that is prepared for the property. The minimum acreage is five acres and the minimum length of the agreement is fifteen years. The property tax assessment on the forest land in the agreement is generally reduced and frozen at a low agricultural rate. If the agreement is broken through failure to follow the plan, sale of the property to someone unwilling to assume the responsibility or if the landowner just wants to be out of the program, back taxes will be levied and will be computed back to the beginning of the agreement. The agreement can be amended to increase or decrease acreage and it can be transferred

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to a buyer if the buyer is willing to assume the responsibilities of the agreement. (28)

forest cover - Forest stands or cover types consisting of a plant community made up of trees and other woody vegetation, growing more or less closely together. (13)

forest health- A measure of the robustness of forest ecosystems. Aspects of forest health include biological diversity; soil, air, and water productivity; natural disturbances; and the capacity of the forest to provide a sustaining flow of goods and services for people. (4)

Forest Health Monitoring program (FHM) - A consortium of many Federal and State agencies that monitors, assesses, and reports on the status of the nation's forests. (12)

Forest Inventory and Analysis (FIA) - A unit of the USDA Forest Service charged with compilation and reporting of data on the nation's forests. Formerly called Forest Survey. (12)

Forest Legacy program – A Program administered by Maryland DNR designed to identify and protect environmentally important forest lands through the use of perpetual conservation easements between willing sellers and willing buyers. Only private forest land in a Forest Legacy Area is eligible for the program. Landowners who are willing to sell their development rights are encouraged to apply during a sign-up period. At the end of a sign-up period, all applications will be evaluated and ranked. The highest ranked applications will enter the acquisition process. If negotiations produce acceptable easement terms, the easement will be acquired and recorded in the land records. If they do not produce acceptable terms, eminent domain will NOT be used. The number of parcels accepted for acquisition will depend on the funding available and the estimated value of the parcels selected. (28)

forest management - A term for the intentional manipulation of forest growth and processes for specific objectives. Management plans have traditionally included timber harvesting but can also be written to make ecological health a primary goal. Management does not necessarily mean harvesting. Thoughtful forest management plans can combine ecological goals such as stream and wetland protection, soil conservation, water quality and reservoir protection, and habitat diversity with the production and harvesting of forest products including timber. Management plans can be used as a tool to restore forest sustainability over time by addressing the environmental stressors on forest health. Forest management plans can be constructed to facilitate the joining of forest fragments, to use silvicultural practices to reintroduce native species long removed from forests and to begin the restoration of structural diversity and ecological function. Management can also set goals for establishing a range of successional stages, from seedling regeneration to ecological maturity, including planning for elements of old growth. Forest management that mimics the natural disturbance regime of a forest can maintain the sustainability of both forest functions and forest products. (1)

forest restoration - To re-establish the presumed structure, productivity and species

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diversity of the forest originally present at a site. In time, the ecological processes and functions of the restored forest will closely match those of the original forest. (30)

forest stand - A community of trees, including above-ground and below-ground biomass and soils, sufficiently uniform in species, composition, age, and management type. (17)

forest sustainability - The natural condition of regeneration and renewal of biological complexity and function, according to a *natural disturbance* regime. Natural disturbances are every day occurrences in forests - for example, single tree blow downs or animal foraging. Less frequently, major ice and wind storms and, to a lesser extent, fires create larger openings in the forest canopy, allowing the regeneration of light dependent plants. Sustainability is maintained by the major natural disturbances that operate infrequently over short intervals. Each of these disturbances has a beginning and an end, after which the ecosystem renews itself over time through regeneration. This process yields forests of great structural and biological complexity wherein, at any time, numerous growth stages are represented, providing habitats for a rich and diverse community of plants and animals. Prolonged and repeated *human disturbances* through clearing and consumptive forest uses has simplified forest structure, degraded soils, reduced forest capacity for supporting rich and diverse natural communities, and forest fragmentation opens habitats for the proliferation of noxious weeds that are rampantly invading forest patches. (1)

forest-dependent - Any species which uses forested habitats, or portions of forested habitat, at any point during the life cycle. This does not include species that may occasionally wander into forests, but are not normally expected to be found in forested habitat. (32)

fossil fuels - Coal, natural gas and petroleum products (such as oil) formed from the decayed bodies of animals and plants that died millions of years ago. (7)

fragmentation - The subdivision of large natural landscapes into smaller, more isolated fragments. Fragmentation affects the viability of wildlife populations and ecosystems. (28)

