



## **BALTIMORE'S FOREST PATCHES: EMERALD ASSETS FOR ECOSYSTEM SERVICES**

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## EXECUTIVE SUMMARY

- Forest Patches – areas of canopy at least 10,000 square feet – make up 34 percent of Baltimore's tree canopy. Twenty percent of Baltimore's tree canopy is in forest patches outside parks. Trees, and forest patches in particular, provide important ecosystem services such as cleaning stormwater and air, cooling the air, and removing carbon from the atmosphere. They provide food and habitat to wildlife and migratory birds. They can provide a venue for education and community involvement. There is also the potential for agroforestry (growing or harvesting foods and fibers in a forest).
- Many of Baltimore City's forest patches are fragmented by multiple ownership, some are partially in "paper" streets or alleys (these are rights-of-way on City plats that have never been built), and few are recognized as forest or as having value by anyone but nearby residents.
- Forest patches often exist because the land they are on is not appropriate for development. These lands can include steep slopes, wetlands, underground springs and floodplains. Because they are not recently disturbed, they often are home to large trees that are not offspring of modern nursery stock. In addition to the benefits large trees provide, they are good sources of local, native seeds.
- Because of their size or multiple ownership, Baltimore's forest patches are vulnerable to development. Few of the patches are protected by the current network of state and city regulations that protect trees and forest. New tools are needed.

## RECOMMENDATIONS

Baltimore City lacks the appropriate tools to protect forest patches from destruction. This section identifies four goals for forest patch preservation and 14 strategies to meet these goals.

### Goal 1. Improve Forest Patch Data

**Strategy 1A: Document and inventory Baltimore's forest patches.** This white paper and expected follow-up work by Baltimore Green Space on a more detailed "forest patch atlas" are good first steps. Resources of the Planning Department may be helpful in developing a full inventory.

**Strategy 1B: Determine financial value of forest patches and the cost of care.**

"Gray" infrastructure such as roads, stormwater facilities, and power plants all require continual investment. So does "green" infrastructure, such as streams, street trees, and forest patches. In an urban environment, nature cannot take care of itself without a helping hand – and that costs money. We can underline the need for reinvestment in our forest patches by attaching a financial value to them. Such an analysis should show: the value of forest patches' environmental services if they were provided by "gray" infrastructure; the forest patches' replacement costs; the investments needed to maintain forest quality (to counter dumping and invasive plants); and the cost of the loss of services in the absence of care.

## Goal 2. Coordinate Work of City Departments

There are approximately 17,000 vacant lots in Baltimore City, about 6,650 of them owned by City government. Not surprisingly, the City is eager to sell this land to developers as well as to abutting landowners. In the meantime, the Department of Public Works is working to reduce the pollutants that our stormwater delivers to the harbor. DPW loses ground when Baltimore loses forest.

**Strategy 2A: Freeze sale of City-owned forested land;** this is an estimated 350 lots.

**Strategy 2B: Facilitate appropriate review for permits.** In the City's "Tidemark" database system for permits, tag all properties that contain portions of forest patches to facilitate appropriate review (as with properties that are in floodplains or the Chesapeake Bay Critical Area).

**Strategy 2C: Evaluate all paper streets** to determine which are actually parts of forest patches. Paper streets that are part of forest patches should be protected and not built out.

**Strategy 2D: Preserve City-owned forested land.** The Departments of Housing and Community Development, Planning, and Public Works should work together to determine how best to preserve City-owned forested land and turn it into long-term Forest Patches as defined in the forthcoming Green Pattern Book (a project spearheaded by the Office of Sustainability as a tool to encourage the planning and implementation of different "green uses" for vacant land by City agencies, NGOs, community-based organizations, and individual residents).

**Strategy 2E: Add forested land to parks.** City-owned forested land that abuts parks or can serve to connect parks along streams should fall under the management of the Department of Recreation and Parks.

## Goal 3. Update Regulations

**Strategy 3A: Amend the City Code, regulations, and policies,** including the Baltimore City Forest Conservation Program and the Baltimore Street Tree Ordinance, to better recognize and protect Baltimore's forest patches.

Baltimore's Forest Conservation Program is due for revisions after the Baltimore City Landscape Manual is adopted. A thorough review of the manual should include input from stakeholders. The current manual fails to fit state-wide regulation to the urban context. For example, in determining the size of a forest patch, the manual should recognize that urban forest patches typically include more than one owner's property. In addition, the regulations should apply to all projects that would disturb at least 2,500 square feet of forest, for any reason. At present, the trigger for the regulation is the amount of disturbance, not whether the area to be disturbed is forested. In a revised program, the trigger should be related to the amount of forest and the amount to be disturbed. To facilitate GIS analysis, forest patches should be defined as consisting of at least 10,000 square feet of canopy. These are examples; a thorough review would identify additional changes.

**Strategy 3B: Protect specimen trees** (trees larger than 20 diameter at breast height) through the Landscape Manual, the Forest Conservation Program, the Baltimore Street Tree Ordinance,

and through new regulations that protect large trees and forest patches at all times, not just during development.

Some municipalities, such as Annapolis, regulate which trees can be cut on private property, with no development trigger. Such an ordinance would have the potential to preserve a substantial portion of Baltimore's tree canopy. However, it would need to be coupled with a strong education campaign on tree maintenance.

#### **Goal 4: Engage Residents**

Forest patches can get much of the care they need from volunteer groups that learn about forest care (See Appendix B). They can remove invasive plants such as ivy and sometimes poison ivy, remove trash, and plant appropriate new trees. They can create trails and run community events. The recommendations that follow seek to foster increased resident stewardship of forest patches.

**Strategy 4A: Create a Forest Patch Registry.** Just as the City does its best to recognize established community-managed open spaces in the planning and disposition processes, it should also recognize the value of forest patches. Through the Department of Planning or the Division of Forestry, create a registry of forest patches where landowners can register the forest patches that include their land. Such forest patches could also include City-owned land and paper streets, as well as land that has met some test for abandonment. The regulations in the revised Baltimore City Forest Conservation Code and Manual should apply to all sites in the registry, perhaps with more stringent conditions.

**Strategy 4B: Create incentives for stewardship and preservation.** The Forest Preservation Act of 2013 (HB 706) provides for tax credits for reforestation or timber stand improvements on commercial forest land of 3 to 1000 acres. This legislation may provide a starting point for crafting legislation that would encourage stewardship and preservation of urban forest patches. Similarly, easements donated to public bodies or private land trusts could in some cases provide an incentive for preservation. Considering that forest patches tend to cross property boundaries, an easement program would encourage groups of residents to jointly protect areas of tree canopy. Baltimore City should determine what incentives for forest patch preservation are most practical, and create the tools to offer these incentives to Baltimore landowners.

**Strategy 4C: Provide stormwater fee credits** to residents who participate in forest stewardship activities. This creates a small financial incentive for residents to care for local forest patches.

**Strategy 4D: Fund educational programming** for forest stewardship through the stormwater utility. Such programs should include community organizing support as well as educational activities and materials. Volunteers rely on programming by nonprofits for expertise, mentoring, and materials.

**Strategy 4E: Refer all residents** interested in providing stewardship to forest patches to Baltimore Green Space's forest patch program.

## INTRODUCTION

The term “urban forest” usually refers to the trees that line our streets and beautify yards. We forget to think of places that feel more like an actual forest. In fact, Baltimore has significant areas of forest patch – areas with large trees, understory plants, and a “floor” of vegetation and decomposing leaves that absorbs rain like a sponge. Baltimore’s forest patches constitute a substantial portion of our total tree canopy: 14 percent of Baltimore’s tree canopy is in forest patches inside parks, and 20 percent is in forest patches outside parks.

These forest patches will play an increasingly important role in the coming years, as City government works to reduce the stormwater that flows to the Chesapeake Bay, reduce the heat island effect, improve air quality, and improve biodiversity. Yet most forest patches, especially those outside of parks, are vulnerable to being cleared for two reasons. First, most of Baltimore’s forest patches are smaller than the area required to trigger current regulations. Second, many of our forest patches cross property lines; when a large forest is sliced into small pieces with different owners, it simply may not exist in regulatory terms.

If forest patches are to thrive, they require stewardship. In urban areas, where ecosystems have been massively disturbed, “natural” areas need human help. Exotic invasive plants can smother large trees and prevent saplings from emerging from the forest floor. Over time, a forest patch’s ability to filter stormwater, clear and cool the air, and support wildlife can become badly degraded. Since summer 2012, Baltimore Green Space has been working with neighborhood stewards of four forest patches, mentoring and providing education on forest patch care. The very encouraging results suggest that care of neighborhood forest patches could become a popular way for Baltimore residents to improve their neighborhoods while enjoying contact with nature.

This paper describes Baltimore’s forest patches, outlines their benefits, and discusses their treatment in current regulations. It then makes a series of policy recommendations to ensure that these “emerald assets” serve us for the long term.

## WHERE ARE BALTIMORE’S FOREST PATCHES?

The maps and statistics in this paper represent new research on Baltimore’s forest patches. In the spatial analyses, we defined a forest patch as an area of tree canopy of at least 10,000 square feet.<sup>1</sup> Our dataset, which was created for this research, includes areas of tree canopy that are most likely to consist of forest (rather than street trees, as in the Original Northwood neighborhood).<sup>2</sup> We then removed the areas of forest that were less than 10,000 square feet. These forest patches

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1. We chose this threshold for three reasons. First, while City code defines a forest as at least 4,000 square feet, the Forest Conservation Manual defines it as 10,000 square feet. Both definitions relate to the footprint. A forest patch’s canopy will exceed its footprint, so a threshold of 10,000 square feet of canopy will fall somewhere between these two contradictory definitions. Second, the regulations that focus on square feet of forest do this to determine where development can proceed; in contrast, we aim to characterize forest patches that cross property lines. Third, the focus on canopy was necessary to facilitate GIS analysis. For this GIS analysis we were not able to define the size of trees that make up the canopy; this will be necessary in any regulations.

