Reforesting Birmingham's Historic George Ward Park with seedlings grown from seeds collected from native trees

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Abstract

Contact with nature is a vital part of mental and physical well-being. Urban parks are a great place for people of all ages to experience nature. George Ward Park, a historic urban park in Birmingham, Alabama, has been suffering from a loss of nature. Natural tree seed and herbaceous vegetation have not been allowed to germinate, primarily due to city maintenance practices in the park. As part of the Centennial Tree Planting Project, the two Alabama Garden Club of America member-clubs headed a reforestation project in George Ward Park. This project is unique in that the park was reforested with seedlings grown from seeds collected from existing trees in the park. Another aspect of the project was to keep the city crew out and allow nature to take its course for the first time since the park's opening. This study evaluates the reforested area after 5 years. Mature trees, planted trees, volunteer trees, and herbaceous vegetation were examined. About 1/3 of the planted trees appear to still be surviving and tons of volunteer trees and herbaceous species have colonized the area in the past 5 years. It is the hopes of this project to be used as a reforestation model for other areas in need of human intervention in order to regenerate.

Urban Parks

Frederick Law Olmsted, the father of landscape architecture, set the stage for the American park movement. During his 40-year career Olmsted and his partners carried out over 500 commissions, including some of the most beloved landscapes in the United States: Central Park, US Capitol grounds, the Biltmore estates, Yosemite, the Great Tetons, and the Niagara Falls Reservation, among many others (Birmingham Historical Society, 2006). His design of New York's Central Park, created in 1859, sparked the start of the park movement in the United States, which was at its peak between1890 and 1940. Parks were seen as being so important that even in the depths of the Great Depression many parks still received large sums of money and support from the federal government (Harnik, 2003). Frederick Law Olmsted wanted his parks to be available to everyone because he believed that nature could have a powerful positive psychological effect on people. One of his fundamental design principles was to work up the natural character of the site. He passed on his techniques to his son and stepson, Frederick Law Olmsted Jr. and John Charles, who both later came to run Olmsted Sr.'s successor firm, Olmsted Brothers (Birmingham Historical Society, 2006).

Olmsted Brothers was the top park-planning firm in the early twentieth century. They developed plans for park systems in cities such as Chicago, Boston, Baltimore, Portland, Seattle, Buffalo, and Louisville. Edward Clark Whiting of Olmsted Brothers worked under Frederick Law Olmsted Jr. and was directly responsible for designing Birmingham's park system. Parks were planned within easy walking distance from every house. Although not all of the Olmsted plan was put into action, some parks and neighborhoods are based on this design. The original Olmsted vision for Birmingham included plans for parks such as George Ward, Avondale, Kelly Ingram, Caldwell, East Lake, and Lynn Parks, as well as neighborhoods such as Mountain Brook, that enhance the natural landscape of the area (Birmingham Historical Society, 2006).

After World War II the park movement drastically declined. Instead, efforts were put into developing suburbs. Most parks began to suffer, some because of previous overuse resulting in trampled plants, erosion, and loss of soil resiliency and health, while others declined due to graffiti, vandalism, crime, and the invasion of nonnative species, all of which can be related to the underuse of a park. Some people at the time even had a costly assumption that private backyards could replace the services provided by city parks (Harnik, 2003). However, still today many parks are heavily used and remain important in the lives of countless people.

Recently, urban parks have been gaining much need support. Urban development is continuously occupying more and more land that it can no longer be excluded from conservation efforts (Van Rossum, 2010). It is vital to preserve nature close to where people live and work (Chiesura, 2004). Urbanization, which destroys natural ecosystems, has intensified globally in recent decades. More than half of humans now live in cities, with $1/10^{th}$ living in megacities of at least 10 million people (Roy, et al, 2012). Even cities that are considered all built out have areas in which they can increase their urban nature. Parks can utilize areas such as abandoned properties, filled landfills, and underutilized rail depots. Parks provide many benefits to cities. They clean the air and water, filter wind and noise, act as outdoor classrooms, increase urban tourism, and can increase property value (Harnik, 2003). Also, urban parks provide the city dweller a much-needed space to experience and interact with nature.