fungus (fungi) - Molds, mildews, yeasts, mushrooms, and puffballs, a group of organisms lacking in chlorophyll (i.e. are not photosynthetic) and which are usually non-mobile, filamentous, and multicellular. Some grow in soil, others attach themselves to decaying trees and other plants whence they obtain nutrients. Some are pathogens, others stabilize sewage and digest composted waste. (8)

ginseng (*Panax*) - A genus of about five or six species of slow-growing perennial plants with fleshy roots, in the family Araliaceae. They grow in the Northern Hemisphere in eastern Asia and North America, typically in cooler climates; *Panax vietnamensis*, discovered in Vietnam, is the southernmost ginseng found. Ginseng is characterized by the presence of ginsenoside. Ginseng is highly prized as an adaptogen (a product that does no harm, but increases the body's resistance to stress). Unfortunately, this

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property is extremely difficult to prove scientifically as well. (16)

GIS or Geographic Information System - A system for archiving, retrieving, and manipulating data that has been stored and indexed according to the geographic coordinates of its elements. The system generally can utilize a variety of data types, such as imagery, maps, or tables. In environmental management applications, GIS is typically used to generate maps. (27)

global carbon cycle - The biogeochemical cycle by which carbon is exchanged between the biosphere, geosphere, hydrosphere and atmosphere of the Earth. (16)

goldenseal (*Hydrastis canadensis*) is a perennial herb in the buttercup family Ranunculaceae, native to southeastern Canada and the northeastern United States. It may be distinguished by its thick, yellow knotted rootstock as well as its large, rounded leaves. Goldenseal is often used as a multi-purpose remedy, having many different medicinal properties. In addition to working as a topical antibiotic, it can also be taken internally as a digestion aid. Goldenseal may be purchased in salve or tablet form. It is often marketed as a "cleanser" to prepare for drug tests, but its actual efficacy as such is unknown. (16)

goodwill - An accounting concept that describes the value of a business entity not directly attributable to its tangible assets and liabilities. (16)

green building - A building that is constructed in a manner that minimizes the impact on the environment. The evaluation of a building includes all aspects of a building project. It includes the site location and design, how the building itself is designed, how it is constructed, and the type of materials used (percent of recycled products, travel distance to the site for the materials, and on-site waste handling and disposal). In addition, the evaluation includes how the building is designed for energy efficiency and how well the building operates after completion. (34)

Green Infrastructure - As a component of the GreenPrint Program, Maryland's Green Infrastructure Assessment provides a scientifically based, landscape approach to identifying and linking ecologically valuable areas in the state. The goal of the project was to "identify an ecologically sound open space network, and ultimately, to incorporate the agreed upon network into local land conservation planning." Using GIS and principles of landscape ecology, The Maryland Department of Natural Resources developed a network consisting of hubs (large core areas of ecological importance) and landscape linkages (natural routes that connect the hubs). These areas were prioritized based on ecological value and the risk of being developed. The resulting Green Infrastructure network map consisted of 33% of Maryland's total land area, of which about two-thirds are unprotected..

Green Renaissance – A series of cutting-edge environmental initiatives announced in January 2005 to ensure the protection of natural resources of Baltimore County through collaboration with communities, businesses, government agencies, environmental groups and the development community.

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greenhouse gas - Greenhouse gases are those gaseous constituents—both natural and anthropogenic—of the Earth’s atmosphere that absorb infrared radiation emitted from the Earth’s surface, the atmosphere, and clouds. By absorbing infrared radiation, these gases trap energy in the Earth’s atmosphere and cause the greenhouse effect—the trapping of heat in the lower atmosphere—and influence the global climate. Water vapor (H₂O), carbon dioxide (CO₂), methane (CH₄), and ozone (N₂O) are the primary greenhouse gases in the Earth’s atmosphere. (17)

Groundwater - The supply of freshwater under the earth’s surface in an aquifer or soil. (35)

groundwater recharge areas – Areas where water from precipitation is transmitted downward to an aquifer. Most areas, unless composed of solid rock or covered by development, allow a certain percentage of total precipitation to reach the water table. However, in some areas more precipitation will infiltrate than in others. Areas, which transmit the most precipitation, are often referred to as "high" or "critical" recharge areas. (34)

Growing Home Campaign – A Baltimore County Program that is conducting outreach and education to homeowners in urban communities about the benefits of planting trees and provides a \$10 coupon for tree purchases.

habitat - The area in which an animal, plant, or microorganism lives and finds the nutrients, water, sunlight, shelter, living space, and other essentials it needs to survive. Habitat loss, which includes the destruction, degradation, and fragmentation of habitats, is the primary cause of biodiversity loss. (23)

harvesting - The cutting, felling, and gathering of forest timber. (28)

headwaters - Small creeks at the uppermost end of a stream system, often found in the mountains, that contribute to larger creeks and rivers. (35)

herbivore - An animal that feeds on grass and other plants.