2. See Appendix C for details. The identification of forest patches was done by Associate Professor Matthew Baker, Geography Department, University of Maryland, Baltimore County, 2012.

include areas with an understory and areas that are more manicured.<sup>3</sup>

Baltimore City has 611,757,338 square feet (14,000 acres) of tree canopy. In Map 1, which shows all of Baltimore's tree canopy, areas with the densest tree canopy are shown in the densest gray. Areas with a more stippled effect are typically leafy residential neighborhoods. There is little tree canopy in the heart of the city, or anywhere near the harbor.<sup>4</sup>

**Map 1**



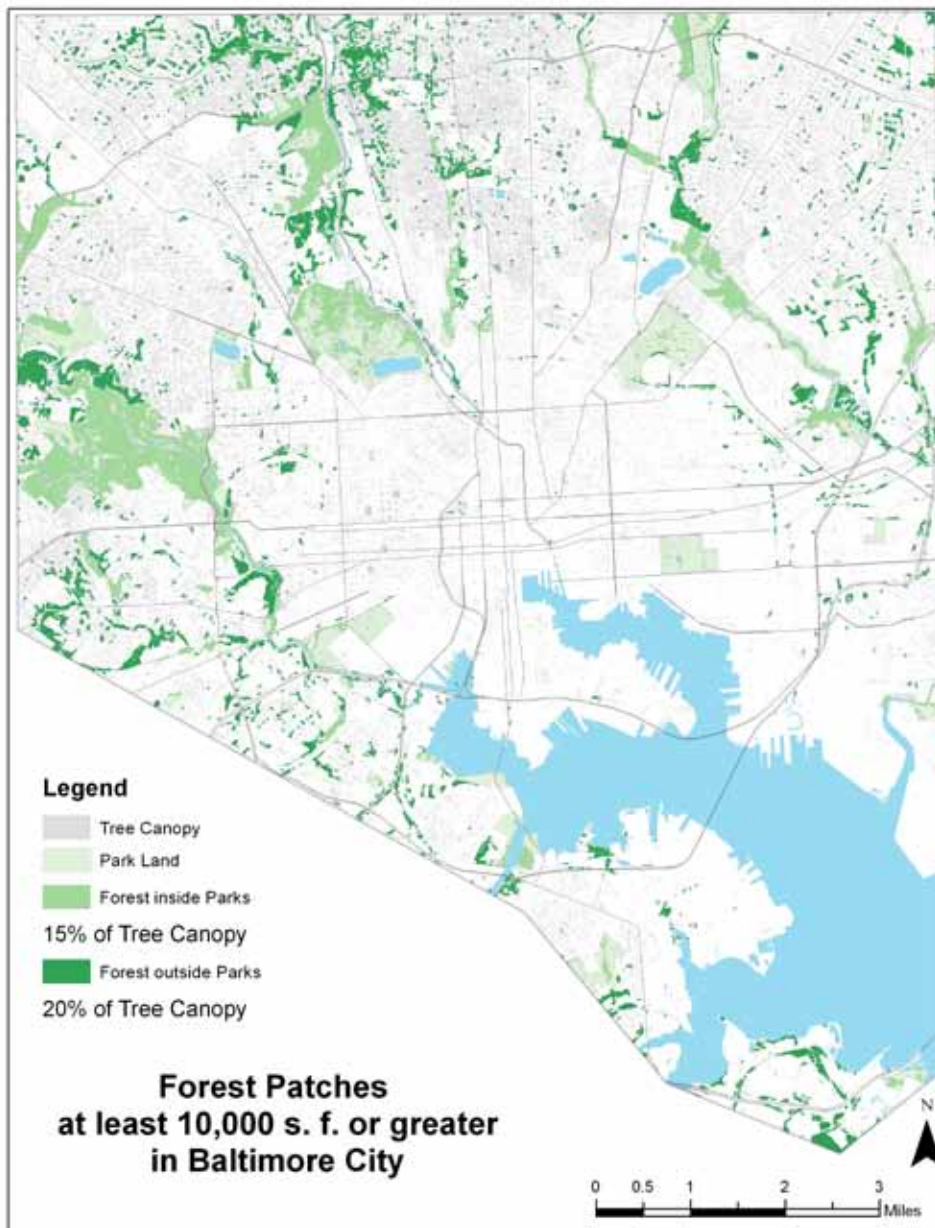
3. In future work we hope to further characterize the forest patches.

4. This dataset was prepared for the Department of Recreation and Parks in 2009.

Map 2 shows Baltimore's forest patches.<sup>5</sup> Together, the forest patches inside and outside of parks comprise 210,038,057 square feet (4,822 acres), or 34 percent, of Baltimore's tree canopy. Of this, 120,437,488 square feet (2,154 acres) are in forest patches outside parks: That is, 20 percent of Baltimore's tree canopy is in forest patches of at least 10,000 square feet outside parks.<sup>6</sup>

Many of the forest patches abut forested areas of parks. There are also numerous forest patches scattered in neighborhoods, most notably in leafy Mount Washington. There are numerous "island" patches in north central and northeast Baltimore, while patches in southwest Baltimore are in many cases more closely connected.

**Map 2**



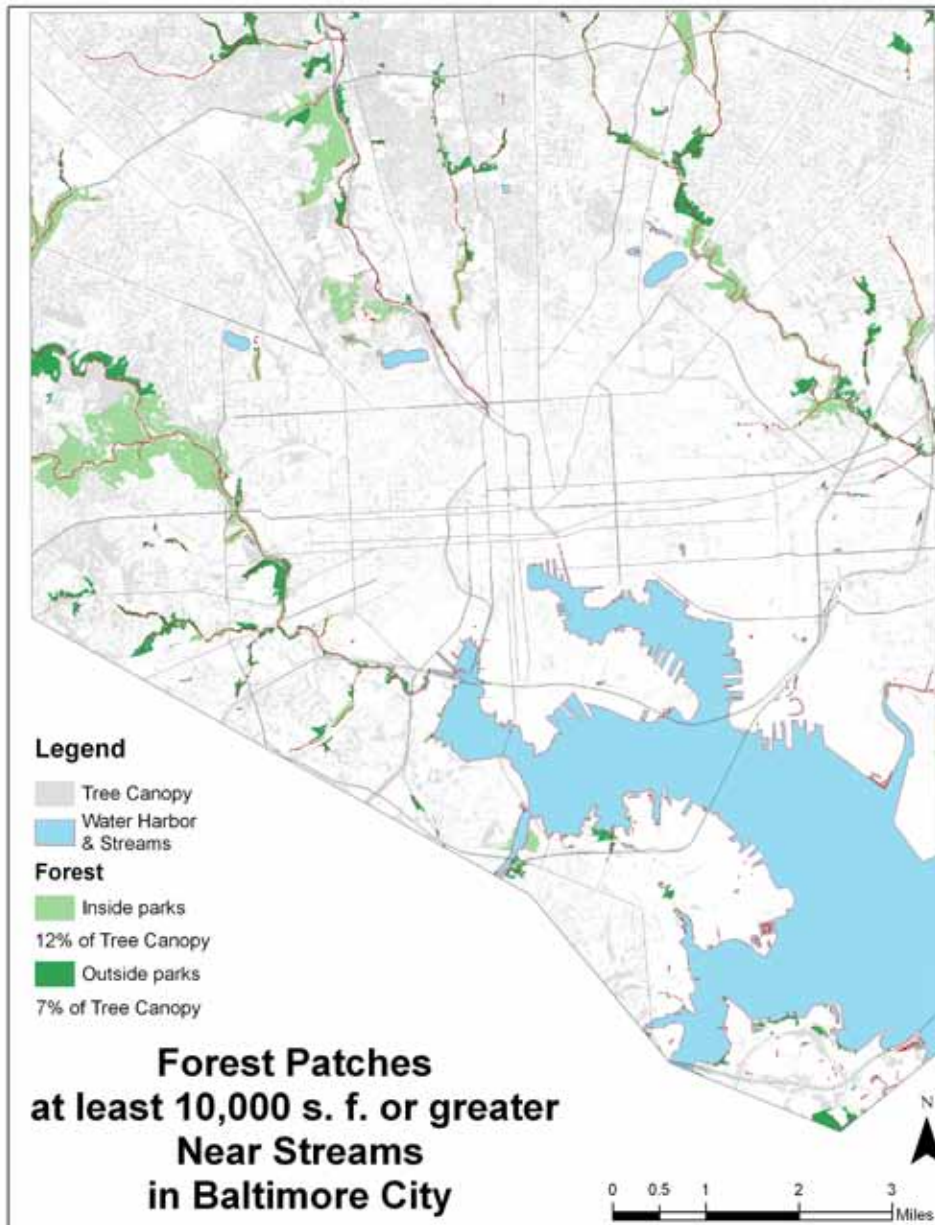
5. To simplify analysis, when forest patches straddle a park boundary, we split the patch into two: one in the park and one outside.

6. Forest patches inside parks may also be vulnerable to development. For example, there is a proposal to remove mature trees from an area of Druid Hill Park to accommodate the construction of an underground water tank.



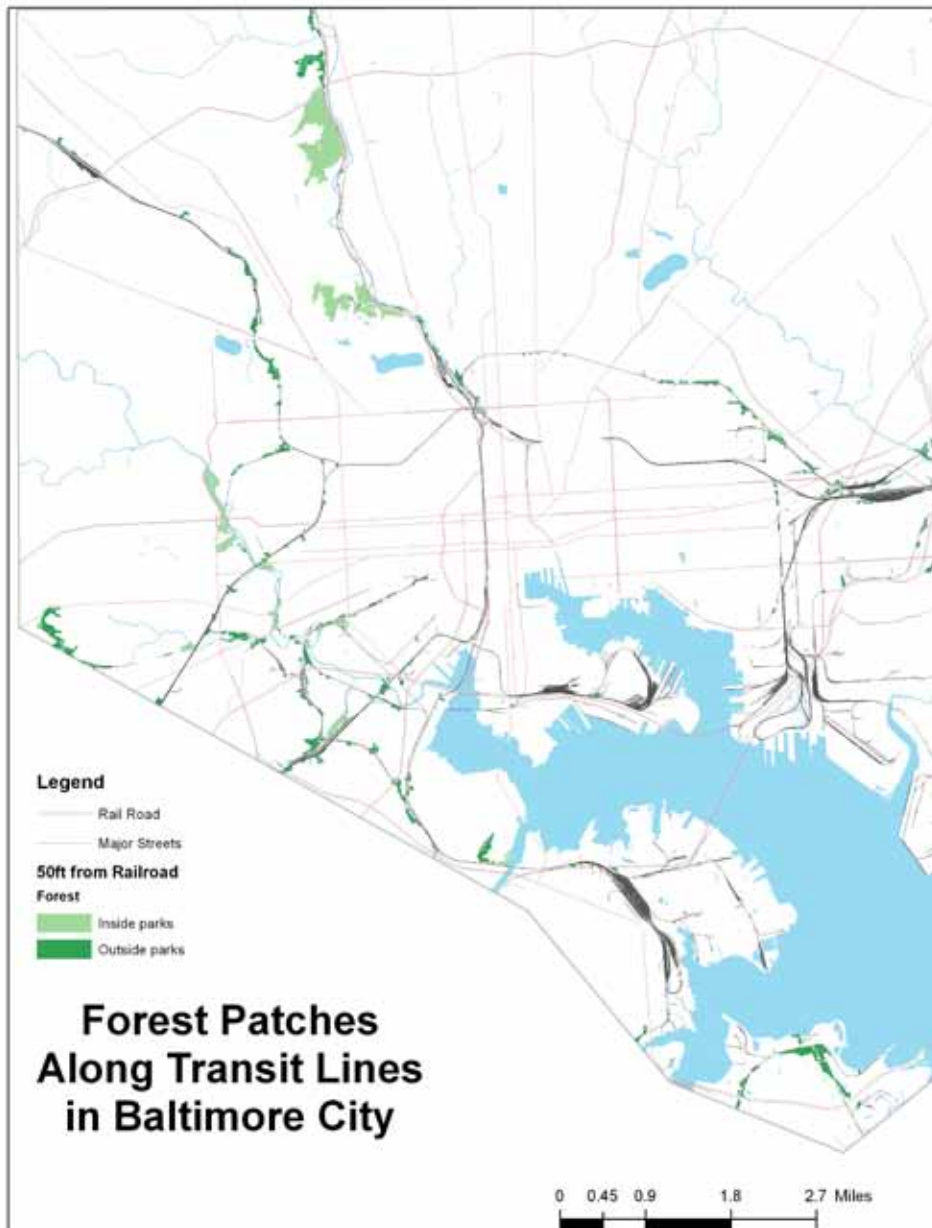
Map 3 shows Baltimore's streams and the forest patches along them. Forest patches that abut streams account for 19 percent of Baltimore's tree canopy. These forest patches play a particularly important role in handling stormwater, as outlined in the next section. While significant portions of the Herring Run (in the eastern part of the city) are shaded by forest patch inside parks, significant parts are also bordered by forest patch outside parks. Similarly, forest patches outside Leakin Park border a significant part of the Gwynn's Falls in southwest Baltimore. The Jones Falls' industrial history is evident from the stream's relative lack of forest.