Contact with nature seems to be an essential part of being happy, healthy, and mentally stable. Richard Louv's book *Last*

Child in the Woods: saving our children from nature-deficit disorder is an excellent source that goes in depth explaining why we as humans need direct contact with nature. Throughout his book he cites many valid studies related to the issue. In one notable study done by Nancy M. Wells, it was shown by a pre-move/post-move study design on low-income urban children that cognitive functioning increased most in those children who were moved to homes with the "most greenness" (Wells, 2000). Another study by Nancy Wells and colleague Gary Evans reveals that children living in close proximity to nature feel less stress from stressful events than children who live in low-nature conditions (Wells and Evans, 2003). Another study concluded that children function and concentrate better after being in green spaces (Taylor, Luo, and Sullivan, 2001). Studies have indicated that hospitals with views of trees and nature correspond with faster recovery time and similarly, that inmates with views of nature were better behaved and got released early more often. Nature also builds character in ways that organized sports cannot (Louv, 2006). Countless studies back up the theory that nature is needed for healthy development and well-being. Urban parks can be a great place for human-nature interactions.

Trees

A tree starts its life by breaking the embryo's dormancy during germination. The first shoots and roots emerge and the seed's stored food is used as energy (Rodd and Stackhouse, 2008). It enters the seedling stage when new roots begin obtaining nutrients from the soil. During this stage a strong roots system begins to develop. Seedlings are followed by the fastest growing stage, the sapling stage, where most energy is put towards upward growth. When a tree is mature its energy use is focused on spreading its canopy wider, increasing its wood bulk, and producing lots of flowers and fruits. Over mature trees are in the long, slow process of decline; however, they do not actually ever stop growing wood or shoots. The next stage, senescence, involves dead limbs and a hollow, decaying trunk. Death eventually follows (Rodd and Stackhouse, 2008).

Trees grow best in soil that has a balance between air and water. Typically the soil that trees grow in has a top layer of humus formed by decaying tree leaves and debris. This is a natural recycling process. Litter from trees and animals are broken down in the soil by insects, fungi, and bacteria. Plants can then take up these nutrients through their roots to fuel their growth. Later, fallen plant debris is broken down, returning the minerals to the soil and making them again available to be taken up by roots. Most roots are concentrated in the subsoil, the layer below the humus. A large oak can supply 250,000 leaves to the soil each fall (Rodd and Stackhouse, 2008).

Humans and trees have always had a unique relationship. Humans find uses in every part of the tree. They provided food and materials, along with shade and shelter. Trees planted around a house can significantly decrease heating and cooling costs. Trees shading bodies of water are necessary for some animal life to survive. They also provide fuel for fire, the key to functioning as the world we know today (Hageneder, 2005). Roots hold soil in place, reduce the effects of flooding and help with erosion (Russell and Cutler, 2004). Trees also help to recycle water by moving it from the ground into the atmosphere and can have an effect on weather patterns by increasing humidity and generating rainfall (Rodd and Stackhouse, 2008).

All life forms on earth rely on plants' ability to photosynthesize. Plants absorb carbon dioxide and release the oxygen that animals need to live. Trees have the ability to produce large amounts of oxygen, which has enabled other life forms, such as humans, to evolve. Research has shown that each day one acre of trees produces enough oxygen to keep 18 people alive. Trees are able to store large amounts of carbon in their woody tissue, a capability termed carbon sequestration. The carbon dioxide that trees store has important impacts on all organisms. Carbon dioxide is the number one greenhouse gas, meaning that it traps infrared radiation within the earth's atmosphere leading to heating of the earth's surface. A healthy tree can store around 13 pounds of carbon annually and one acre of trees can store 2.5 tons of carbon per year (Russell and Cutler, 2004). Worldwide, plants capture and store an estimated 100 billion tons of carbon per year (Rodd and Stackhouse, 2008). Trees are the most efficient way to remove carbon dioxide from the atmosphere and are the ultimate air filters. They replace carbon dioxide with oxygen and filter airborne particles that are a major cause of respiratory problems (Russell and Cutler, 2004). Trees absorb sulfur dioxide that is produced by burning coals, hydrogen fluoride and tetrafluride that can be release in the production of steel and phosphate fertilizer, chlorofluorocarbons produced by air-conditioning units and refrigerators, as well as many other particle pollutants produced as a by-product of internal combustion engines in cars (Russell and Cutler, 2004). In cities the size of Chicago, trees can annually filter out 234 tons of particle pollutants.