Horticultural – Relating to the study and practice of cultivating plants. (9)

hotspot - A hotspot is a center of high activity within a larger area of low activity. The term is applied to different things in different contexts: in geology, a hotspot is a location on the Earth's surface that has volcanism for a long period of time. In meteorology, a hotspot is an area where the atmosphere is relatively hot. Examples of hotspots include the air over a desert. (7)

hydrology - Scientific study of water distribution, properties, and effects. (21)

Indicator - An indicator is defined as any component of the environment that quantitatively estimates the condition of ecological resources, the magnitude of stress,

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the exposure of a biological component to stress, or the amount of change in condition. (2)

indigenous (species) - Any species of wildlife native to a given land or water area by natural occurrence. (4)

interior forest - Forest at least 300 feet from an edge (37)

invasive species - Non-native species that threaten ecosystems, habitats or species. (7)

K-12 – Kindergarden to 12th grade.

Kyoto Protocol - The Kyoto Protocol was adopted at the Third Session of the Conference of the Parties (COP) to the UN Framework Convention on Climate Change (UNFCCC) in 1997 in Kyoto, Japan. It contains legally binding commitments, in addition to those included in the UNFCCC. Countries included in Annex B of the Protocol (most OECD countries and EITs) agreed to reduce their anthropogenic emissions of greenhouse gases (CO₂, CH₄, N₂O, HFCs, PFCs, and SF₆) by at least 5 % below 1990 levels in the commitment period 2008 to 2012. (7)

land cover - Anything that exists on, and is visible from above the Earth's surface. Examples include vegetation, exposed or barren land, water, snow, and ice. (2)

land use - The way land is developed and used in terms of the kinds of human activities that occur (e.g., agriculture, residential areas, industrial areas). (2)

Lyme disease - An infectious tick-borne disease, caused by the *Borrelia* spirochete, a gram-negative microorganism. Lyme disease is so named because it is generally believed to have first been observed in and around Lyme, Connecticut in 1975. It is transmitted to humans by the bite of infected ticks. (16)

market demand - The total demand for a good or service by everyone in the population. (40)

Master Plan 2010 - The Baltimore County Charter requires a master plan to be adopted or updated at least every ten years. The master plan is an important document that provides policies and guidelines for sustaining livable communities and achieving balanced development in Baltimore County, Maryland. Master plan 2010 reflects the county's continuing commitment to smart growth by directing future development to its designated growth areas and preserving its rural areas for agriculture and rural conservation. (10)

mature forest – Ecologically, “mature forest” typically contains the greatest biological diversity in composition, structure and functional services (1); economically, “mature forest” refers to stands of timber where the age of the leading species in a stand is greater than the specified cutting age. Cutting ages are established to meet forest

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management objectives. Usually stands with leading species are classified as mature timber when the stand age is greater than 80 years. (14)

MD Department of Natural Resources (MD DNR) - The state agency that oversees forest, wildlife, and State park issues. Provides forest management plans, wildlife and crop damage control strategies.

MD Environmental Trust (MET) - A statewide local land trust governed by a citizen Board of Trustees. Their goal is the preservation of open land, such as farmland, forest land, and significant natural resources. The primary tool for doing this is the conservation easement, a voluntary agreement between a landowner and MET.

migrations - When living things move from one biome to another. In most cases organisms migrate to avoid local shortages of food, usually caused by winter. Animals may also migrate to a certain location to breed, as is the case with some fish. (16)

MMBtu - One million British thermal units.

MOU – Memorandum of Understanding

multiple use management - The management of all the various renewable surface resources of National Forest lands for a variety of purposes such as recreation, range, timber, wildlife and fish habitat, and watershed. (4)

multipliers - Capture the size of the secondary effects in a given region, generally as a ratio of the total change in economic activity in the region relative to the direct change. Multipliers may be expressed as ratios of sales, income or employment, or as ratios of total income or employment changes relative to direct sales. Multipliers express the degree of interdependency between sectors in a region's economy and therefore vary considerably across regions and sectors. (41)

native forest communities - Any local indigenous forest community containing the full complement of native species and habitats normally associated with that community, or having the potential to develop these characteristics. (42)

native species - Plants, animals, fungi, and micro-organisms that occur naturally in a given area or region.

non-attainment status - Areas of the country where air pollution levels persistently exceed the national ambient air quality standards may be designated "non-attainment." (43)

non-timber forest products - Goods of biological origin other than wood, derived from forests, other wooded land and trees outside forests.