**Map 3**



Map 4 shows forest patches along ground-level transit lines (railroad and light rail). Transit lines anchor linear forest patches, supplementing the role of streams in creating emerald corridors. In the past, row houses were built very close to rail lines, but today it is not permissible to rebuild so close to the rail line. The creation of new forest patches is a practical re-use of this land.

**Map 4**

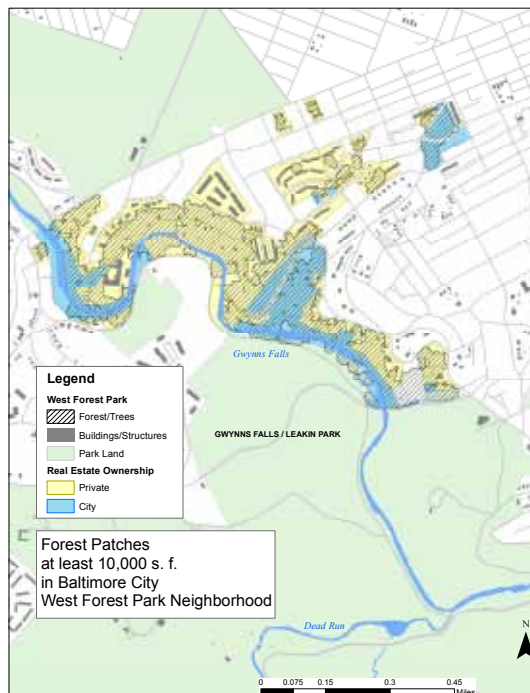


Some of Baltimore’s “island” forest patches, such as Springfield Woods (bordering Wilson Park, Pen Lucy, and Original Northwood) are forested areas with no other uses. Many, such as a patch along bordered by Midwood Avenue, Winston Avenue, and Beaumont Avenue, consist of a central forested area with substantial tree canopy in neighboring yards. Both of these forest patches include “paper streets”: places where streets were planned but were never built.

Many forest patches consist of both private and City-owned land. Baltimore City owns 350 “vacant” lots that are in fact part of forest patches outside parks.

Maps 5 and 6 show two forest patches that are anchored by City-owned land. Map 5 shows an area contiguous to Leakin Park that the Gwynns Falls flows through. A forest patch encompasses one City-owned lot and three large private undeveloped lots. Map 6 shows the Wilson Park forest patch; as shown, it encompasses more than a dozen individual lots and a paper street.<sup>7</sup>

**Map 5**



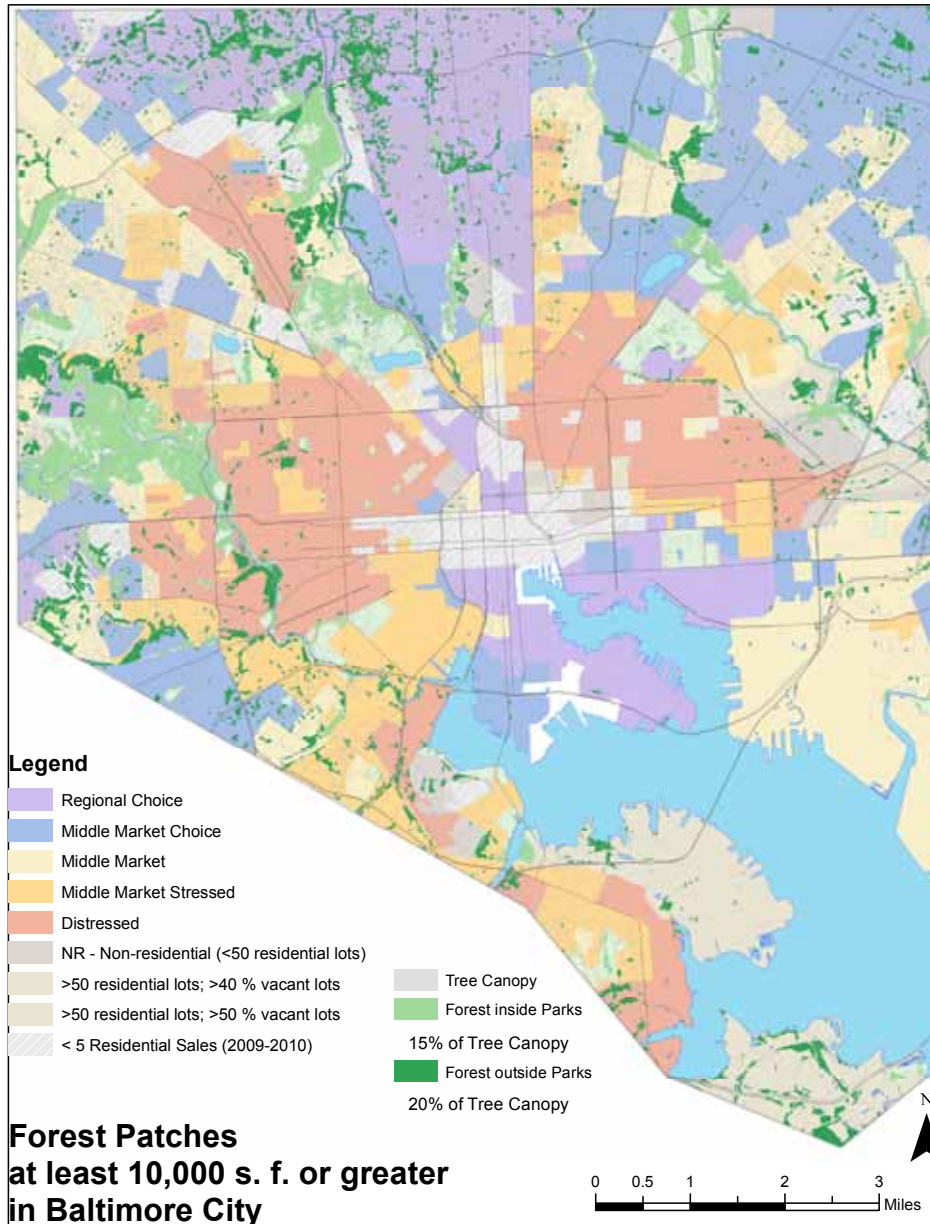
**Map 6**



7. In fact, some of the forest shown here has been cleared; this is discussed later in this paper.

While wealthier neighborhoods are typically more leafy than less affluent neighborhoods, forest patches occur in neighborhoods at all economic levels. Map 7 superimposes the forest patches outside parks on the City's 2011 Housing Market Typology Map. We found that 11 percent of the land in "regional choice" areas is in forest patches (8,078 acres); 10 percent for "middle market choice" (9,477 acres), and 9 percent for "middle market" (9,923 acres). In contrast, 13 percent of the land in "middle market stressed" areas is in forest patches (6,899 acres), as is 11 percent of land in "distressed" areas (8,625 acres). Thirteen percent of land with other classifications is in forest patches.

**Map 7**



## WHY CARE ABOUT FOREST PATCHES?

Why do forest patches matter? What can they offer to residents and to City government? How can they help Baltimore meet important environmental and regulatory challenges? And what's so special about the forest floor? This section discusses why forest patches are relevant to policy-making in Baltimore City, beginning with a note on the value of larger, mature trees.

**Big Trees Do More than Small Trees** Forest patches usually include very large trees, which are of particular environmental value. According to the Georgia Model Urban Forest Book, “trees less than 15 to 20 years old provide few of the environmental benefits that are considered important factors in the justification for more trees in the urban environment.”<sup>8</sup> In contrast, a large tree removes carbon from the atmosphere at a rate of about 49 kg of carbon per year, 82 times that removed by a small tree. A large tree removes 50 times more pollution from the air than small trees.<sup>9</sup> And while a 10-inch red maple intercepts 1,565 gallons of water per year, a 20-inch red maple intercepts 5,926 gallons and a 30-inch red maple intercepts 11,263 gallons.<sup>10</sup> While all trees cool the air and shade the ground, “older larger trees maximize these benefits.”<sup>11</sup> According to the U.S. Forest Service, “Loss of large trees in the near future would likely lead to a loss of benefits as it will take years for the smaller tree to compensate for the loss of the canopy of large trees.”<sup>12</sup>

**Stormwater** Rain is precious, as we are reminded each time Maryland is threatened by drought. Baltimore, like all modern cities, was built to shed water. In the process, it turns a precious resource into a pollutant. Approximately 43 percent of Baltimore is composed of impervious surfaces – rooftops, sidewalks, streets and alleys, parking lots, etc.<sup>13</sup> The rain that falls on them must go somewhere. In Baltimore, the rain flows down the streets, washing with it substantial litter, car wastes, nitrogen, phosphorus, and other pollutants. The dirty water flows into storm sewers, and from there into an underground network of aging pipes, many of which also conduct streams that once ran aboveground. All this ends up in the Baltimore harbor. The soil within the city becomes dry, and pollution flows to the Chesapeake Bay. Stormwater runoff from municipal stormwater systems, together with runoff from industry and construction sites, is the biggest threat to the Baltimore Harbor and the Patapsco River.<sup>14</sup>

In contrast, forested land absorbs rain water and slowly releases it. During a storm, rain is caught in the leaves of trees, and is slower to make its way to the ground. Once on the ground, the rain is absorbed by the spongy layer of decomposed leaves. Microbes in the soil clean the water, breaking down many pollutants to harmless substances. Trees take up some of this cleaned water, and slowly release it to the atmosphere through their leaves. Cleaner, filtered water makes its way down to the water table, where it flows toward the bay.

Baltimore is under enormous regulatory pressure to reduce and clean up its stormwater runoff. The federal Environmental Protection Agency (EPA) has imposed a “pollution diet” on all

8. *Georgia Model Urban Forest Book*, Georgia Forestry Commission, 2001, page 21.

9. See Nowak, *Baltimore's Urban Forest*, p. 5 (on carbon sequestration) and p. 6 (on pollution).

10. These figures are from <http://www.treebenefits.com/calculator/>

11. *Georgia Model Urban Forest Book*, p. 10.

