Environmental Evaluators Networking Forum

June 8, 2009

Application of Criteria and Indicators for Forest Sustainability at the Local Government Level

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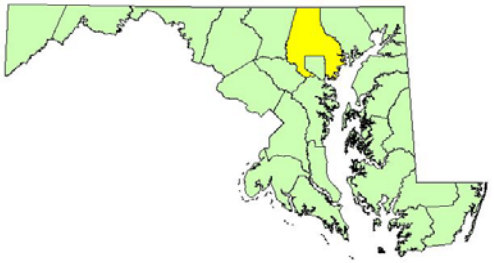
BALTIMORE COUNTY
MARYLAND

Baltimore County, MD

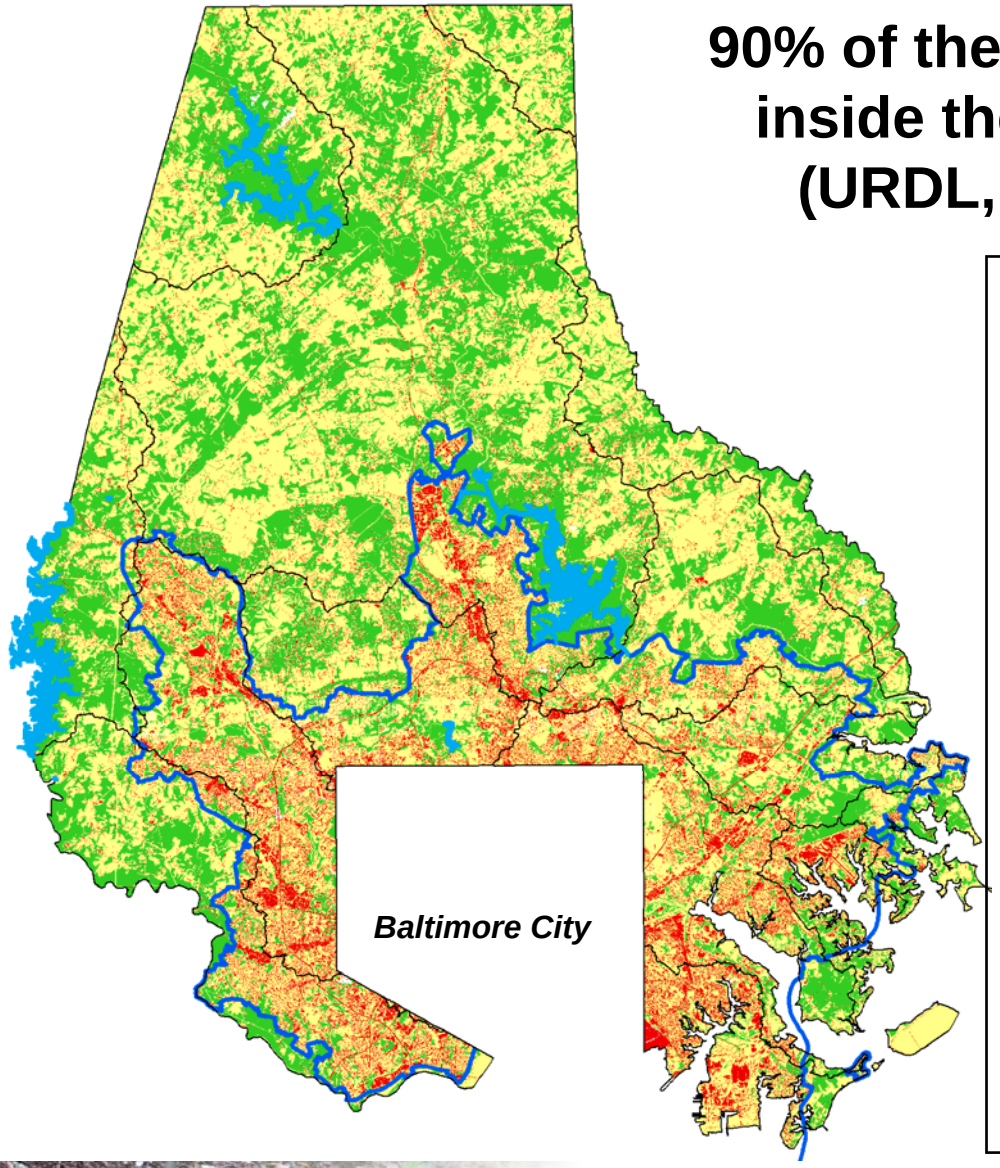
… an introduction



- 610 sq. mi.
- 809,000 people
- No Incorporated Municipalities
- Urban Density >3,400/sq. mi.
- Growth Rate: 1%/yr. 1970-2030

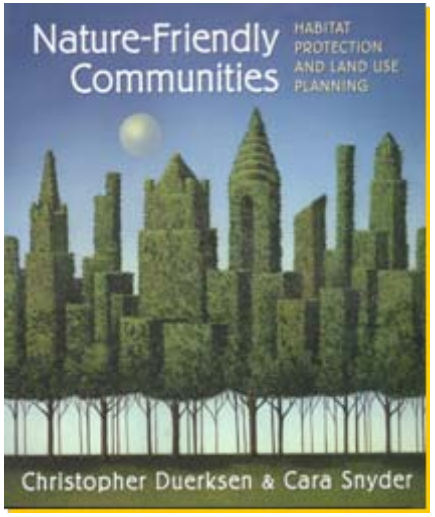
Local Government: "Closest to the People"