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NRCS (The Natural Resources Conservation Service) - provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment.

nutrient - Any substance, such as fertilizer, phosphorous, and nitrogen compounds, that enhances the growth of plants and animals. (35)

old growth - Old forests often containing several canopy layers, variety in tree sizes and species, decadent old trees, and standing and dead woody material. (4)

outcomes - The result, effect, or consequence that occurs from carrying out an environmental program or activity that is related to an environmental or programmatic goal or objective. Outcomes may be environmental, behavioral, health-related, or programmatic in nature, and must be quantitative. (44)

overlain - The combination of different data layers so that they appear to perfectly overlap. The process of overlaying can be used to multiply data, add data, or simply join the data. (45)

Ozone - Ozone, the triatomic form of oxygen (O₃), is a gaseous atmospheric constituent. In the troposphere, it is created both naturally and by photochemical reactions involving gases resulting from human activities (photochemical smog). In high concentrations, tropospheric ozone can be harmful to a wide range of living organisms. Tropospheric ozone acts as a greenhouse gas. In the stratosphere, ozone is created by the interaction between solar ultraviolet radiation and molecular oxygen (O₂). Stratospheric ozone plays a decisive role in the stratospheric radiative balance. Depletion of stratospheric ozone, due to chemical reactions that may be enhanced by climate change, results in an increased ground-level flux of ultraviolet (UV-) B radiation. (7)

pale jewelweed (*Impatiens pallida*) - One of two native species of touch-me-not that grow in wet woods and meadows, often in limestone sites

parcelization - The division of parcels of land into smaller parcels among multiple owners.

patch - A contiguous area with similar characteristics relative to the issues of concern. Patches may be defined differently depending on the questions being addressed, however a patch will be the contiguous unit of area within a landscape with similar conditions based on the problem being considered. (20)

per capita - A Latin phrase meaning for each head. Usually used to indicate the average per person of any given statistic, commonly income. (16)

Planning Board - The Baltimore County Planning Board, established by the County Charter, consists of 15 members, serving for three-year terms, staggered so that one-third of the terms expire each year. Each of the seven County Council members

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appoints a Board member from the respective County Council District. The County Executive appoints the other eight members and nominates the Chairperson and Vice Chairperson, subject to confirmation by the County Council. The County Charter gives the Planning Board a major role in recommending the content of the Capital Program and Budget. The Board's other advisory responsibilities include making recommendations or decisions on:

- * The Baltimore County Master Plan
- * The Comprehensive Zoning Map Process
- * Amendments to zoning and related regulations
- * Legislative Projects
- * Area and special plans and other amendments to the Master Plan
- * Functional plans, such as the Master Water and Sewerage Plan and Basic Services Maps
- * Planned Unit Developments
- * Developments that conflict with the Master Plan or involve historic landmarks
- * Renaissance Redevelopment Projects

point source - A stationary location or fixed facility from which pollutants are discharged; any single identifiable source of pollution; e.g. a pipe, ditch, ship, ore pit, factory smokestack. (9)

primary producer - Organisms that produce their own food using energy from the sun or from chemical sources. Terrestrial primary producers are generally green plants that use energy from the sun in the process of photosynthesis to transform inorganic compounds to simple organic compounds to use for sustenance. (16)

primary wood manufacturers - Take logs and other round sections cut from trees—called roundwood—and convert them into products such as lumber, veneer, or pulp. (47)

real estate transfer taxes - State and local taxes that are assessed on real property when ownership of the property is transferred between parties. These taxes are used in many areas to fund programs designed to preserve rapidly depleting open spaces in commercial or residential areas, and to fund housing programs for low-income residents. (48)

regeneration - Re-establishment of a forest stand by natural or artificial means following the removal of the previous stand by felling or as a result of natural causes, e.g. fire or storm. (13)

relict forest communities - A remnant or fragment of the vegetation of an area that remains from a former period when the vegetation was more widely distributed. (49)

remote sensing - Any data or information acquisition technique that utilizes airborne techniques and/or equipment to determine the characteristics of an area. (14)