Although trees are excellent air filterers, their ideal growing conditions involve clean air. Photosynthesis is harder for trees in areas of high air pollution and the trees lenticels can become clogged by city dirt and grime (Russell and Cutler, 2004). However, trees are a necessary part of the urban landscape. Urban trees, trees in the city and suburbs, have 2 distinct origins. Most are planted trees but in some places the city was built around nature and a number of remnant trees that would have been part of the original forest are surviving. The number of remnant trees is decreasing each year and some cities lack them all together (Rodd and Stackhouse, 2008). Trees in cities do present some disadvantages: "littering" the city with unwanted plant parts such as leaves, pollen, fruits, and flowers, as well as large limbs and falling trees that could cause damage. Nonetheless, these shortcomings are over shadowed by the good that urban trees do. It is critical that efforts are being made to preserve and restore urban tree coverage.

Project History

For its 100^{th} year anniversary The Garden Club of America (GCA) celebrated trees by asking all 200 member-clubs to head a tree-related project in their community. The theme of the project, "preserving the past, growing the future", allowed all member clubs to develop their own project idea and has already been the source of more than 23,500 tree plantings. GCA headquarters in New York City has been working on a reforestation project in Central Park. The two GCA clubs in Alabama, Little Garden Club and Red Mountain Garden Club, focused on a reforestation project in the historic George Ward Park.

George Ward Park, originally named Greensprings Park, is a 100-acre park located in the Glen Iris neighborhood of Birmingham, Alabama, and was designed by the famous Olmsted Brothers landscape architect firm. It was first intended to be a green space within walking distance for residence as well as factory works, intended to allow them to easily escape to a forest that feels far away, but is actually in the middle of the city. It was designed to be a naturalistic park with trails through the natural forest and other features such as sports fields, meadows, and possibly a zoo. The park was carved into the existing forest and trees from the forest were left as landscape trees. A number of these same trees are still standing in the park and represent a direct link to the original forest. However, since its opening in 1925, the trees have produced virtually no offspring and the number of mature trees in the park is diminishing each year due to a number of reasons, including lightening, high winds, and old age.

Trees are not regenerating for a number of reasons. First, the area is maintained by the city with the maintenance practice of mow, blow, and grow. This means they clear out the area and then plant nursery available, usually nonnative, fast growing trees and shrubs. Often times these are trees that are not suitable for the site. The trees native to the site are not typically found in the nursery trade because they are slow growing. They consist of hickories, cherries, and largely several upland oak species. In addition to poor tree selection, the city usually plants single, isolated trees. Isolated trees are far more susceptible to decline than clumps of trees because there is no protection from surrounding trees. In addition, nonnative trees are not adapted to the area as well as native species are. All species are adapted to certain climate conditions. As a result of these factors, planted trees typically do not live for longer than a year. Many seeds in the park are lost to squirrels and other animals. Some are washed away along with eroding topsoil. Those seeds that do stay will typically dry out due to lack of leaf litter and topsoil at the site. The ground is now mostly composed of subsoil, which is not good for growing. Because the trees are not regenerating, if action is not taken George Ward Park could face the reality of losing all of it's trees.