Baltimore County - Managed Growth

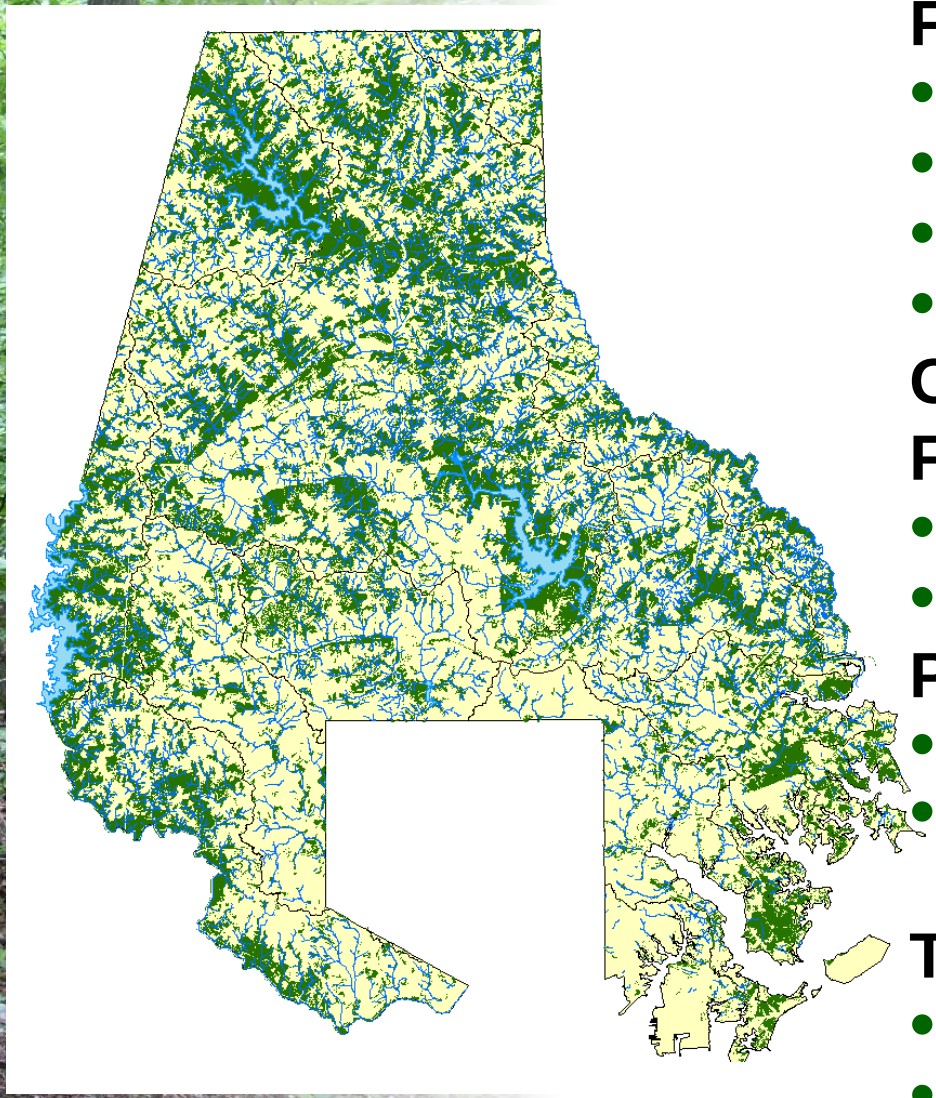


90% of the year 2000 population lived inside the urban growth boundary (URDL, 1967) on 1/3 of the land

"Baltimore County has one of the most ambitious and successful land management and environmental protection programs in the country. An impressive combination of tools and strategies..."



Baltimore County's Forests



Forest Cover:

- 34% County-wide (132,000 ac.)
- 49% canopy cover
- 45% reservoir watersheds
- 52% stream buffers

Ownership: 75% private

Fragmentation:

- >9,000 patches; 315 >100 ac.
- 14.6 acre mean

Parcelization:

- 40-50,000 owners
- 75% of patches, 12% of acres have < 5 owners

Threats:

- Deer, invasives, pests
- Land conversion

Environmental Evaluation and Scale

CONTEXT FOR BALTIMORE COUNTY FOREST MANAGEMENT

- **Mission**: protect, enhance & perpetuate the natural resources of Baltimore County
- **Scales & levels**:
  - Ecological - forest community type, watershed, forest patch, stand, tree
  - Social - national, state, intra-state region, county, community, parcel
- **Roles**: scientists, users (program managers), evaluators
- **Process**: Identify issues, collect & analyze data (monitoring & assessments); formulate plans & policies; develop & implement programs; evaluate outcomes
- **Principle**: better data – better dialogue – better decisions

Forest Cover: A Strategic Local Tool

MPCI CRITERIA

- **BIOLOGICAL DIVERSITY**
- **PRODUCTIVE CAPACITY**
- **ECOSYSTEM HEALTH & VITALITY**
- **SOIL & WATER RESOURCES**
- **GLOBAL CARBON CYCLES**
- **SOCIO-ECONOMIC BENEFITS**
- **LEGAL, INSTITUTIONAL & ECONOMIC FRAMEWORKS**

- **Reservoir Protection** (Safe Drinking Water Act Source Water Assessment)
- **Water Quality** (Clean Water Act TMDLs & NPDES MS4 permits; Tier II waters)
- **Chesapeake Bay Restoration** (Ches. 2000 Agreement: Tributary Strategies, Executive Council Directives (urban tree canopy, riparian buffers, forest conservation)
- **Comprehensive Plans** (MD Planning Act: Sensitive Areas Element and Water Resource Element (HB1141)
- **Community Greening** (2006 Baltimore Watershed Agreement)
- **Greenhouse Gas Emissions Reduction** (Sustainability Office climate change goal)
- **Air Quality** (SIP for ozone)

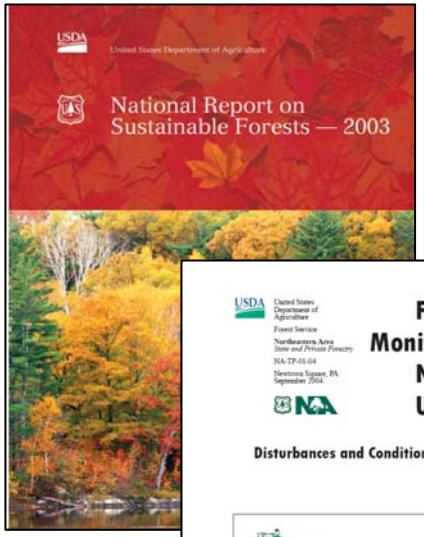
Developing a Forest Sustainability Program

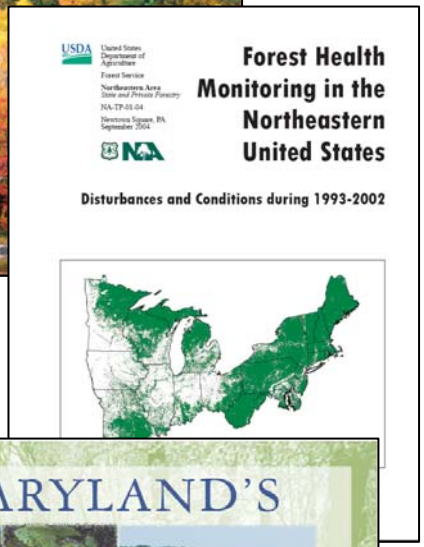
- **Management Frameworks:**
  - 1995 Green Infrastructure
  - 2001 Forest Sustainability (MPCI)
- **Forest Assessment:**
  - GIS Landscape Analyses & Typologies
- **Develop Management Strategy:**
  - 2003 Issues & Indicators Forum
  - Steering Committee
  - 2005 Strategy & MOU
  - 2006 “5E” Forum
- **Strategy Implementation:**
  - Operating and Capital Programs (Growing Home Campaign, Rural Residential Reforestation)
  - Partnerships
- **Evaluation:** MPCI