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renewable energy - Energy resources such as wind power or solar energy that can keep producing indefinitely without being depleted. (15)

reservoir source water areas - Baltimore uses surface water from rainfall and snowmelt as the source of its water. Reservoirs outside the city limits collect and store water. Three impoundments comprising two water sources and one river provide raw water to the City' water filtration plants. (50)

resilience- The ability of an ecosystem to maintain diversity, integrity, and ecological processes following a disturbance. (4)

Resource Conservation Zones – Baltimore County zoning classifications creating a framework for orderly development, provision of "suitable" areas for rural- suburban development, protection of natural and man-made resources from the compromising effects of development, protection of areas desirable for more intensive future development by regulating undesirable forms of interim development, and conservation of land and water resources.

riparian - An area of land adjacent to a stream, river, lake or wetland that contains vegetation that, due to the presence of water, is distinctly different from the vegetation of adjacent upland areas. (14)

rotation - The number of years required to establish and grow timber crops to a specified condition of maturity. (4)

Rural Legacy Program – A Maryland DNR program that provides the focus and funding necessary to protect large, contiguous tracts of land and other strategic areas from sprawl development and to enhance natural resource, agricultural, forestry and environmental protection through cooperative efforts among state and local governments and land trusts. Protection is provided through the acquisition of easements and fee estates from willing landowners and the supporting activities of Rural Legacy Sponsors and local governments.

Rural Residential Stewardship Initiative – A Baltimore County program that partners with conservation organizations to provide site-based stewardship education and projects.

secondary economic impacts - Indirect and induced effects are sometimes collectively called secondary effects. Secondary effects are the changes in economic activity from subsequent rounds of re-spending.

secondary wood manufacturers - Dry, plane, cut, and assemble processed wood (lumber, veneer, and other primary products) into parts or finished products. Examples of secondary products include office furniture, kitchen cabinets, architectural millwork, pallets, and paper products. (47)

sector - An activity involving labor and material resources, integrated with other such

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activities.

sediment - Suspended particles of organic matter (ie.dirt from erosion) in water. It is a growing problem with our streams and rivers with increased erosion from land practices. (18)

seral - The stage of succession of a plant or animal community that is transitional. If left alone, the seral stage will give way to another plant or animal community that represents a further stage of succession. (4)

SFLA (Maryland's Strategic Forest Lands Assessment) - classifies forests in Maryland according to their ecological and socioeconomic values.

silviculture - The art and science that promotes the growth of single trees and the forest as a biological unit. (4)

sink - Place in the environment where a compound or material collects. (8)

solid waste - Discarded solid materials. Includes agricultural waste, mining waste, industrial waste and municipal waste. (7)

species composition - The percentage of each recognized tree species comprising the forest type based upon the gross volume, the relative number of stems per hectare or basal area. (14)

State Implementation Plans (SIP) - EPA approved state plans for the establishment, regulation, and enforcement of air pollution standards. (8)

storm flow - Rainfall runoff that reaches a stream channel during, or soon after a rainfall event that causes high rates of discharge. (51)

stream channel - The streambed and banks formed by fluvial processes, including deposited organic debris. (14)

stressors - Physical, chemical, or biological entities that can induce adverse effects on ecosystems or human health. (8)

structural heterogeneity - Composed of parts of different kinds, or having widely dissimilar elements. (52)

succession - The changes that occur in communities over time. Specifically, the presence of specific species may provide an environment that is conducive to the influx of other species. In the southern United States, pine trees, due to the local environment they provide, are normally considered the precursors to hardwood trees. Note that, while succession is a considered a valid model for predicting change in an ecosystem, many factors (human intervention and weather related events, for example) can interrupt the successional cycle. (18)

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surface runoff - Precipitation, snow melt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of non-point source pollutants in rivers, streams, and lakes. (8)

sustainability - Meeting the needs of society today without diminishing the ability of future generations to meet their needs. (1)

sustainable forestry - The stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biological diversity, productivity, regeneration capacity, vitality and their potential to fulfill, now and in the future, relevant ecological economic and social functions, at local, national and global levels, and that does not cause damage on other ecosystems. (13)

Total Maximum Daily Loads (TMDL's) - As defined by the EPA, a TMDL "is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. [Its] calculation must include a margin of safety to ensure that the water body can be used for the purposes the State has designated. The calculation must also account for seasonal variation in water quality." The TMDL must also provide some "reasonable assurance" that the water quality problem will be resolved. The states are responsible to implement TMDLs on impaired water bodies. Failure to do so will require the EPA to intervene.