The local Alabama GCA member club's tree project was to reforest George Ward Park with trees grown from seeds collected from the existing trees in the park. This idea was based on the thought that trees grown from local seeds will be more suited for the environment. At least one parent tree has survived at George Ward Park for about 100 years and was at a time part of the native broad-leaf deciduous forest that once defined the landscape. Preserving this genetic information was one way this project strove to "preserve the past", as well as to preserve and restore George Ward Park and have effects on preserving Birmingham's urban tree canopy as a whole.

The restoration area was approximately a 3-acre area on the eastern side of the park. Seeds were collected from the park, propagated, and grown into seedlings in a greenhouse at the Birmingham Botanical Gardens. Seedlings were planted a year later. In addition to planting trees, native tree seed and herbaceous vegetation was allowed to fall and germinate due to lack of city maintenance in the designated area.

Since 2009 about 1,000 trees have been planted, essentially made possible by Little Garden Club, Red Mountain Garden Club, Friends of George Ward Park, Glen Iris Neighborhood Association, The Birmingham Disc Golf Association, the Jefferson County Master Gardeners, the Japan American Gardens Society, and the staff of the Friends of the Birmingham Botanical Gardens. A group on invested volunteers is essential to any major replanting project. Volunteers are needed for years after the initial planting. It must been seen that the land continues to receive the proper attention that it needs. In the case of the George Ward Park reforesting project, this means insuring regular maintenance does not restart in the project area. The purpose of this study was to determine if the reforestation efforts over the last 5 years, which included native tree plantings and allowing nature to take its course, was successful at the site, which was previously virtually completely bare -- aside from some mature trees, in hopes that this method can be used as a model for further reforestation projects in areas such as other parks and storm damaged regions.

Methods

The study area was examined using sequential 33x33 ft plots (10x10 meter. Within each plot herbaceous growth was estimated to be 0, 25, 50, 75, or 100 percent. Standard turf grass was not included in the estimation. Herbaceous species occurring in the plot were recorded and up to the top three most abundant species were noted. Most plants were classified to species or genus, but several had to be clumped into groups such as "composites". Grass was found in nearly every plot and was only recorded if it was one of the top three predominant species. The site was also surveyed for trees that were planted as part of the original project and seedlings that have germinated on their own in the last 5 years. Height of planted and volunteer trees was estimated. Some invasive trees, such as mimosa, and shrubs were recorded in the herbaceous category; therefore numbers and heights are not known. The mature trees in each plot were also cataloged. The diameter at breast height was taken using a diameter tape at roughly 4.5 feet from the base of the uphill side of the tree. Trunks, roots, branches, and foliage were quickly examined in order to assign the tree a condition rating of good, fair, poor, or dead. Good trees have a full foliage and lack major deformities. Fair trees have some deformities or missing limbs and are in mediocre condition. Trees that are in the process of decline or are severely beat up were classified as poor. Dead trees are standing but exhibit no signs of life.

Results and Discussion

The study area was a total of 73 10x10 meter plot, and therefore 730 square meters or about 7,857.7 square feet.

MATURE TREES	#
Black cherry (*Prunus serotina*)	25
Sweetgum (*Liquidambar styraciflua*)	14
Post Oak (*Q. stellata*)	11
Virginia Pine (*Pinus virginiana*)	9
Southern Red Oak (*Q. falcata*)	8
Water Oak (*Q. nigra*)	8
Flowering Dogwood (*Cornus florida*)	8
Blackjack Oak (*Q. marilandica*)	3
Loblolly Pine (*Pinus taeda*)	2
Black Oak (*Q. velutina*)	1
Mockernut Hickory (*Carya tomentosa*)	1
Red Hickory (*Carya ovalis*)	1

Table 1 Mature trees by species: Total number of each species of mature trees found in the study area

A total of 91 standing mature trees were found in the study area, averaging 1.25 mature trees per plot. Number of mature trees within a plot ranges from 0 to 5. The mature canopy is made up of 12 different species: southern red oak (*Q. falcate*), post oak (*Q. stellate*), black oak (*Q. velutina*), blackjack oak (*Q. marilandica*), water oak (*Q. nigra*), black cherry (*Prunus serotina*), mockernut hickory (*Carya tomentosa*), red hickory (*Carya ovalis*), loblolly pine (*Pinus taeda*), Virginia pine (*Pinus virginiana*), flowering dogwood (*Cornus florida*), and sweetgum (*Liquidambar styraciflua*). **Table 1** shows the number of each species in the study area. Black cherry was the species most represented, followed by sweetgum and post oak. Of the 91 mature trees, 39 were found to be in good condition, 41 in fair, 9 in poor, and 3 were dead standing. **Figure 1** represents mature canopy health category percentages.