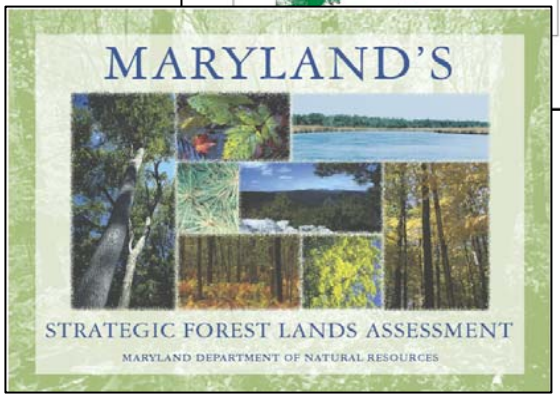
Data Approach

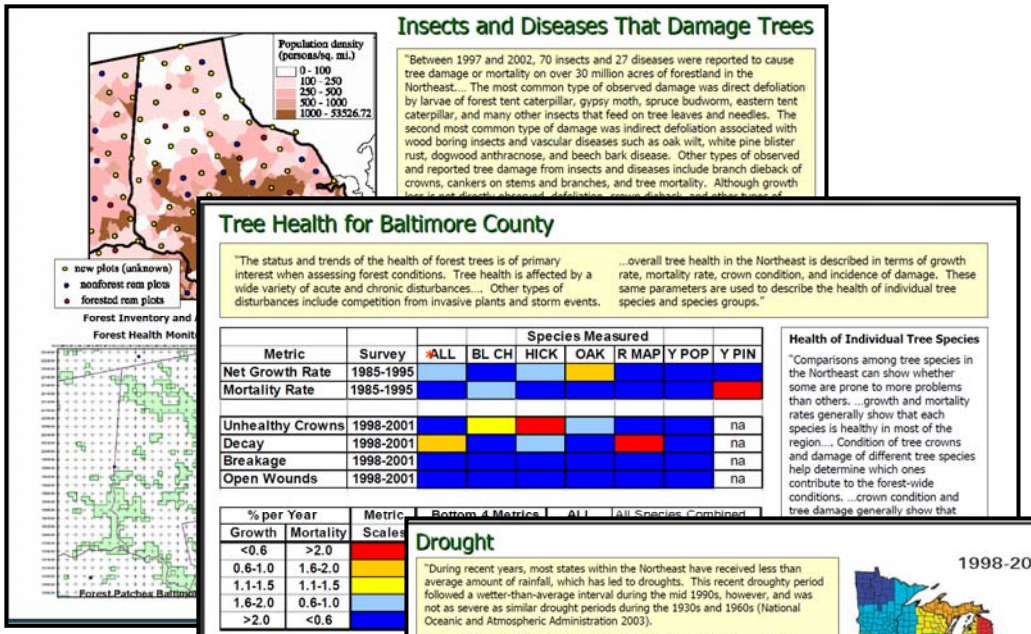
- Evaluated adequacy of existing County data compared to Montreal Process Indicators
- Adopted Montreal Criteria as program goals in context of external mandates and County initiatives
- Collected and evaluated existing Federal and State data to determine adequacy for use at County scale
- Contracted with agencies for technical analyses using standard Forest Service protocols (UFORE model, Urban Canopy cover)
- Conducted GIS analyses to characterize forest conditions and trends using existing County data (land cover, watersheds, streams, buffers, zoning, cadastral records, LiDAR)
- Tracked performance data for existing programs and new initiatives
- Compiled data for biennial reporting

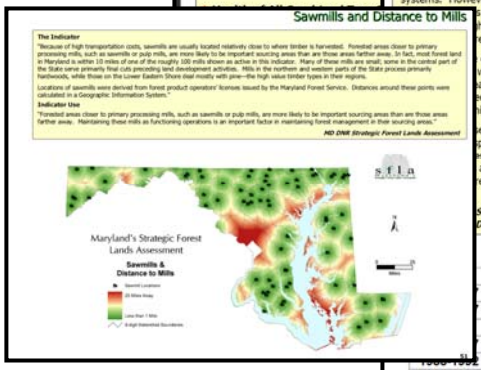
Scaling Down Using Federal & State Data to Assess Conditions & Trends