12. Nowak, *Baltimore's Urban Forest*, p. 31.

13. TreeBaltimore website: <http://treebaltimore.org/baltimores-trees/>

14. <http://www.bluewaterbaltimore.org/the-waterkeeper/programs/stormwater-pollution/>

states in the Chesapeake Bay Watershed. Baltimore faces large fines if it cannot meet specific targets for reducing certain emissions into the Bay, particularly nitrogen and phosphorus. At the state level, Baltimore must comply with its permit to release stormwater into local streams and the harbor. This permit, the Municipal Separate Storm Sewer System permit (called the MS4 permit), states that the City must comply with all pollution limits such as those set by the EPA. It also stipulates that Baltimore must reduce its impervious area by 20 percent, capture or treat the first inch of rain from 20 percent of its impervious surfaces, or some combination.

A key strategy to comply with these regulations is to build structures that intercept and absorb run-off. These are called “best management practices,” or BMPs. BMPs must absorb not just the rain that falls on them, but also rain that fell uphill or is otherwise directed to them. Examples include drainage ponds, rain gardens, rainwater harvesting, and tree planting. The gold standard for BMPs is forested land. As Kimberly Burgess, Baltimore’s Chief of Surface Water Management at the Department of Public Works, said, “All BMPs do is to try to mimic what a forest does.”<sup>15</sup>

Both the federal and the state regulations start from the status quo – progress is measured in terms of change from the quantity of pervious and impervious surface since 2010. There is no credit for preservation of the forest patches we already have. Yet these patches, which provide needed stormwater services, are in many cases vulnerable. Baltimore City will struggle to meet its regulatory obligations if it loses areas of precious forest patch that are already getting part of the job done; that is, the regulations give no credit for existing patches, but their loss could well trigger a penalty.

**Tree Canopy Goal** Baltimore aims to double its tree canopy by 2037 – from 20 to 40 percent.<sup>16</sup> According to a 2002 U.S. Forest Service survey, 32 percent of Baltimore’s trees are in forested areas.<sup>17</sup> (According to our analysis presented here, the figure is 34 percent; the differences are likely methodological). While new plantings are obviously necessary to reach our tree canopy goals, we lose ground whenever we remove or neglect established forest.

**Climate Change** A Climate Action Plan was adopted by the Baltimore City Planning Commission in November 2012. The Plan includes a strategy to “Protect and enhance Baltimore’s tree canopy and number of trees planted.”<sup>18</sup>

Urban trees and other plants have an important role to play in solving climate change: “Because of its proximity to numerous emission sources, urban vegetation can have increased impacts on global climate change both directly (e.g., removing greenhouse gases) and indirectly (e.g., altering nearby emissions).”<sup>19</sup> A third contribution of forest patches is direct cooling.

*Cooling* Cities are often 2 to 8 degrees warmer than rural areas because so many of their

15. Discussion at Baltimore Urban Waters Partnership meeting, December 4, 2012.

16. See the Baltimore City Sustainability Plan, Greening Goal 1. Strategy B for this goal is to “protect our existing trees.” In addition, Greening Goal 4 is to “protect Baltimore’s ecology and biodiversity.” *The Baltimore City Sustainability Plan*, 2009.

17. Nowak, *Baltimore’s Urban Forest*, page 27. Of a total of 2,835,500 trees, 909,200 are in forests. Note that Nowak’s definition of forest differs from that used here.

18. *Baltimore Climate Action Plan*, Baltimore City Department of Planning, 2013, p. 61.

19. Nowak, *Baltimore’s Urban Forest*, page 10.

surfaces absorb heat instead of reflecting it.<sup>20</sup> Forest patches provide some balance. Forest patches along streams cool the streams. In summer 2012, excessive water temperatures in the Chesapeake Bay contributed to massive fish kills after summer storms, so it would be sensible to ensure that our waterways moderate water temperatures.<sup>21</sup> Trees near houses can markedly decrease the use of energy for both cooling and heating; we expect that forest patches that include residential land enjoy this benefit. The less energy is used for cooling, the fewer greenhouse gases are generated.<sup>22</sup>

*Carbon Sequestration* Trees play an important role in determining climate. In fact, one theory for what caused the “little ice age” from about 1550 to about 1750 is that land management practices in North America radically changed after disease destroyed much of the Native American population after 1492. The native population had made extensive use of fire to thin and control the growth of forests. With the end of extensive burning, reforestation occurred at an extraordinary scale, removing so much carbon from the atmosphere that harvests in Europe were frequently delayed or destroyed.<sup>23</sup> Today we have the opposite problem.

Trees in Baltimore store about 527,300 tons of carbon, 26 percent of that in forests.<sup>24</sup> In general, large trees in forests store more carbon than open-grown, maintained trees.<sup>25</sup> This means that forest patches are particularly important for carbon sequestration.

**Human Health** A large body of evidence shows that contact with nature improves physical and mental health. A paper that summarizes some of the most rigorous studies using objective measures (for example, actual blood pressure instead of reported levels of anxiety) concludes that “Parks and other green environments are an essential component of a healthy human habitat” and “play a central role in human health and healthy human functioning.”<sup>26</sup>

Baltimore's forest patches should be considered a recreational asset for residents, whether for quiet contemplation or for the camaraderie and exercise involved in maintaining a forest patch. Forest patches – more than other outdoor settings – provide the opportunity to observe an entire natural community: tiny organisms such as lichens, monumental trees, and quick and colorful birds.

*Air Quality and Human Health* Forest patches, like all trees, also play a role in reducing asthma and other diseases caused by exposure to air pollutants.<sup>27</sup> Researchers at the University of Maryland examined reasons for children's Emergency Department visits from 1997 to 2000. While the researchers found that poverty accounted for the high usage of the emergency

20. *Georgia Model Urban Forest*, p. 13.

21. On the fish kill, see, for example, <http://baltimore.cbslocal.com/2012/05/24/algae-blooms-killings-thousands-of-fish-in-baltimores-waterways/>

22. Baltimore Green Space staff recently visited a forest patch in spring before the trees had leaves. The interior of the forest patch was markedly cooler than a portion of forest patch that had been cleared. Unfortunately, we were unable to record the temperatures.

23. Charles C. Mann, *1493*, (New York: Random House, 2011), pp 38-42.

24. Nowak, *Baltimore's Urban Forest*, p. 28.

25. As Nowak et al. write, “Open-grown, maintained trees tend to have less above-ground biomass than predicted by forest-derived biomass equations for trees of the same d.b.h. [diameter at breast height].” *Baltimore's Urban Forest*, p. 19.

26. Frances E. Kuo, *Parks and Other Green Environments: Essential Components of a Healthy Human Environment*, National Recreation and Park Association, 2010, p. 5.

27. See, for example, <http://www.treebenefits.com/calculator/>.

department, they also concluded that different environmental factors predicted visits for asthma more than for other respiratory issues.<sup>28</sup> The zip codes with the highest admissions for asthma are notably deficient in tree canopy, including forest patches.<sup>29</sup>

Forests have a multi-story structure: tall trees on top, shorter trees, then shrubs and other lower-story plants. This dense structure means that forest patches have more leaf area than similar-sized areas of tree canopy created by street trees – there are simply more plants in a given area to process air pollution.<sup>30</sup>

**Birds** Baltimore Green Space's bird walks in North Baltimore forest patches suggest that these areas play an important role in supporting bird migration and breeding. The species found inside the patches typically differ even from the more exciting backyard birds; species spotted include hermit thrush, least flycatcher, bay-breasted warbler, and bald eagle. We also spotted nesting black vultures; these birds rarely nest in or near Baltimore. In addition, the resources that forest patches provide may be part of the reason why many Baltimore neighborhoods support a wide variety of birds.

According to Mike Hudson, the birder for Baltimore Green Space's bird walks, "Forest patches differ from canopy cover in the average neighborhood in one big way – they offer habitat below the treetops. Many birds don't actually feed and nest in the canopy. Many only nest in small- to mid-sized trees, and a great many species forage on or near the ground. Forest patches provide the undergrowth and groundcover needed for feeding and nesting." These areas may also offer more privacy.

According to the U.S. Forest Service, "Public forests are critical to the long-term health of bird populations and the recovery of endangered species."<sup>31</sup> Evidence from Baltimore Green Space's bird walks suggests that the same is true of urban forest patches, whether in parks or outside of them.

See Appendix B for a list of birds found in and around four North Baltimore forest patches.

## HOW ARE BALTIMORE'S FOREST PATCHES?

The previous section explained why forest patches are valuable. How well do Baltimore's forest patches live up to their potential? This section features information gathered by Baltimore Green Space through its work with residents of four neighborhoods who care for their local forest patches. The forest patches are: the Govans Urban Forest, Wilson Park Forest Patch, Winston-Govans Forest Patch, and Springfield Woods. Appendix A provides details about these patches and the residents' stewardship.

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28. Carol J. Blaisdell et al., "Risk Areas for Pediatric Acute Care: Asthma Differs from Upper and Lower Respiratory Illness," *Health & Place*, 13:2 (2007), pp 404-416.

29. The zip codes that appear to have highest rates of childhood asthma are 21202 and 21231, with zipcodes 21201, 21217, 21213, 21205, and 21224 next highest.

30. Nowak, *Baltimore's Urban Forest*, p. 34.

31. The quote is from the press release (<http://www.nrs.fs.fed.us/news/release/bird-research>) for the report North American Bird Conservation Initiative, U.S. Committee, 2011, "The State of the Birds 2011: Report on Public Lands and Waters (Washington, D.C.: U.S. Department of Interior).



Forest patches are important “reservoirs” for native species: Ninety-three percent of trees in Baltimore’s forest patches are native to North America, and 86 percent are native to Maryland. A smaller percentage of native trees are found in other land uses (such as residential or institutional).<sup>32</sup> For example, the Winston Govans patch is home to a towering white oak estimated at 80-90 years old. A healthy American elm, estimated at 50-80 years, lives in the Wilson Park Forest Patch. Springfield Woods has four species of oak, as well as tulip trees, fringetree, American hollies, and American beech. Govans Urban Forest includes elms and oaks, and notable smaller trees such as basswood, hawthorn, and box elder.

Forest patches typically have more varied bird populations than the neighborhoods surrounding them. (See Appendix B for a list of bird species identified at three forest patches.) Residents also reported seeing foxes and other animals that are challenged to find suitable habitat in the city.

Forest patches offer a kind of special habitat for residents, as well. Residents often have fond memories of playing in the forest as children, and many enjoy watching the birds. The woods provide the opportunity, rare in the city, to be surrounded by trees.

Baltimore’s forest patches do face challenges, including unwelcome plants. Many forest patches are infested with English ivy and other invasive plants, such as lesser celandine. These plants interfere with healthy forest development in several ways. First, they may dominate the forest floor, so that new tree seedlings cannot emerge and survive. Second, they may kill growing and mature trees. For example, ivy grows up a tree into the canopy, where it spreads and blocks the tree’s access to sunlight. In the end, the tree becomes a post to hold up the ivy. English ivy cannot produce seed on the ground, but it can reach its mature form and produce seed on a tree. Several of the patches we work with have invasive trees, in particular *Ailanthus* (“tree of heaven”) at their edges, sometimes working their way into the patch.