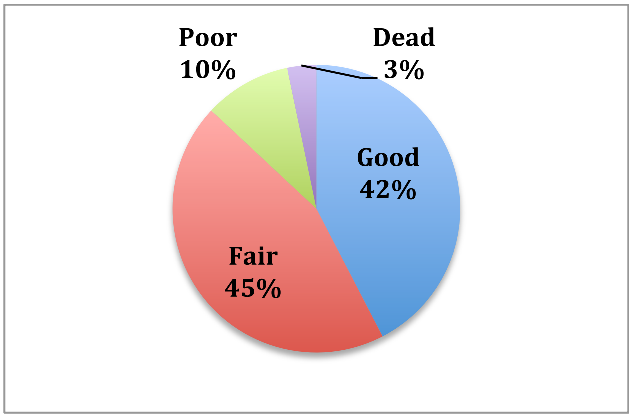

Figure 1- Mature Canopy Health: percentage of good, fair, poor, and dead mature tree.

Surviving Species	# found, % of surviving
Black oak	73, 23%
White oak	57, 18%
Blackjack oak	50, 15%
Post oak	35, 11%
Chestnut oak	23, 7%
Mockernut hickory	21, 7%
Southern red oak	15, 5%
Red hickory	10, 3%
Northern red oak	5, 2%
Scarlet oak	5, 2%
Persimmon	4, 1%
Blackgum	2, 0.5%
Burr oak	1, 0.25%

Table 2- Surviving Planted Seedlings: The right column shows the number of each speceis found, followed by the percentage of the surviving trees that each species makes up.

Sweetgum by far made up the largest number of good rated trees. Almost 80% of the mature sweetgum trees in the study area were given the condition rating of good. Only 20% of mature black cherries received this same rating; 60% were rated as fair. The largest percentage of mature trees were rated as fair. Diameter ranges from 6 to 34 inches. The median average diameter is 20. **Figure 2** represents the mean and range diameter of each mature tree species.