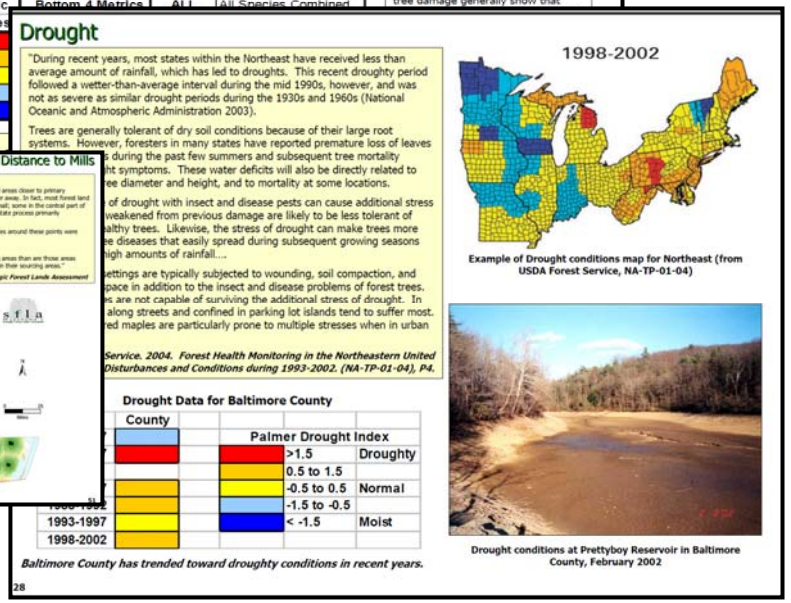




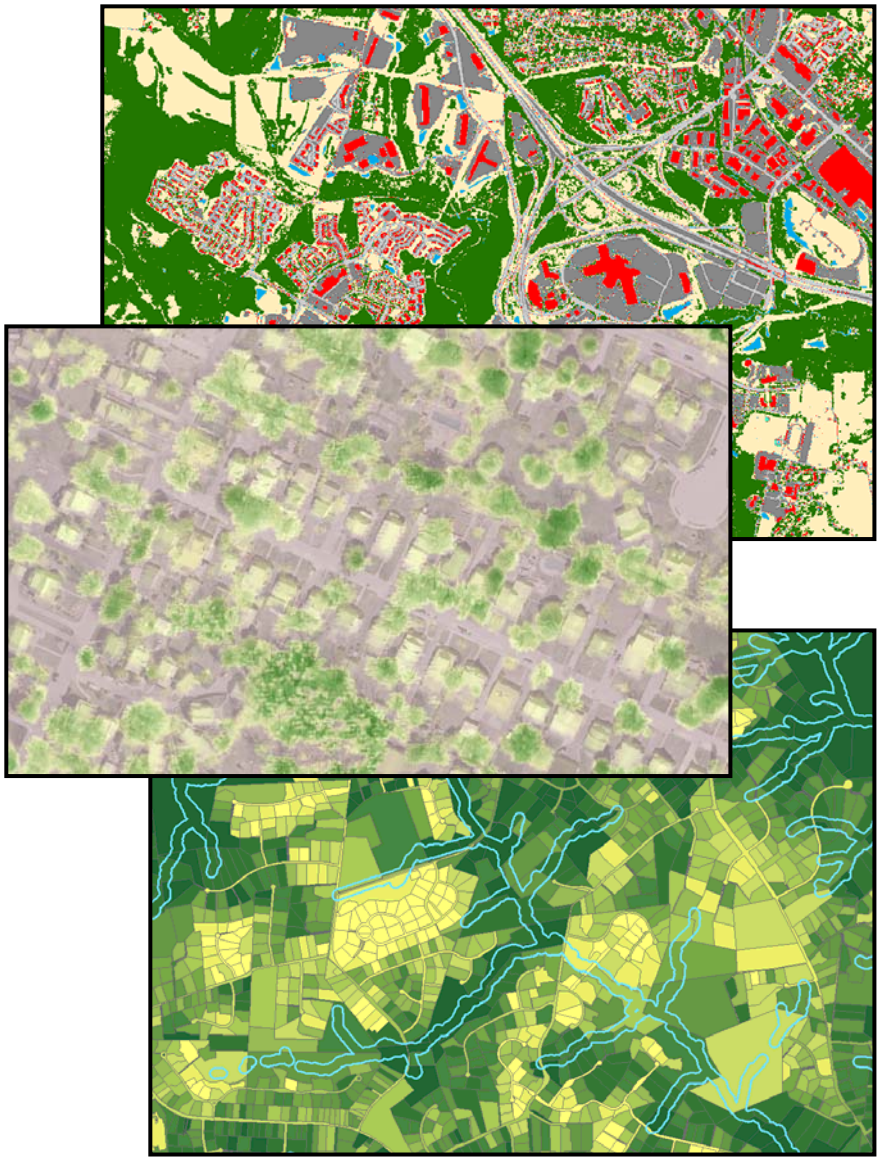


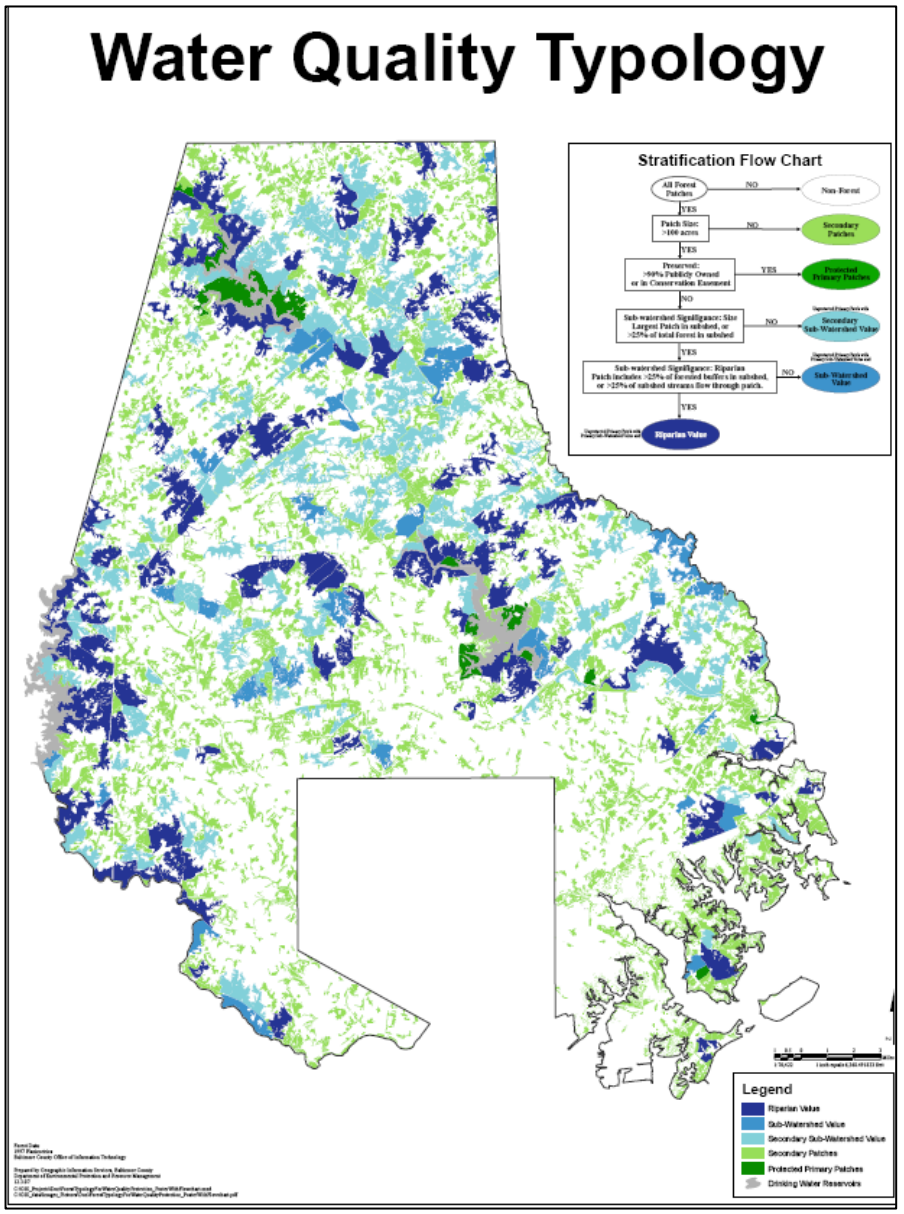






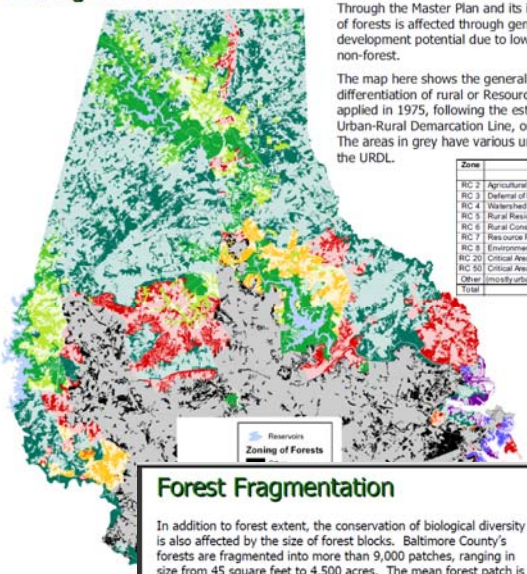
Using GIS to Characterize Forest Resources





Using GIS to Characterize Forest Resources

Zoning of Forested Land



Through the Master Plan and its implementation tools, especially zoning, the sustainability of forests is affected through general control over the use of land. Areas with low development potential due to low density will be less vulnerable to conversion of forests to non-forest.

The map here shows the general zoning pattern of Baltimore County, especially the differentiation of rural or Resource Conservation (R.C.) zones. These R.C. zones were first applied in 1975, following the establishment of the County's urban growth boundary, the Urban-Rural Demarcation Line, or URDL, in 1967 within the southern third of the County. The areas in grey have various urban, denser zoning classifications and are largely inside the URDL.