Poison ivy is another pest. This is a native plant that is highly toxic to people. It is hard for volunteers to maintain a forest patch that is infested with poison ivy, though intrepid volunteers can make a large difference. In Wilson Park, volunteers killed inch-thick poison ivy vines that were climbing a tree.

A final “pest” is dumping. Forest patches can be seen as a convenient place to illegally dispose of household goods and construction waste. For example, we found large concrete pipes at the Govans Forest Patch, in addition to pallets and other trash. There is evidence that fighting dogs have been kept at Springfield Woods, and enormous amounts of glass and other waste have been removed from a stream in the woods.



32. Nowak et al., *Baltimore's Urban Forest*, United States Department of Agriculture, 2002, p. 58.

In cities, “natural” systems are highly compromised by human activity. As a result, they need human intervention. Baltimore’s forest patches badly need ongoing stewardship to keep them healthy and functioning. We have found that residents often care deeply about their forest patches, but need education to understand what kind of care the patch needs, and how to do the work. With each workshop, we mobilize additional residents to care for their forest patches. To date, our work has focused in areas that are considered “middle market stressed” or “distressed.” By promoting and maintaining their forest patches, residents are turning what seemed like unattractive features into assets that can attract new residents.

## REGULATIONS AND FOREST PATCHES

Current city and state regulations governing land use and development do not adequately protect forest patches. Because they apply only when a planned project is of a certain size, they cannot adequately protect forest patches that span multiple parcels of land held by multiple owners. In an extreme example, if each owner were to clear just under 5,000 square feet of a very large forest patch, the entire patch could be destroyed without triggering any regulations that govern forest conservation, stormwater, or design review.

Yet with so few natural resources left in Baltimore to clean our water and air, it is important to protect our forest patches. The regulations discussed below are simply the wrong tools for the job – even where they are notable for their rigor where they do apply.

**Forest Conservation Program** Maryland’s State Forest Conservation Technical Manual governs the conservation of Maryland’s forests during land use changes.<sup>33</sup> Baltimore City created a supplement to the manual to adapt the state regulations to an urban setting.<sup>34</sup> Neither is a tool for preventing a change in land use.

The state manual applies only when a project is contemplated on 40,000 square feet on “a unit of land.” The City manual reduces this to 20,000 square feet of disturbance. That is, the regulation is triggered based on the area to be disturbed whether or not the land is forested.

A “forest” is defined in the City manual as “a biological community dominated by trees and other woody plants covering a land area of 10,000 square feet or greater. Forest includes (1) areas that have at least 100 trees per acre with at least 50% of those trees having a two inch or greater diameter at 4.5 feet above the ground, and (2) forest areas that have been cut but not cleared. Forest does not include orchards.”<sup>35</sup> Thus, the current Baltimore regulations allow for the elimination of entire forest patches of up to 20,000 square feet. The entire manual should be reviewed to ensure that it protects city-scale forests.

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33. Ginger Page Howell and Tod Ericson, eds., *State Forest Conservation Technical Manual*, Maryland Department of Natural Resources, 3rd ed., 1997.

34. *Baltimore City Supplement to the State Forest Conservation Manual*, Baltimore City Department of Planning, 1992.

35. *Baltimore City Supplement*, p. 10.

## SPOTLIGHT: A FOREST-PRESERVING OUTCOME

Springfield Woods is a 2.5-acre forest patch just south of 43rd Street and west of the Alameda. It is on a parcel of land once owned by the real estate developer Harry Wilson, and is immediately south of Wilson Park. Residents of Wilson Park successfully blocked development on this site in the 1970s. On the City's plats, this site consists of a paper street, a paper alley, and 23 building lots. The forest patch includes a stream that is not shown on current stream maps (or in Map 3 in this paper), but that is shown in an atlas from 1876.<sup>36</sup> There are many "specimen trees" with diameter at breast height of at least 20 inches, and in much of the forest patch the forest floor is in good shape. In about 2010, the Planning Department worked with a prospective buyer to evaluate the site for construction of a church. Due to the large number of specimen trees and the steep slope, the plan was abandoned. (The stream would also have limited development options had it been documented at the time.)



36. *City Atlas of Baltimore, Maryland, and Environs*, 2 vols. (Philadelphia: G.M. Hopkins, 1876).

## SPOTLIGHT: A FOREST- DESTROYING OUTCOME

The Wilson Park Forest Patch grows on and around a “paper street” linking 43rd Street to Cold Spring Lane. It is behind the house that Mr. Wilson lived in, and includes a brick “fire pit” that may have been part of Mr. Wilson’s extended backyard. On city plats, 13 lots include at least part of the forest patch; these lots are owned by the City and by two different development companies. Long-time residents of Wilson Park are extremely fond of the forest patch because of the variety of wildlife it harbors. They report seeing hawks, foxes, and an eagle. In 2011, a new resident on the Alameda bought the two lots that abut the rear of his property. He promised the neighborhood that he would make little change, but in fact the two lots, totaling 5,600 square feet, and the original backyard were cleared, with only one tree retained. A substantial area of concrete was then put down, with the remaining land seeded for grass. In this case, the City regulations failed in two ways. First, in regulatory terms there was no forest, because the minimum of 10,000 square feet was not on a single unit of land. Second, the regulations would not prevent the disturbance of 5,600 square feet.



area of clearing



**Baltimore City Landscape Manual** Baltimore City is in the process of updating its zoning code. This code refers to a Baltimore City Landscape Manual, which will be finalized and approved by the Department of Planning once the new zoning code is in place.

While one goal of the manual is to “preserve existing trees and tree canopy to the maximum extent practicable,” the regulations would rarely protect forest patches.<sup>37</sup> First, the regulations only apply when a project would trigger Site Plan Review (i.e., it is a commercial development or a residential development that involves more than three properties). Thus, the regulations would rarely apply in residential neighborhoods that have single and duplex houses.

**Baltimore City Critical Areas Management Program Manual** The “Critical Areas Program” is a state-wide program to promote the environmental health of the Chesapeake Bay. Under this program, all land within 1,000 feet of the shore is deemed “critical,” and stringent development restrictions apply (though for projects that cannot meet the requirements on site, off-site remediation is available). The regulations also apply in certain areas of the Gwynn’s Falls. These regulations cannot help the vast majority of Baltimore’s forest patches, which lie too far upstream or away from water altogether. However, its approach might make a good model for forest patch regulations.

**Flood Plains** No development, including clearing, is permitted within 25 feet of a watercourse. This regulation protects a very small area of Baltimore’s forests. However, this regulation may make some lots adjacent to streams undevelopable. In addition, stringent state regulation of development in non-tidal floodplains (that is, rivers) makes development in these areas typically impossible. However, these areas account for a small portion of forest patches.

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37. *Baltimore City Landscape Manual* (draft), Baltimore City Planning Department, p. 18.

## RECOMMENDATIONS

Forest patches provide residents with recreational opportunities, while providing valuable ecological services to the City as a whole. They clean water, clean the air, create healthier neighborhoods, and reduce summer temperatures. They provide crucial habitat for migratory and breeding birds. They can provide a venue for education and community involvement. There is also the potential for agroforestry: growing or harvesting foods and fibers. Unfortunately, Baltimore City lacks the appropriate tools to protect forest patches from destruction. This section identifies four goals for forest patch preservation and 14 strategies to meet these goals.

### Goal 1. Improve Forest Patch Data

**Strategy 1A: Document and inventory Baltimore's forest patches.** This white paper and expected follow-up work by Baltimore Green Space on a more detailed "forest patch atlas" are good first steps. Resources of the Planning Department may be helpful in developing a full inventory.

**Strategy 1B: Determine financial value of forest patches and the cost of care.** "Gray" infrastructure such as roads, stormwater facilities, and power plants all require continual investment. So does "green" infrastructure, such as streams, street trees, and forest patches. In an urban environment, nature cannot take care of itself without a helping hand – and that costs money. We can underline the need for reinvestment in our forest patches by attaching a financial value to them. Such an analysis should show: the value of forest patches' environmental services if they were provided by "gray" infrastructure; the forest patches' replacement costs; the investments needed to maintain forest quality (to counter dumping and invasive plants); and the cost of the loss of services in the absence of care.

### Goal 2. Coordinate Work of City Departments

There are approximately 17,000 vacant lots in Baltimore City, about 6,650 of them owned by City government. Not surprisingly, the City is eager to sell this land to developers as well as to abutting landowners. In the meantime, the Department of Public Works is working to reduce the pollutants that our stormwater delivers to the harbor. DPW loses ground when Baltimore loses forest.

**Strategy 2A: Freeze sale of City-owned forested land;** this is an estimated 350 lots.

**Strategy 2B: Facilitate appropriate review for permits.** In the City's "Tidemark" database system for permits, tag all properties that contain portions of forest patches to facilitate appropriate review (as with properties that are in floodplains or the Chesapeake Bay Critical Area).

**Strategy 2C: Evaluate all paper streets** to determine which are actually parts of forest patches. Paper streets that are part of forest patches should be protected and not built out.

**Strategy 2D: Preserve City-owned forested land.** The Departments of Housing and Community Development, Planning, and Public Works should work together to determine how best to preserve City-owned forested land and turn it into long-term Forest Patches as defined in

the forthcoming Green Pattern Book (a project spearheaded by the Office of Sustainability as a tool to encourage the planning and implementation of different “green uses” for vacant land by City agencies, NGOs, community-based organizations, and individual residents).

**Strategy 2E: Add forested land to parks.** City-owned forested land that abuts parks or can serve to connect parks along streams should fall under the management of the Department of Recreation and Parks.

### **Goal 3. Update Regulations**

**Strategy 3A: Amend the City Code, regulations, and policies,** including the Baltimore City Forest Conservation Program, to better recognize and protect Baltimore's forest patches.

Baltimore's Forest Conservation Program is due for revisions after the Baltimore City Landscape Manual is adopted. A thorough review of the manual should include input from stakeholders. The current manual fails to fit state-wide regulation to the urban context. For example, in determining the size of a forest patch, the manual should recognize that urban forest patches typically include more than one owner's property. In addition, the regulations should apply to all projects that would disturb at least 2,500 square feet of forest, for any reason. At present, the trigger for the regulation is the amount of disturbance, not whether the area to be disturbed is forested. In a revised program, the trigger should be related to the amount of forest and the amount to be disturbed. To facilitate GIS analysis, forest patches should be defined as consisting of at least 10,000 square feet of canopy. These are examples; a thorough review would identify additional changes.

**Strategy 3B: Protect specimen trees** (trees larger than 20 diameter at breast height) through the Landscape Manual, the Forest Conservation Program, and through new regulations that protect large trees and forest patches at all times, not just during development.

Some municipalities, such as Annapolis, regulate which trees can be cut on private property, with no development trigger. Such an ordinance would have the potential to preserve a substantial portion of Baltimore's tree canopy. However, it would need to be coupled with a strong education campaign on tree maintenance.

### **Goal 4: Engage Residents**

Forest patches can get much of the care they need from volunteer groups that learn about forest care (See Appendix B). They can remove invasive plants such as ivy and sometimes poison ivy, remove trash, and plant appropriate new trees. They can create trails and run community events. The recommendations that follow seek to foster increased resident stewardship of forest patches.