tract - A parcel of land considered separately from adjoining land because of differences in ownership, timber type, management objective, or other characteristics. (31)

Tree-Mendous Maryland - The Tree-Mendous Maryland Program is a state sponsored program, administered by the Maryland Department of Natural Resources (DNR). The function of the program is to provide trees to Maryland citizens at a minimal cost for planting on public property or community open space. Baltimore County has actively promoted the program since its inception in the spring of 1990. In cooperation with the DNR, Department of Public Works, and the Baltimore County Forestry Board, PPRD assists communities in developing "Greening Committees", selecting appropriate tree species, and by delivering trees to the neighborhoods.

Trophic Level - The position in the food chain assessed by the number of energy transfer steps to reach that level; e.g., primary producers below, herbivores, below carnivores. (54)

urban forest - The collection of trees growing in the city, and the plants that grow beneath them. (9)

Urban Forest Effects (UFORE) model - The UFORE computer model was developed to help managers and researchers quantify urban forest structure and its functions. UFORE is designed to use standardized field data from randomly located plots, and local hourly air pollution and meteorological data to quantify urban forest structure and numerous urban forest effects for cities across the world. The model calculates

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numerous attributes about the urban forest, including: species composition, diameter distribution, tree health, species diversity, and exotic vs. native species distribution. The model also calculates various forest functions and values related to tree effects on: air pollution, greenhouse gases and global warming, pollen, and building energy use. (53)

virus - Submicroscopic agents that infect plants, animals and bacteria, and are unable to reproduce outside the tissues of the host. A fully formed virus consists of nucleic acid (DNA or RNA) surrounded by a protein and lipid (fat) coat. The nucleic acid of the virus interferes with nucleic acid-synthesizing mechanism of the host cell, organizing it to produce more viral nucleic acid. Viruses cause many diseases (e.g., mosaic diseases of many cultivated plants, myxomatosis, foot and mouth disease, the common cold, influenza, measles, poliomyelitis). Many plant viruses are transmitted by insects, some by eelworms. Animal viruses are spread by contact, droplet infection or by insect vectors and some are spread by the exchange of body fluids. (7)

Watershed - A watershed consists of all the land and waterways that drain into the same body of water. Smaller watersheds join with other watersheds to drain into larger watersheds; thousands of smaller watersheds drain into large rivers like the Mississippi or Colorado rivers. (18)

woodlot - The wooded portion of a private property upon which small-scale forestry operations are carried out. (14)

zoning - To designate, by ordinances, areas of land reserved and regulated for specific uses, such as residential, industrial, or open space. (35)

Sources of Definitions for Terms in the Glossary:

- (1) Forest Sustainability Issues Paper, Baltimore County Linking Communities to the Montreal Process Criteria and Indicators Project, 2003
- (2) US Environmental Protection Agency, Office of Research and Development, Mid-Atlantic Integrated Assessment
- (3) Oregon Board of Forestry, Forestry Board for Oregon, 2003.
- (4) People's Glossary of Ecosystem Management Terms, US Forest Service, <http://www.fs.fed.us/publications/>
- (5) A Complete Natural Resource Inventory Glossary With Emphasis on Forestry, US Forest Service, <http://forestry.about.com/blforqls.htm>
- (6) Glossary of Forest Terms, Maryland DNR, <http://www.dnr.state.md.us/forests/gloss.html>
- (7) EEA Multilingual Environmental Glossary, <http://glossary.eea.eu.int/EEAGlossary>
- (8) USEPA Terms of Environment: Glossary, Abbreviations and Acronyms; <http://www.epa.gov/OCEPaterms/>

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- (9) Sustainable City – Definitions; <http://www.sustainable-city.org/Plan/Parks/defs.htm>
- (10) Baltimore County Office of Planning website:
http://www.co.ba.md.us/Agencies/planning/master_planning/index.html
- (11) Baltimore County Council Official website:
<http://www.baltimorecountycouncil.org/about.htm>
- (12) The Health of Southern Forests, SUDA Forest Service, Glossary;
<http://www.fs.fed.us/r8/foresthealth/hosf/glossary.htm>
- (13) Food and Agriculture Organization of the United Nations. Definitions and Basic Principles of Sustainable Forest management in Relation to Criteria and Indicators.
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- (14) BorealForest.org Glossary of Forestry Terms.
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- (18) COWETA LTER Glossary of Terms.
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