Zone	Zone Name	Zoning Acres	Forest Acres	% of Zone Forested	Density (du/ac)
RC 2	Agricultural Protection	139,333.1	48,749.1	35%	0.02 du/ac (1 lot/50 ac.)
RC 3	Deferral of Planning	811.7	329.4	41%	0.3 du/ac (1 lot/3.3 ac.)
RC 4	Watershed Protection	17,441.9	8,632.9	49%	0.2 du/ac (1 lot/5 ac.)
RC 5	Rural Residential	37,022.1	14,093.8	38%	0.5 du/ac (1 lot/2 ac.)
RC 6	Rural Conservation and Residential	12,818.9	5,959.6	46%	0.2 du/ac net (1 lot/5 ac.)
RC 7	Resource Preservation	32,089.1	21,133.7	66%	0.0 < 50 ac., 0.04 > 50 ac. (1:25)
RC 8	Environmental Enhancement	11,006.6	6,031.9	55%	0.05 ≥ 50 ac. (1:10, 2:30, 3:50)
RC 20	Critical Area	7,093.5	3,850.1	54%	0.05 (1 lot/20 ac.)
RC 50	Critical Area Agricultural	4,091.4	1,088.2	27%	1 lot/50 for > 20 ac; 1 lot/20-100 ac.
Other	(mostly urban zones)	127,711.6	20,329.5	16%	
Total		389,419.7	130,198.2	33%	

As indicated in the table above, only 16% of the County's forest cover is located in the urban zones (black or m"other" on the map), which also accommodate 90% of the County's population. This means that the bulk of the County's forest cover is relatively protected from conversion due to low development potential.

Outside of the Chesapeake Bay Critical Area zones, the R.C. zone with the least percentage of forest cover is the expansive R.C.2 Agricultural Protection zone, which also

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Forest Patch Parcelization - Acreage

The integrity of forest patches for habitat and conservation of biological diversity can be affected by the degree to which the forest patches themselves are parcelized. This indicator shows forest patches by the size of their individual parcels recorded in the land records for purposes of assessment and taxation. More than 150,000 recorded parcels have forest cover.

The data do not indicate whether the multiple parcels in a forest patch are necessarily owned by different property owners, but that is often likely to be the case, especially for smaller, more urban patches. Parcelization may imply that different owners can be managing for different objectives.

The data indicate that 88% of the property parcels that include forest cover contain one acre or less of forest but collectively these 133,000 parcels total only about 8% of the total acres of forest. Only 102 forest parcels, comprising 0.1% of forest parcels, contain more than 100 acres of forest and total about 14% of total forest cover.

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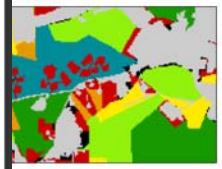

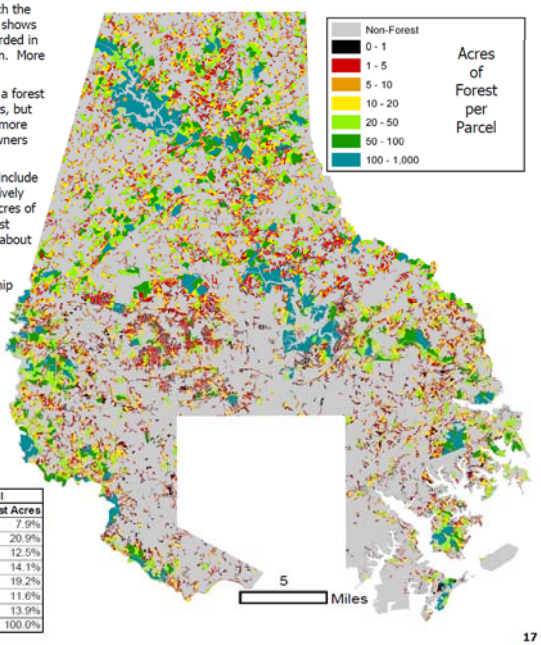

mber Parcels	Total Forest Acres	% of Total Parcels	% of Total Forest Acres
33,020	10,461.1	88.4%	7.9%
12,512	27,698.9	8.3%	20.9%
2,366	16,576.5	1.6%	12.5%
1,341	18,645.5	0.9%	14.1%
838	25,520.1	0.6%	19.2%
228	15,416.4	0.2%	11.6%
102	18,382.0	0.1%	13.9%
50,407	132,700.5	100.0%	100.0%

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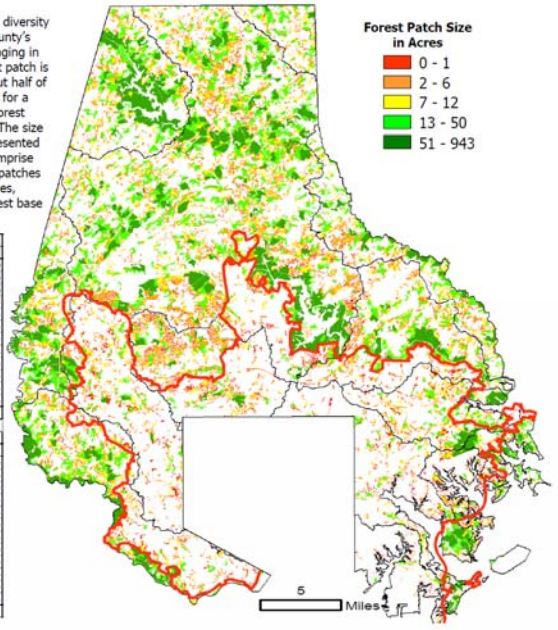
Forest Fragmentation

In addition to forest extent, the conservation of biological diversity is also affected by the size of forest blocks. 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 ≥ 0.25 acre, the mean patch size is 27.2 acres. The size distribution of forest patches greater than 0.25 acre is presented in the table. 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.



	Forest Patches			
Patch Size (acres)	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%		

	Forest Acreage			
Patch Size (acres)	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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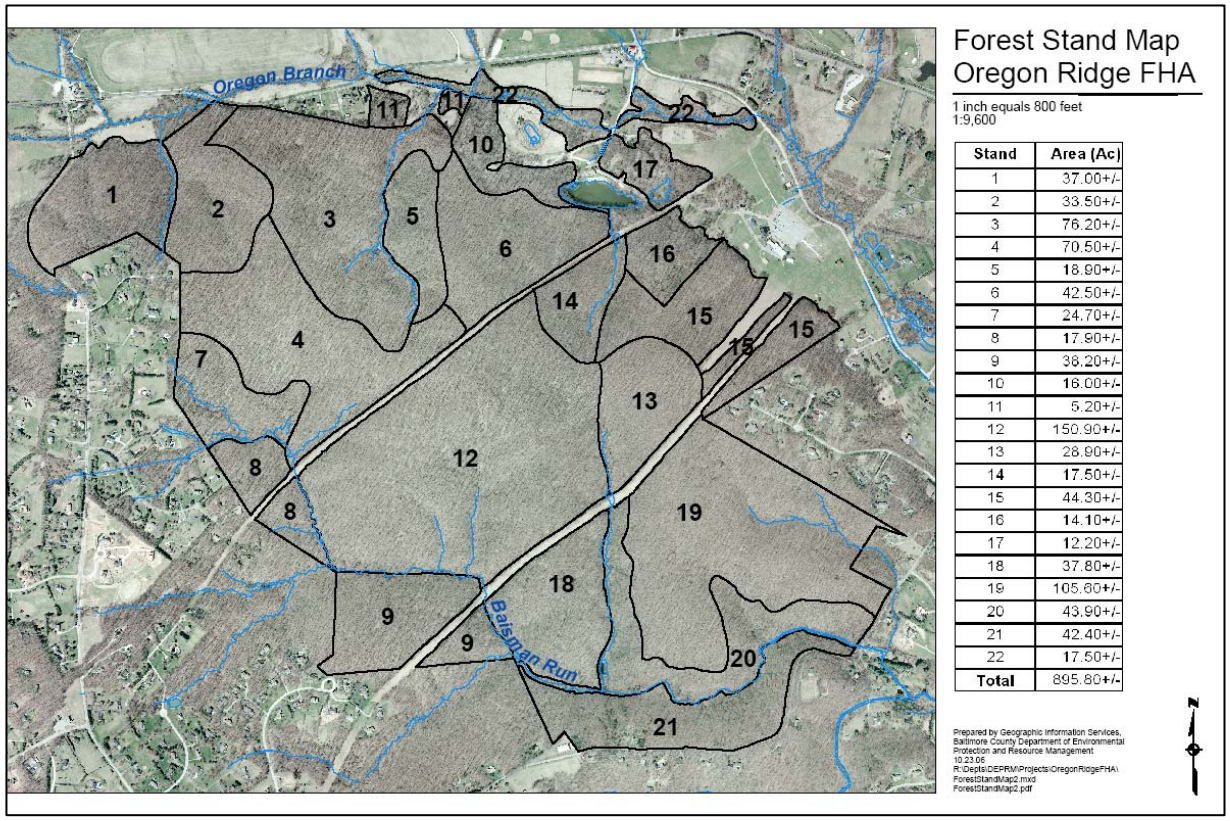
Oregon Ridge Park Forest Health Assessment and Management Plan