**Strategy 4A: Create a Forest Patch Registry.** Just as the City does its best to recognize established community-managed open spaces in the planning and disposition processes, it should also recognize the value of forest patches. Through the Department of Planning or the Division of Forestry, create a registry of forest patches where landowners can register the forest patches that include their land. Such forest patches could also include City-owned land and paper streets, as well as land that has met some test for abandonment. The regulations in the revised Baltimore City Forest Conservation Code and Manual should apply to all sites in the registry, perhaps with more stringent conditions.

**Strategy 4B: Create incentives for stewardship and preservation.** The Forest Preservation Act of 2013 (HB 706) provides for tax credits for reforestation or timber stand improvements on commercial forest land of 3 to 1000 acres. This legislation may provide a starting point for crafting legislation that would encourage stewardship and preservation of urban forest patches. Similarly, easements donated to public bodies or private land trusts could in some cases provide an incentive for preservation. Considering that forest patches tend to cross property boundaries, an easement program would encourage groups of residents to jointly protect areas of tree canopy. Baltimore City should determine what incentives for forest patch preservation are most practical, and create the tools to offer these incentives to Baltimore landowners.

**Strategy 4C: Provide stormwater fee credits** to residents who participate in forest stewardship activities. This creates a small financial incentive for residents to care for local forest patches.

**Strategy 4D: Fund educational programming** for forest stewardship through the stormwater utility. Such programs should include community organizing support as well as educational activities and materials. Volunteers rely on programming by nonprofits for expertise, mentoring, and materials.

**Strategy 4E: Refer all residents** interested in providing stewardship to forest patches to Baltimore Green Space's forest patch program.



## APPENDIX A

### FOUR NORTH BALTIMORE FOREST PATCHES AND BALTIMORE GREEN SPACE'S COMMUNITY ORGANIZING WORK

Baltimore Green Space's work with forest patches grew out of the sale of land in the Wilson Park Forest Patch, a sale that resulted in clear-cutting of a substantial portion of the forest patch. In addition to working on policy approaches to protect forest patches, we started a Stewards' Group to help residents learn how to care for their neighborhood forest patches. Some of the data in this paper was collected at these sites.

Through the Stewardship Group we provide sites with education, volunteers, and information about grants. One of the most exciting aspects of the group is the commitment of the forest stewards to participating in workshops in each others' communities. They have begun building a true coalition to support each other in learning and working in each other's forests.

#### **Govans Urban Forest Patch**

The York Road Partnership (YRP) wanted to care for an uncared-for forest patch along the west side of the 5200 block of York Road that was officially preserved (through use of the Baltimore City Forest Conservation Manual) when a CVS was built at the corner of York Road and Notre Dame Lane. They were unsure whether their presence was appropriate, and they didn't know how to care for the site, which had an excess of dumping and invasive plants such as English Ivy. We helped them understand that their presence was needed and to plan their first steps. We organized a tour of forest patches that was attended by Ian Yesilonis of the U.S. Forest Service, and he provided a list of starter projects. YRP recruited Loyola University's Rugby team to assist them on a series of 6 workdays. We also ran our first Villainous Vines workshop at this location. An enormous amount of trash has been removed and substantial ivy removed. With assistance from the Parks & People Foundation, the Partnership has begun planting native trees in areas where dumping and ivy had made it impossible for saplings to emerge, and Ian Yesilonis has begun to develop a management plan. We are helping the group learn more about the conservation easement that protects the land. We estimate that the forest patch is about one-third of an acre.

#### **Springfield Woods**

At the beginning of 2012, Butch Berry started caring for a 2.5-acre forest patch he had played in as a child. He removed trash, especially from a stream, and cut paths. We helped Butch get formal permission from the owner to maintain the forest. In addition, we have provided him with information about plants, and have given him advice on outreach and community organizing – all of which he immediately puts to use. We've also connected him with resources such as volunteers and grants. For example, about 30 Hopkins volunteers spent a day removing trash. We hosted several bird walks at Springfield Woods and the next one will include a local Boy Scout troop. Springfield Woods is receiving a Parks & People Foundation grant this season. The forest patch is located just south of 43rd Street, and just west of the Alameda. For updates on Springfield Woods, visit the Facebook page "Friends of the Springfield Woods of Baltimore."

**Wilson Park Woods**

Wilson Park is the neighborhood that inspired our Forest Patch program – their beautiful forest patch was substantially reduced by clear-cutting of forest (without breaking any rules). Most of the residents are older, but they are moving toward more active management of the remaining forest. The residents have hosted two workshops on removal of invasive plants. Each time we have held an event more residents have taken up care of the forest patch. Residents are also working to adopt the unpaved street, to better protect it from encroachment or sale. The group will receive a grant this season from the Parks & People Foundation, and we connected the residents with volunteers. The forest patch features a large American elm, estimated at 50-80 years old, and a very small spring. Before the tree removal, the forest patch included at least 30,800 square feet, or about seven-tenths of an acre. The forest patch is located just south of Cold Spring Lane and west of the Alameda, along the paper street known as Kenilworth Avenue.

**Winston-Govans Forest Patch**

This patch is composed of a center-block lot of 16,300 square feet, two paper streets, and substantial tree canopy in the back yards surrounding the central lot. We connected with the Winston Govans forest patch through a bird walk we hosted. They are now in the midst of adopting the paper streets that comprise a good portion of the forest. The site includes a very large white oak. Additionally, we have twice noted bald eagles at this site. Once the streets are adopted the community will be able to apply for greening grants and receive native trees from Tree Baltimore at a discounted rate.

## APPENDIX B

### BIRDS OF NOTE AT NORTH BALTIMORE FOREST PATCHES

#### Winston Govans Forest Patch

##### Birds noted on April 14, 2012

Cooper's Hawk  
 Bald Eagle 1  
 Mourning Dove 7  
 Rock Pigeon 5  
 Red-bellied Woodpecker 2  
 Downy Woodpecker 1  
 Northern Flicker 2 (nest found)  
 Blue Jay 4  
 Fish Crow 2  
 American Crow 1  
 Crow species 2  
 Carolina Chickadee 6  
 White-breasted Nuthatch 1  
 Carolina Wren 1  
 Northern Mockingbird 2  
 European Starling 5  
 Northern Cardinal 3  
 Field Sparrow 1  
 Chipping Sparrow 14  
 White-throated Sparrow 2  
 Dark-eyed (slate-colored) Junco 3  
 Brown-headed Cowbird 2  
 Common Grackle 10  
 House Finch 4  
 House Sparrow 2

#### Wilson Park Forest Patch

##### Birds Noted June 24, 2011

Northern Cardinal 3  
 Gray Catbird 5  
 Fish Crow 2  
 Red-eyed Vireo 2  
 American Robin 3  
 Carolina Chickadee 2  
 Northern Mockingbird 1  
 Scarlet Tanager 1  
 Great-crested Flycatcher 1  
 Baltimore Oriole 2  
 Tufted Titmouse 1  
 Chimney Swift 7  
 American Goldfinch 3  
 American Crow 1  
 White-eyed Vireo 1

Least Flycatcher 1  
 House Wren 1  
 Downy Woodpecker 1

#### Springfield Woods

##### Birds Noted June 24, 2011

Gray Catbird 3  
 Eastern Pewee 1  
 Carolina Chickadee 1  
 Northern Cardinal 1  
 Tufted Titmouse 2  
 Blue Jay 1  
 Chimney Swift 3  
 Yellow Warbler 1  
 Acadian Flycatcher 1  
 Common Grackle 3  
 House Sparrow 1  
 House Finch 1  
 Chestnut-sided Warbler 1  
 Red-winged Blackbird 1  
 American Robin 1  
 Great Crested Flycatcher 1  
 Cedar Waxwing 5  
 Red-eyed Vireo 1

##### Birds Noted April 28, 2012

Mourning Dove  
 Chimney Swift  
 Ruby-throated Hummingbird  
 Red-bellied Woodpecker  
 Northern Flicker  
 Empidonax Flycatcher  
 Red-eyed Vireo  
 White-eyed Vireo  
 Blue Jay  
 American Crow  
 Tufted Titmouse  
 Carolina Chickadee  
 House Wren  
 Ruby-crowned Kinglet  
 Blue-gray Gnatcatcher 2  
 American Robin  
 Gray Catbird  
 European Starling  
 Northern Parula  
 Yellow-rumped Warbler 30  
 Black-throated Green Warbler  
 Bay-breasted Warbler  
 Black-and-white Warbler  
 Common Yellowthroat

Northern Cardinal  
 Eastern Towhee  
 White-throated Sparrow  
 Brown-headed Cowbird

#### Results of Breeding Survey, June 22, 2012

##### Species definitely breeding:

Black Vulture 3  
 Carolina Wren 2  
 European Starling 2  
 American Robin 10  
 Gray Catbird 8  
 Northern Cardinal 4  
 House Finch 3

##### Species possibly breeding:

Downy Woodpecker 3  
 Eastern Wood-pewee 1  
 Acadian Flycatcher 1  
 Great Crested Flycatcher 1  
 House Wren 1  
 Tufted Titmouse 1  
 Carolina Chickadee 4  
 Cedar Waxwing 12  
 Red-eyed Vireo 2  
 House Sparrow 5

##### Other Species Observed:

Mourning Dove 5  
 Chimney Swift 6  
 White-breasted Nuthatch 1  
 Common Grackle 10  
 American Goldfinch

#### Birds Noted November 17, 2012

Turkey Vulture 7  
 Bald Eagle 1  
 Red-tailed Hawk  
 Ruby-throated Hummingbird 1  
 Red-bellied Woodpecker 2  
 Downy Woodpecker 1  
 Hairy Woodpecker 1  
 Blue Jay 6  
 American Crow 5  
 Fish Crow 1  
 Crow species 23  
 Tufted Titmouse 3  
 Carolina Chickadee 2

Golden-crowned Kinglet 2  
Ruby-crowned Kinglet 1  
Winter Wren 1  
American Robin 10  
Hermit Thrush 3  
Northern Cardinal 3  
House Finch 1  
American Gold Finch

**Trees of Note at Winston-  
Govans, Govans Urban Forest,  
Springfield Woods, and  
Wilson Park Woods**

American Beech  
American Elm  
American Holly  
arrowwood  
basswood  
black cherry  
black gum  
black locust  
black oak  
black Walnut  
box elder  
brookside alder  
chestnut  
common elderberry  
fringetree  
green ash  
greenbrier  
hawthorn  
highbush blueberry  
red maple  
redbud  
silky dogwood  
silver maple  
southern red oak  
spicebush  
strawberry-bush  
thornless honey locust  
tuliptree  
white ash  
white oak  
willow oak  
yew

## APPENDIX C

### FOREST PATCH DOCUMENTATION

Jason Hesch

#### Input Data:

- 1) forest\_patches\_original.shp
- 2) geodata.EGISDATA.tree\_canopy.shp
- 3) geodata.EGISDATA.park
- 4) geodata.EGISDATA.realprop
- 5) geodata.EGISDATA.baltcity
- 6) geodata.EGISDATA.water
- 7) geodata.EGISDATA.railroad