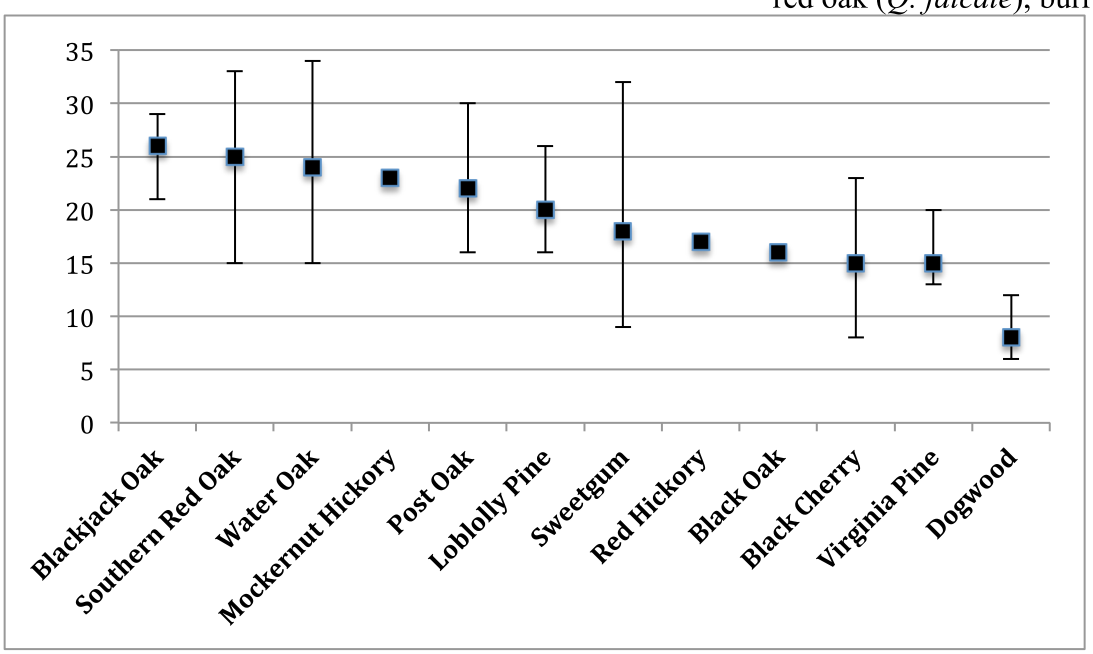

Figure 2- Mature Tree Diameter: The square represents the average diameter for each species The error bars show the range in diameter for each species

Thirteen species of planted trees were found in the site: red hickory (*Carya ovalis*), mockernut hickory (*Carya tomentosa*), persimmon, (*Diospyros spp.*), blackgum (*Nyssa sylvatica*), white oak (*Q. alba*), scarlet oak (*Q. coccinea*), southern red oak (*Q. falcate*), burr oak (*Q. macrocarpa*), blackjack oak (*Q. marilandica*), chestnut oak (*Q. prinus*), northern red oak (*Q. rubra*), post oak (*Q. stellate*), and black oak (*Q. velutina*). About 1/3 of the planted trees appear to still be surviving in the park. A total of 316 trees were counted, including 29 trees that were planted outside of the plotted study site. Black oak

(*Q. velutina*) was recorded more times than any other planted species, followed by white oak (*Q. alba*) and blackjack oak (*Q. marilandica*). **Table 2** shows the number of each species as well as the percentage of that species that make up the total surviving trees. Surviving planted trees average 4 1/3 per plot, ranging from 0 to 17 trees per plot. Surviving trees range in height from ½ ft to 15 ft. **Table 3** summarizes planted tree sizes.

Twenty-eight species of volunteer trees have inhabited the area within the last 5 years, adding up to a total of 750 counted volunteer trees. Number of each species, as well as average height and height range of volunteer trees can be found in **Table 4.** Twelve are already over 10 feet tall. Volunteer trees average 10 per plot and the plots have a median of 8 trees. Number of volunteer trees found in a plot ranges from 0 to 31. Species most commonly found

Estimated height (ft)	**½ -2**	**3-5**	**6-8**	**7-9**	**10+**
# of trees found in site	240 (76%)	31 (10%)	13 (4%)	9 (3%)	10 (3%)

Table 3- Surviving Seedlings Height: The total number of planted trees within each height group is listed, as well as the percentage of surviving trees that each height class represents.

Table 4- Volunteer Species Number and Height Summary: The number of each species of volunteer trees recorded is listed, as well as the height range and the average height