Forest Stand Map
Oregon Ridge FHA

1 inch equals 800 feet
1:9,600

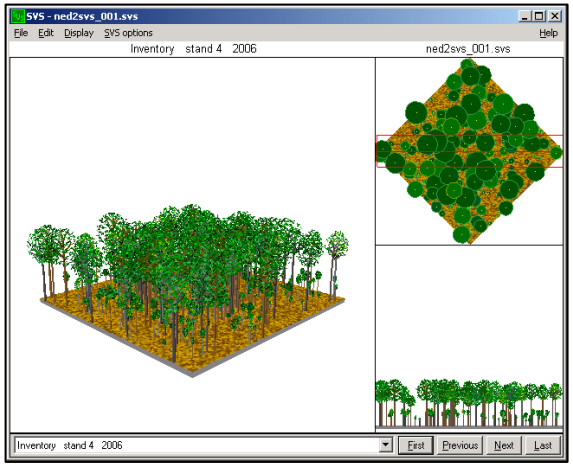
Stand	Area (Ac)
1	37.00+/-
2	33.50+/-
3	76.20+/-
4	70.50+/-
5	18.90+/-
6	42.50+/-
7	24.70+/-
8	17.90+/-
9	38.20+/-
10	16.00+/-
11	5.20+/-
12	150.90+/-
13	28.90+/-
14	17.50+/-
15	44.30+/-
16	14.10+/-
17	12.20+/-
18	37.80+/-
19	105.60+/-
20	43.90+/-
21	42.40+/-
22	17.50+/-
Total	895.80+/-

Prepared by Geographic Information Services, Baltimore County Department of Environmental Protection and Resource Management
10.23.06
R:\Depts\DEPRM\Projects\OregonRidgeFHA\ForestStandMap2.mxd
ForestStandMap2.pdf

900 acres (1,700 trees in 119 plots) assessed using Forest Service NED model

Findings:

- 54% of plots have no regeneration
- losing oak dominance
- deer, Gypsy moth, invasives threats

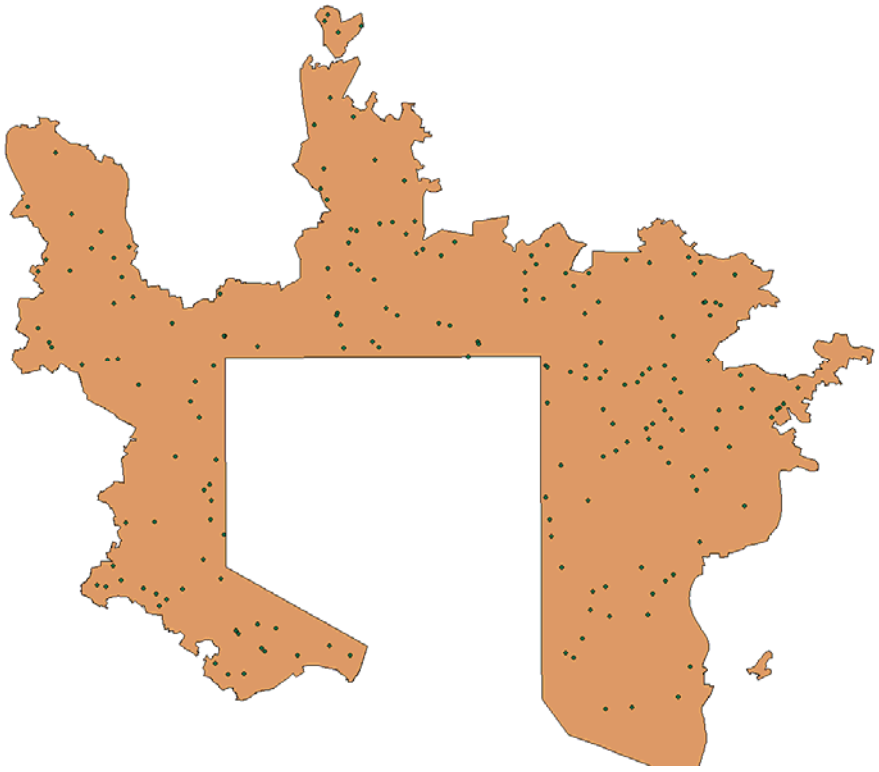


Recommendations:

- Manage for deer, invasives, oak regeneration
- Hazard tree management; trail maintenance

Provided management actions, schedule, cost estimates for 22 forest stands

Urban Forest Effects (UFORE) Model

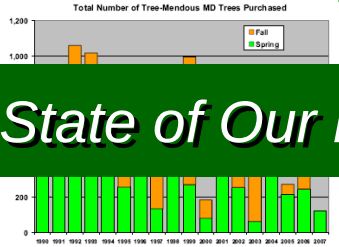


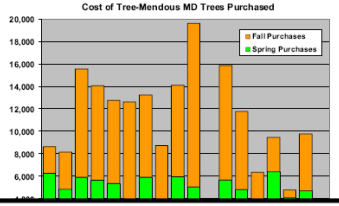
sampled 197 plots, stratified by 8 land uses (108,400 acres); soil carbon analysis

- DEPRM contracted with Forest Service (2007); field work by UMBC
- 130,700 acre URDL (municipal surrogate; ~2x size of Balto. City)
- estimated 6.76 million trees within the URDL (90 species)
- replacement value: $6.3 billion
- 58.3% of trees <6” diameter
- annual carbon sequestration: 38,500 tons ($0.797 million)
- annual energy cost reduction for residential buildings: $18.3 million
- 2nd most-frequently occurring tree type is dead trees (8.7% of total)
- deferred to UTC study for % existing urban canopy cover

The State of Our Forests – 2007: Reporting Program Progress

Reforestation: Tree-Mendous Maryland





The Tree-Mendous Maryland Program represents a successful organizational partnership for reforestation in Baltimore County. Since Spring 1990, the County has actively promoted Tree-Mendous Maryland, a tree planting program administered by the Maryland

elected officials. Program information was also provided to umbrella groups such as the Federated Garden Clubs of MD, as well as to community and business coalitions, at DEPRM education events, to DEPRM staff, and to the public who visit DEPRM's office. Also, the Department of Public Works customarily picked up all tree orders for the County from whichever cooperating nursery received the State's order from growers. DPW assisted with free delivery for community orders of 10 trees or greater. In recent years, the MD DNR and the County Forestry Board have been less active in working with communities, and DEPRM now handles the free delivery of trees. Baltimore County is the only local jurisdiction to provide delivery of trees and, as a result of its promotion of the Program, the County 's citizens have consistently led the State in the number of trees planted each season.