#### Edited Data:

- 1) Forest\_patches\_merge
- 2) Forest\_patches\_GT10K.shp
- 3) Forest\_GT10K\_Balt\_clip.shp
- 4) Forest\_patches\_Dissolved\_clip.shp
- 5) Parks\_dissolved.shp
- 6) Forest\_Centroids\_park\_2.shp
- 7) Forest\_Park\_Not\_Centroid.shp
- 8) Forest\_touch\_park\_2.shp
- 9) Forest\_outside\_parks\_2.shp
- 10) Forest\_Near\_Streams.shp
- 11) Parks\_intersect\_ForestStreams.shp
- 12) Forest\_50ft\_Railroad.shp
- 13) Forest\_100ft\_Railroad.shp
- 14) Parks\_intersect\_Railroad100ft.shp
- 15) Parks\_intersect\_Railroad100ft\_Dissolved.shp
- 16) PublicOwnedLand\_Baltimore\_v2.shp
- 17) PublicOwnedLand\_Federal\_v2.shp
- 18) Forest\_PublicOwnLand\_Federal.shp
- 19) Forest\_PublicOwnLand\_Baltimore.shp
- 20) Forest\_Lots\_2.shp
- 21) Forest\_Property\_spatialJoin5.shp
- 22) Buildings\_Forestry.shp

#### Preparing the data for spatial analysis.

1. Used the Cartography Tools > Generalization > **Aggregate Polygons function** on forest\_patches\_original.shp to dissolve abutting polygons so that each polygon represents a single contiguous patch. Output Data: forest\_patches\_merge
2. **Select by Attribute** to query patches that are 10,000 square feet and larger on forest\_patches\_merge. Exported selection. Output Data: forest\_patches\_merge\_GT10K.shp
3. Used Analysis Tools > Extract > **Clip** on forest\_patches\_merge\_GT10K with geodata.EGISDATA.baltcity (Baltimore city boundary) to extract the forest patches which are within the city boundary. Output Data: Forest\_GT10K\_Balt\_clip.shp
4. **Dissolved** Forest\_GT10K\_Balt\_clip.shp to make a single polygon. Output Data: Forest\_Patches\_Dissolved\_Clip.shp

#### Parks

5. Data Management Tools > Generalization > **Dissolve** geodata.EGISDATA.park. This was

necessary because the city's park layer had parks boundaries within parks. Output Data: Parks\_Dissolved.shp

6. **Select by location** > Source Layer: Parks\_Dissolved.shp. Target layer: Forest\_GT10K\_Balt\_clip. Spatial Selection method: have their centroids in the source layer. Exported selection. Output: Forest\_Centroids\_Park\_2.shp
7. Created **new column** in Forest\_GT10K\_Balt\_clip.shp attribute table.
8. Opened Forest\_GT10K\_Balt\_clip.shp attribute table. **Joined** Forest\_Centroids\_Park\_2.shp to table. Where all objectID matched I typed in "Centroid" as the value in the "Park" field.
9. Opened Forest\_GT10K\_Balt\_clip.shp attribute table. **Select by attribute** > field: "Park" equal to value "centroid". Reverse selection to get all polygon features that are not centroid. Exported selection. Output: Forest\_Park\_Not\_Centroid.shp.
10. **Cut & paste** polygon ObjectID#3088 from Forest\_Park\_Not\_Centroid layer to Forest\_Centroids\_Park\_2. This was a very large polygon with a majority of its area within a park. Revised Forest\_GT10K\_Balt\_clip.shp table to reflect this change by adding "centroid" in "Park" field.
11. **Select by location** > Source Layer: Parks\_Dissolved.shp. Target layer: Forest\_Park\_Not\_Centroid.shp. Spatial Selection method: intersect the source layer. Exported selection. Output Data: Forest\_touch\_parks\_2.shp
12. Opened Forest\_GT10K\_Balt\_clip.shp attribute table. **Joined** Forest\_touch\_parks\_2.shp to table. Where all objectID matched typed in "touch" as the value in the "Park" field.
13. Opened Forest\_GT10K\_Balt\_clip.shp attribute table. **Select by attribute** > field: "park" IS NULL. To select all polygons that are not touching or centroid. Exported selection. Output: Forest\_outside\_parks\_2.shp

#### Streams

14. **Select by location** > Source Layer: geodata.EGISDATA.water. The target layer: Forest\_GT10K\_Balt\_clip.shp. Spatial Selection method: are within a distance of 50 ft of the source layer feature. Includes patches which barely touch a water source. Exported selection. Output Data: Forest\_Near\_Streams.shp
15. **Select by location** > Source Layer: Forest\_Near\_Streams.shp. Target Layer: geodata.EGISDATA.park. Spatial Selection Method: intersect the source layer. Exported selection. Output Data: Parks\_intersect\_ForestStreams.shp
16. **Dissolve Function:** Data Management Tools > Generalization > Dissolve Parks\_intersect\_ForestStreams.shp. Sum Statistics Shape Area. For display purposes, to show only outside boundaries. i.e. to not show boundary of parks within parks show. Output Data: Parks\_intersect\_ForestStreams\_Dissolved.shp

#### Transit Lines

1. **Select by location** > Source Layer: geodata.EGISDATA.railroad. Target Layer: Forest\_GT10K\_Balt\_clip.shp. Spatial Selection Method: are within a distance of 50 ft and 100 ft of the source layer. Exported selection. Output Data: Forest\_50ft\_Railroad.shp & Forest\_100ft\_Railroad.shp
2. Forest\_100ft\_Railroad.shp: **Symbology** > Categories > Unique values > Field Value: "PARK". Add value "outside". With check mark on "all other values". Renamed labels.
3. **Select by location** > Source Layer: Forest\_100ft\_Railroad.shp Target Layer: geodata.EGISDATA.park Spatial Selection Method: intersect the source layer. Exported selection. Output Data: Parks\_intersect\_RailRoad100ft.shp
4. **Dissolve Function:** Data Management Tools > Generalization > Dissolve Sum Statistics Shape Area. Output Data: Parks\_intersect\_RailRoad100ft\_Dissolved.shp

5. geodata.EGISDATA.railroad: **Symbology** > Categories > Unique values > Value Field: "SUBTYPE". Add value: "RLABD" and "RLABDH". With check mark on "all other values". Renamed labels.

### Public Real Estate Ownership

1. Open geodata.EGISDATA.realprop > **Select by attribute** > Owner\_Abbr = HABC, MCC, DHCD. Exported selection. Output Data: PublicOwnLand\_Baltimore\_v2.shp
  - a. PublicOwnLand\_Baltimore.shp: Owner\_Abbr = HABC, MCC, DHCD. (same as above, double checking numbers. However, geodata.EGISDATA.realprop is constantly being updated. Therefore numbers are used statically at one point in time.)
2. Open geodata.EGISDATA.realprop > **Select by attribute** > Owner\_Abbr = USA, HUD, VA Exported selection. Output Data: PublicOwnLand\_federal\_v2.shp
  - a. PublicOwnLand\_federal.shp: Owner\_Abbr = USA, HUD. (Missing VA value)
3. **Select by location** > Source Layer: PublicOwnLand\_Federal.shp. Target layer: Forest\_outside\_parks.shp. Spatial Selection method: intersect the source layer. Exported selection. Output Data: Forest\_PublicOwnLand\_federal.shp
4. **Select by location** > Source Layer: PublicOwnLand\_Baltimore.shp. Target layer: Forest\_outside\_parks.shp. Spatial Selection method: intersect the source layer. Exported selection. Output Data: Forest\_PublicOwnLand\_baltimore.shp

### Forest Real Estate Ownership

1. **Select by location** > Source Layer: Forest\_GT10K\_Balt\_clip.shp Target Layer: geodata.EGISDATA.realprop. Spatial Selection Method: intersect the source layer. Exported selection. Output Data: Forest\_Lots\_2.shp
  - a. Forest\_Lots.shp: Missing Owner\_Abbr field and other fields. Bad version.
2. **Hide fields:** Join\_Count, SubType\_GE, Section, Assessor, TaxBase, BfcvLand, BfcvImpr, LandExmp, ImprExmp, CityCred, StatCred, CcredAmt, ScredAmt, PermHome, AssesGrp, CurrLand, CurrImpr, ExampLand, ExmpImpr, FullCash, ExmpType, ExmpCode, UseGroup, SdatCode, ArTaxBas, DistSwch, Dist\_Id, StateTax, City\_tax, Ar\_owner, DeedBook, DeedPage, SaleDate, StdIrPre, St\_Name, St\_Type, Bldg\_no, Fraction, Unit\_num, Span\_num, SpanFrac, DhcdUse1, DhcdUse2, DhcdUse3, DhcdUse4, DwelUnit, Eff\_Unit, RoomUnit, RpdelTag, Respacy, SalePric, SrvCntr, Year\_build, LDate, OwnMde, Grmdrent
3. **Spatial Join:** Target Layer: Forest\_GT10K\_Balt\_clip. Join feature: Forest\_Lots\_2.shp. One-to-Many selected. Match: Intersect. Output Data: Forest\_Property\_spatial-Join5.shp. This action joins each forest patch to its respective real estate property it touches. i.e. one forest patch can touch or overlay 5 separate lots. This is for a look up table.
  - a. Fields to include: ObjectID\_1, PIN, Blocklot, FullAddr, Block, Lot, Ward, Lot\_Size, No\_Imprv, Zone Code, Owner\_Abbr, Owner\_1, Owner\_2, Owner\_3, Zip\_Code, Extd\_Zip, PropDesc, Neighbor, BdgSqft,

### Spatial Analysis: Statistics

Open Attribute-table > right-click *shape.area* > statistics > sum

1. **Tree Canopy:** 611,757,338 sf.  
(Forest Patches)
2. **Forest Patches:** 210,038,057 sf.
  - a. Percentage:  $(210,038,057_{\text{sf forests}} \div 611,757,338_{\text{Sf trees}}) = 0.343$
3. **Forest-Streams:** 114,609,535 sf.
  - a. Percentage:  $(114,609,535_{\text{sf forest Near Stream}} \div 210,038,057_{\text{sf forests}}) = 0.546$
  - b. Percentage:  $(114,609,535_{\text{sf forest Near Stream}} \div 611,757,338_{\text{Sf trees}}) = 0.187$
  - c. Percentage:  $(91,315,587_{\text{sf forest Near stream-Inside Parks}} \div 611,757,338_{\text{Sf trees}}) = 0.797$