Many factors affect the number of tree orders over the seasons, such as drought. Since 1990, DEPRM has received 458 orders for Tree-Mendous Maryland trees. Citizens have purchased and planted 11,628 trees at a total purchase price of

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Increasing Urban Tree Canopy: The Growing Home Campaign

The Growing Home Campaign supported local businesses and provided an average discount of 15.5% per tree for homeowners. It also leveraged about $18 of total private sector investment per dollar of County cost share funds. The initial 2006 pilot and the 2007 Campaign were supported by

Growing Home Campaign Activity		2006	2007	Total
Trees Purchased	#	1,600	1,022	2,622
Total Retail Tree Cost	$	91,980	77,360	169,340
Average Cost/Tree	$	57.49	75.69	64.58
Campaign Coordinator & Printing	-$	48,787	41,600	90,387
Net Economic Impact	$	83,193	61,310	144,503

for the 2006 Campaign

The 2007 Campaign included 30 retail nurseries and garden centers across the County and in adjacent jurisdictions.

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Community Forestry Operations

Part of the legal, institutional, and economic framework for forest management is the provision of services by local government for urban forestry operations. Forests and trees often interface with communities under less than favorable conditions, and a reliable response capability is important, especially in a large county with a large population and no incorporated municipalities.

In Baltimore County, the Department of Public Works performs many necessary functions related to community forestry. The Bureau of Highways conducts tree trimming, and tree and stump removal, as necessary following storm events and in response to other circumstances where public safety becomes an issue. The Bureau also deals with trees that have raised public sidewalks. Activities to respond to these hazards is performed under a program permit from the MD Dept. of Natural Resources in accordance with the MD

Roadside Tree Law. The Bureau also collects Christmas trees from residential areas. The DPW's Bureau of Solid Waste mulches those trees and also manages contracts for tree trimming in alleys where the collection of solid waste is impacted by trees.

The table presents DPW community forestry operations data – activity and cost - for FY 2002 through FY 2007. The number of roadside trees trimmed varies per year and averaged about 4,170 trees. Tree removals (sidewalk conflicts and other removals) have increased rather steadily and averaged 1,325 per year. Data is less complete for Christmas tree collection but show a noticeable decline, despite a slow increase in the total cost of Christmas tree mulching. Contractual trimming varied over the period and may reflect, as with other activities, the frequency and magnitude of storm events. The overall DPW community forestry operations have doubled in cost over the past 6 years and averaged about $1.1 million per year.

Photos courtesy of DPW

DPW Community Forestry Operations

Bureau of Highways	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 02-07 Total
Tree Trimming (Roadside Trees)							
number	3,531	3,079	2,722	2,228	5,203	8,248	25,011
cost	106,747	146,301	115,451	133,103	361,867	373,906	1,239,375

Green Schools: Growing in the Classroom and the Community

Baltimore County Green Schools and Green Centers 1999-2007

Year	# Schools	# Centers
1999	5	
2000	2	
2001	3	
2002	4	
2003	1	
2004	3	
2005	1	1
2006	6	
2007	6	1
Total	31	2

Getting Greener Schools

Statewide, 163 schools and 16 Green Centers have been recognized.

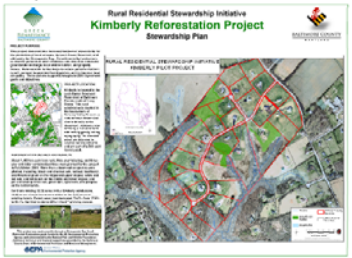
Baltimore County leads the State with 19% of the Maryland Green Schools.

Reforestation: Rural Residential Stewardship Initiative

This project seeks to increase forest cover in priority rural areas such as stream buffers and contiguous forest patches, primarily in reservoir watersheds. It educates rural residential lot owners about their role as managers of larger forest and stream systems shared with other lot owners. Landowners are provided an incentive – free tree planting – to convert mowed, "excess" lawn areas to new forests. Landowners agree to monitor and maintain the reforestation areas on their lots.

The 2006 pilot project resulted in reforestation of 17 acres on 12 lots in two rural residential subdivisions (Kimberly and Bernoudy farms). The pilot project was supported by a grant from the US Environmental Protection Agency, awarded through the Chesapeake Bay Small Watershed grant program and administered by the National Fish and Wildlife Foundation.

Another grant was received to continue the program in 2008. The "Valleys Reforestation Initiative" has a target to reforest 21.7 acres within the Membership area of the Valleys Planning Council, which covers 21% of Baltimore County. The VPC, established 40 years ago, is a leading land preservation organization. DEPRM will credit future nutrient and sediment load reductions from reforestation toward program goals for protecting drinking water reservoirs and numeric targets for Clean Water Act Total Maximum Daily Loads (TMDLs).



DEPRM asks for a resident to volunteer to host a meeting of their neighbors to introduce the project. The program is therefore brought to the community. The "watershed context" is presented, as well as a poster-sized detailed aerial photograph of the subdivision. DEPRM subsequently conducts "walk and talk" sessions with each landowner to design the reforestation. After installation of the trees, DEPRM trains landowners to monitor the project and provides a booklet explaining exactly how and why the reforestation was completed, in addition to maintenance guidance. A community "stewardship plan" showing reforestation areas is provided to each participating landowner.

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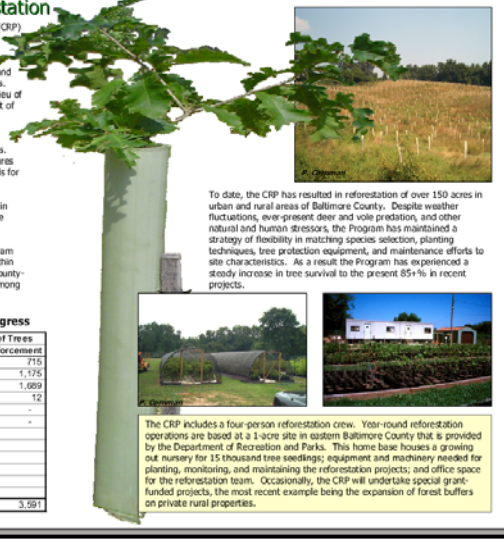
Community Reforestation

The Community Reforestation Program (CRP) was established by the Department of Environmental Protection and Resource Management to provide a dedicated workforce for the planting, monitoring, and maintenance of forest mitigation projects. The Program is funded through fees-in-lieu of mitigation for forests removed as a result of public and private land development, as required by the implementation of the County's Forest Conservation Act and Chesapeake Bay Critical Area Regulations. Several approaches and program structures were utilized to meet increasing demands for site maintenance and long-term cost efficiency. These included contracting individual reforestation projects starting in 1994, to contracting for a comprehensive operation in 1999 with a youth service organization affiliated with the federal AmeriCorps program. In 2003 the Program was established as a dedicated effort within DEPRM. The CRP is the only full-time County-wide reforestation mitigation program among Maryland's counties.



To date, the CRP has resulted in reforestation of over 150 acres in urban and rural areas of Baltimore County. Despite weather fluctuations, ever-present deer and vole predation, and other natural and human stressors, the Program has maintained a strategy of flexibility in matching species selection, planting techniques, tree protection equipment, and maintenance efforts to site characteristics. As a result the Program has experienced a steady increase in tree survival to the present 85+% in recent projects.

Reforestation Program Progress

Year	Acres Planted	# of Trees Planted	# of Trees Reinforcement
2007	15.07	922	715
2006	20.83	2,893	1,175
2005	16.70	3,986	1,689
2004	17.01	2,834	12
2003	21.01	3,253	-
2002	15.05	695	-
2001	15.25	6,781	
2000	5.77	3,602	
1999	6.23	127	
1998	5.13	737	
1997	1.60	143	
1996	10.80	3,592	
Total	150.45	28,643	3,591

The CRP includes a four-person reforestation crew. Year-round reforestation operations are based at a 1-acre site in eastern Baltimore County that is provided by the Department of Recreation and Parks. This home base houses a growing out nursery for 15 thousand tree seedlings; equipment and machinery needed for planting, monitoring, and maintaining the reforestation projects; and office space for the reforestation team. Occasionally, the CRP will undertake special grant-funded projects, the most recent example being the expansion of forest buffers on private rural properties.

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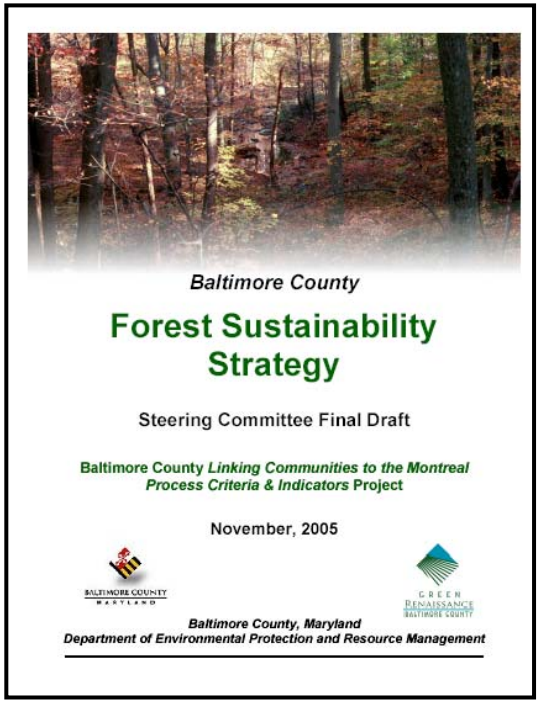
MONTREAL PROCESS CRITERIA	STRENGTHS ⇐ SUSTAINABILITY ⇒ LIMITATIONS	
Criterion #1: **Conservation of Biological Diversity**	❑ The dominant forest cover type is Oak, a keystone ecological species. ❑ Two large areas have good FIDs populations. ❑ > 6,000 acres of State-designated Wildlands exist.	❑ Forest cover is only one-third of original extent. ❑ Forests are highly fragmented at >9,000 patches, and they are highly parcelized. ❑ Urban tree canopy is probably less than 40%.
Criterion #2: **Maintenance of Productive Capacity of Forest Ecosystems**	❑ Overall forest cover has increased over the past century. ❑ Non-consumptive timber harvests have declined significantly in recent years.	❑ Forest harvesting during the Colonial era was extensive and largely consumptive. ❑ Forest conversion to development is increasing and now averages 245 acres per year.
Criterion #3: **Maintenance of Forest Ecosystem Health and Vitality**	❑ Most tree species surveyed through FIA have generally good health. ❑ The County is conducting forest health studies. ❑ Few forest fires occur and fire potentials are low to moderate.	❑ Recent years are more droughty than normal. ❑ Ambient ground-level ozone and ozone injury to indicator plants are very high. ❑ Gypsy moth are active and deer are impeding natural regeneration of oak forests.
Criterion #4: **Conservation and Maintenance of Soil and Water Resources**	❑ Productive soils and abundant water are available for the growth of forests. ❑ Forest cover is highest in reservoir watersheds.	❑ About half of streams have no forested buffers. ❑ Reservoir watershed forest cover is low at <50%. ❑ There are few protected primary patches as mapped for the water quality typology.
Criterion #5: **Maintenance of Forest Contribution to Global Carbon Cycles**	❑ Research is underway in the region and for the County to understand the forest's contribution to carbon sequestration.	❑ Offsetting atmospheric carbon using forest strategies needs to be pursued aggressively. ❑ Better education is needed regarding carbon issues.
Criterion #6: **Maintenance and Enhancement of Long-Term Multiple Socioeconomic Benefits to Meet the Needs of Societies**	❑ Secondary wood manufacturing here is above average for metropolitan counties in Maryland. ❑ The Montreal Process has raised awareness of the issue of economic sustainability of forest resources and studies and projects are being discussed.	❑ Timber and primary wood manufacturing contributes little to the County's economy. ❑ The economic sustainability of forest resources is not promoted and there is likely a high aversion to commercial timber management. ❑ Portions of the County are becoming far removed from forestry support services.
Criterion #7: **Legal, Institutional, and Economic Framework for Forest Conservation and Sustainable Management**	❑ The County has advanced land use planning tools for forest protection. ❑ The Green Renaissance framework and innovative programs are in place to address needs. ❑ There are citizen organizations with interest and capability to partner in forest programs.	❑ Tree removals appear to exceed replanting in urban areas, and measures of success for some planting programs are declining. ❑ Many innovative and successful programs are dependent on grants.

Forest Sustainability Program Documents

Baltimore County is a national model for the application, at the community level, of the Montreal Process Criteria & Indicators (MPCI), a science-based tool for measuring the ecological and economic sustainability of forest resources



http://www.baltimorecountymd.gov/Agencies/environment/workgroup/index.html

Program Progress

- Signed 2005 partnership MOU for program implementation
- Secured Capital Budget funding for program implementation
- Engaged stakeholders (Steering Committee, 2003 Issues Forum, 2006 “5E Forum,” 2008 Counties Workshop)
- Completed Oregon Ridge Park Forest Health Assessment & Plan
- Obtained tree canopy layer for Urban Tree Canopy Goals
- Completed Urban Forest Effects (UFORE) Model within URDL
- Initiated Growing Home Campaign - $10 coupons for residential tree planting
- Initiated Rural Residential Reforestation projects
- Developed Forests and Trees web site
- Conducted forest analysis in support of Gypsy moth suppression and deer herd management
- Developed recommendations for forest management in support of greenhouse gas emissions reduction goal (carbon management)