- d. Percentage:  $(23,293,948_{\text{sf forest Near stream-Outside Parks}} \div 611,757,338_{\text{Sf trees}} = 0.203)$
  - 4. Forest-in-Parks Group1 (patches completely within): 9,867,300 sf**
    - a. Percentage:  $(9,867,300_{\text{sf forest Within Parks}} \div 210,038,057_{\text{sf forests}} = 0.047)$
    - b. Percentage:  $(9,867,300_{\text{sf forest Within Parks}} \div 611,757,338_{\text{Sf trees}} = 0.016)$
  - 5. Forest-in-Parks Group2 (centroids in parks): 88,977,449 sf**
    - a. Percentage:  $(88,977,449_{\text{sf forest Centroid Parks}} \div 210,038,057_{\text{sf forests}} = 0.424)$
    - b. Percentage:  $(88,977,449_{\text{sf forest Centroid Parks}} \div 611,757,338_{\text{Sf trees}} = 0.145)$
  - 6. Forest-touch-Parks Group1: 106,360,279 sf**
    - a. Percentage:  $(106,360,279_{\text{sf forest Touch Parks}} \div 210,038,057_{\text{sf forests}} = 0.506)$
    - b. Percentage:  $(106,360,279_{\text{sf forest Touch Parks}} \div 611,757,338_{\text{Sf trees}} = 0.174)$
  - 7. Forest-touch-Parks Group2: 27,250,131 sf**
    - a. Percentage:  $(27,250,131_{\text{sf forest Touch Parks}} \div 210,038,057_{\text{sf forests}} = 0.130)$
    - b. Percentage:  $(27,250,131_{\text{sf forest Touch Parks}} \div 611,757,338_{\text{Sf trees}} = 0.045)$
  - 8. Forest-within&touching-Parks Group1 & 2: 116,227,580 sf**
    - a. Percentage:  $(116,227,580_{\text{sf forest Within & Touch Parks}} \div 210,038,057_{\text{sf forests}} = 0.553)$
    - b. Percentage:  $(116,227,580_{\text{sf forest Within & Touch Parks}} \div 611,757,338_{\text{Sf trees}} = 0.190)$
  - 9. Forest-outside-Parks Group1 & 2: 93,810,478 sf**
    - a. Percentage:  $(93,810,478_{\text{sf forest Outside Parks}} \div 210,038,057_{\text{sf forests}} = 0.447)$
    - b. Percentage:  $(93,810,478_{\text{sf forest Outside Parks}} \div 611,757,338_{\text{Sf trees}} = 0.153)$
  - 10. Forest-Railroads 50ft: 36,439,516 sf**
    - a. Percentage:  $(36,439,516_{\text{sf RR50}} \div 210,038,057_{\text{sf forests}} = 0.173)$
    - b. Percentage:  $(36,439,516_{\text{sf RR50}} \div 611,757,338_{\text{Sf trees}} = 0.060)$
  - 11. Forest-Railroads 100ft: 41,121,004 sf**
    - a. Percentage:  $(41,121,004_{\text{sf RR100}} \div 210,038,057_{\text{sf forests}} = 0.196)$
    - b. Percentage:  $(41,121,004_{\text{sf RR100}} \div 611,757,338_{\text{Sf trees}} = 0.067)$
  - 12. Forest (outside parks)-Public ownership Federal v1: 3,721,868 sf**
    - a. Percentage:  $(3,721,868_{\text{sf forest fed}} \div 210,038,057_{\text{sf forests}} = 0.018)$
    - b. Percentage:  $(3,721,868_{\text{sf forest fed}} \div 611,757,338_{\text{Sf trees}} = 0.006)$
  - 13. Forest (outside parks)-Public ownership Baltimore City v1: 32,700,272 sf**
    - a. Percentage:  $(32,700,272_{\text{sf forest Balt}} \div 210,038,057_{\text{sf forests}} = 0.153)$
    - b. Percentage:  $(32,700,272_{\text{sf forest Balt}} \div 611,757,338_{\text{Sf trees}} = 0.053)$
- (actual property parcels)
- 14. Forested Private Real Estate: 451,593,978 sf ; 8,561 #**
    - a. Percentage:  $(451,593,978_{\text{sf forested private RE}} \div 1,411,908,909_{\text{sf city-wide private RE}} = 0.320)$ 
      - i. Pct#:  $(8,561_{\text{num forested private RE}} \div 211,256_{\text{num city-wide private RE}} = 0.041)$
    - b. Percentage:  $(451,593,978_{\text{sf forested private RE}} \div 714,151,274_{\text{sf total forested RE}} = 0.632)$ 
      - i. Pct#:  $(8,561_{\text{num forested private RE}} \div 9,462_{\text{num total forested RE}} = 0.905)$
    - c. Percentage:  $(451,593,978_{\text{sf forested private RE}} \div 1,787,102,020_{\text{sf total city-wide RE}} = 0.253)$ 
      - i. Pct#:  $(8,561_{\text{num forested private RE}} \div 224,145_{\text{num total city-wide RE}} = 0.038)$
  - 15. Forested Public Federal Real Estate: 1,967,176 sf ; 9 #**
    - a. Percentage:  $(1,967,176_{\text{sf forested Fed RE}} \div 7,995,928_{\text{sf city-wide Fed RE}} = 0.246)$ 
      - i. Pct#:  $(9_{\text{num forested Fed RE}} \div 151_{\text{num city-wide Fed RE}} = 0.060)$
    - b. Percentage:  $(1,967,176_{\text{sf forested Fed RE}} \div 714,151,274_{\text{sf total forested RE}} = 0.003)$ 
      - i. Pct#:  $(9_{\text{num forested Fed RE}} \div 9,462_{\text{num total forested RE}} = 0.001)$
    - c. Percentage:  $(1,967,176_{\text{sf forested Fed RE}} \div 1,787,102,020_{\text{sf total city-wide RE}} = 0.001)$



i. Pct#:  $(9 \frac{\text{num forested Fed RE}}{\text{num total city-wide RE}} \div 224,145 = 0.00004)$

**16. Forested Public Baltimore Real Estate: 260,590,120 sf ; 892<sub>#</sub>**

a. Percentage:  $(260,590,120 \frac{\text{sf forested Balt RE}}{\text{sf city-wide Balt RE}} \div 367,197,182 = 0.710)$

i. Pct#:  $(892 \frac{\text{num forested Balt RE}}{\text{num city-wide Balt RE}} \div 12,738 = 0.070)$

b. Percentage:  $(260,590,120 \frac{\text{sf forested Balt RE}}{\text{sf total forested RE}} \div 714,151,274 = 0.365)$

i. Pct#:  $(892 \frac{\text{num forested Balt RE}}{\text{num total forested RE}} \div 9,462 = 0.094)$

c. Percentage:  $(260,590,120 \frac{\text{sf forested Balt RE}}{\text{sf total city-wide RE}} \div 1,787,102,020 = 0.146)$

i. Pct#:  $(892 \frac{\text{num forested Balt RE}}{\text{num total city-wide RE}} \div 224,145 = 0.004)$

**17. Forested Real Estate which Abutt a stream: 362,575,197 sf ; 788<sub>#</sub>**

a. Percentage:  $(362,575,197 \frac{\text{sf forested abutt stream RE}}{\text{sf city-wide public RE}} \div 375,193,111 = 0.966)$

i. Pct#:  $(788 \frac{\text{num forested abutt stream RE}}{\text{num city-wide public RE}} \div 12,889 = 0.061)$

ii. public = federal + baltimore stats

b. Percentage:  $(362,575,197 \frac{\text{sf forested abutt stream RE}}{\text{sf city-wide private RE}} \div 1,411,908,909 = 0.257)$

i. Pct#:  $(788 \frac{\text{num forested abutt stream RE}}{\text{num city-wide private RE}} \div 211,256 = 0.004)$

c. Percentage:  $(362,575,197 \frac{\text{sf forested abutt stream RE}}{\text{sf total forested RE}} \div 714,151,274 = 0.508)$

i. Pct#:  $(788 \frac{\text{num forested abutt stream RE}}{\text{num total forested RE}} \div 9,462 = 0.083)$

d. Percentage:  $(362,575,197 \frac{\text{sf forested abutt stream RE}}{\text{sf total city-wide RE}} \div 1,787,102,020 = 0.203)$

i. Percentage:  $(788 \frac{\text{num forested abutt stream RE}}{\text{num total city-wide RE}} \div 224,145 = 0.004)$

e. Percentage:  $(196,256,936 \frac{\text{sf forested abutt stream private RE}}{\text{sf forested private RE}} \div 451,593,978 = 0.435)$

i. Pct#:  $(542 \frac{\text{num forested abutt stream private RE}}{\text{num forested Private RE}} \div 8,561 = 0.063)$

f. Percentage:  $(166,318,261 \frac{\text{sf forested abutt stream public RE}}{\text{sf forested public RE}} \div 262,557,296 = 0.633)$

i. Pct#:  $(246 \frac{\text{num forested abutt stream public RE}}{\text{num forested public RE}} \div 901 = 0.273)$

**18. Forested Real Estate which have no improvement (i.e. no homes): 166,265,724 sf ; 2,216<sub>#</sub>**

a. Percentage:  $(166,265,724 \frac{\text{sf forested NOimprv RE}}{\text{sf city-wide public RE}} \div 375,193,111 = 0.443)$

i. Pct#:  $(2,216 \frac{\text{num forested NOimprv RE}}{\text{num city-wide public RE}} \div 12,889 = 0.172)$

ii. public = federal + baltimore stats

b. Percentage:  $(166,265,724 \frac{\text{sf forested NOimprv RE}}{\text{sf city-wide private RE}} \div 1,411,908,909 = 0.118)$

i. Pct#:  $(2,216 \frac{\text{num forested NOimprv RE}}{\text{num city-wide private RE}} \div 211,256 = 0.010)$

c. Percentage:  $(166,265,724 \frac{\text{sf forested NOimprv RE}}{\text{sf total forested RE}} \div 714,151,274 = 0.233)$

i. Pct#:  $(2,216 \frac{\text{num forested NOimprv RE}}{\text{num total forested RE}} \div 9,462 = 0.234)$

d. Percentage:  $(166,265,724 \frac{\text{sf forested NOimprv RE}}{\text{sf total city-wide RE}} \div 1,787,102,020 = 0.093)$

i. Percentage:  $(2,216 \frac{\text{num forested NOimprv RE}}{\text{num total city-wide RE}} \div 224,145 = 0.010)$

e. Percentage:  $(93,608,439 \frac{\text{sf forested NOimprv private RE}}{\text{sf forested private RE}} \div 451,593,978 = 0.207)$

i. Pct#:  $(1,554 \frac{\text{num forested NOimprv private RE}}{\text{num forested Private RE}} \div 8,561 = 0.182)$

f. Percentage:  $(72,657,286 \frac{\text{sf forested NOimprv public RE}}{\text{sf forested public RE}} \div 262,557,296 = 0.277)$

i. Pct#:  $(662 \frac{\text{num forested NOimprv public RE}}{\text{num forested public RE}} \div 901 = 0.735)$



Baltimore Green Space works to protect community gardens, pocket parks, and other open spaces created and cared for by city residents.

At the request of community groups, Baltimore Green Space acquires community-managed open spaces and provides support to those who care for them. This allows communities to ensure that their urban oases endure without taking on the responsibilities of acquisition, ownership, and liability.

Our Forest Patch Program provides guidance to residents who want to learn to care for a forest patch in Baltimore City. For more information, please write to [office@baltimoregreenspace.org](mailto:office@baltimoregreenspace.org), call 443-996-3811, or visit [baltimoregreenspace.org](http://baltimoregreenspace.org)

**Baltimore Green Space**  
**A Land Trust for Community-managed Open Space**