Species	**#**	**Range, Average height**	**Species**	**#**	**Average height**
sweetgum (*Liquidambar styraciflua*)	149	0.5-10, 2.4	**post oak (*Quercus stellata*)**	6	0.5-5, 2.1
cherry laurel (*Prunus caroliniana*)	117	0.5-8, 1.6	**paper mulberry (*Morus papyrifera*)**	5	4-18, 11.2
sugarberry (*Celtis laevigata*)	106	0.5-12, 2.6	**althea/ rose of Sharon (*Hibiscus syriacus*)**	2	1.5-5, 3.3
water oak (*Quercus nigra*)	96	0.5-8, 2.1	**callery pear/ Bradford pear (*Pyrus calleryana*)**	2	3-6, 4.5
black cherry (*Prunus serotina*)	52	0.5-12, 2.5	**northern red (*Quercus rubra*)**	2	0.5-1, 0.8
red mulberry (*Morus rubra*)	44	1-18, 5.0	**chinese ligustrum**	2	1-14, 7.5
blackgum	40	1-10, 4.3	**pignut hickory (*Carya glabra*)**	1	1
loblolly pine (*Pinus taeda*)	27	0.5-5, 1.2	**black walnut (*Juglans nigra*)**	1	14
red bud (*Cercis canadensis*)	23	0.5-10, 2.3	**juniper (*Juniperus virginiana*)**	1	2.5
virginia pine (*Pinus virginiana*)	22	0.5-3, 1.6	**crape myrte (*Lagerrstroemia spp.*)**	1	4
Carolina buckthorn (*Frangula caroliniana*)	20	1-10, 3.7	**Southern magnolia (*Magnolia grandiflora*)**	1	1
white oak (*Quercus alba*)	10	0.5-6, 3.8	**paulownia/ princesstree (*Paulownia tomentosa*)**	1	1
Southern red oak (Quercus falcata	10	0.5-2, 1.0	**Sassafras (*Sassafras albidum*)**	1	1
mockernut hickory (*Carya tomentosa*)	6	1-6, 2.7	**mystery tree 48**	1	

were sweetgums (*Liquidambar styraciflua*), cherry laurels (*Prunus caroliniana*), and sugarberries (*Celtis laevigata*). These three species alone make up half of the volunteer trees. One interesting find was a 14-foot black walnut (*Juglans nigra*). Trees less than 5 feet comprised 82% of volunteer trees recorded in the site, while 16% were between 5 and 10 feet and 2% were over 10 feet tall.

Examining the herbaceous species that have inhabited the area was also an important aspect of this project. Only two plots were estimated to be 0% covered. 19 were estimated to be 25%, 23 were 50%, 18 were 75%, and 13 were 100% covered. Well over 84 species were documented in the study site. 84 species, genus', or general groupings were identified. Only about 20% were identified as being invasive. Plant or plant groupings average 14 per plot and almost 1 new plant per plot. Plots range from including 3 to 25 classified plants. Blackberry was found to be present in the most plots. See **Table 5** for information on the top 5 species found in the most plots. Grasses were dominant in 64% of the plots, followed by blackberry at 47%, and chasmanthium found as one of the three

Table 5- Herbaceous recorded in most plots: This table shows the top 5 species recorded in the most plots, as well as the number of plots it was found in and the percentage of total plots it was found in.

	# plots found in, % of plots found in
1. Blackberry	56, 77%
2. Smilax	53, 73%
3. Poison ivy	52, 71%
4. Wild petunia	44, 60%
5. Privet	43, 59%

Table 6- Herbaceous Speices: Species or plant groupings are listed in decending order based on the number of plots each one was found in. Several species could not be identified.

Grasses	muscadine grape (*Vitis rotundifolia*)	sweetclover (*Melilotus alba*)
blackberry (*Rubus occidentalis*)	nandina (*Nandina domestica*)	wild strawberry (*Fragaria virginiana*)
greenbrier (*Smilax spp.*)	eastern milkpea (*Galactia regularis*)	wild pear (*Pyruss spp.*)
poision ivy (*Toxicodendron radicans*)	wild yam (*Dioscorea spp.*)	Periwinkle (vinca minor)
chinese privet (*Ligustrum sinense*)	Black night shade (*Solanum nigrum*)	daylilly (*Hemerocallis spp.*)
(*Lespedeza desmodium*)	Sedge	Crossvine (*Bignonia capreolata*)
narrow leaf plantain (*Plantago lanceolata*)	Pokeberry (*Phytolacca americana*)	Spurge (*Euphorbia corollata*)
virginia creeper (*Parthenocissus quinquefolia*)	Yellow passionflower (*Passiflora lutea*)	smooth sumac (*Rhus glabra*)
Violet (*Viola spp.*)	false indigo (*Baptisia spp.*)	giant ragweed (*Ambrosia trifida*)
mimosa (*Albizia julibrissin*)	andropogon	(*Rubus spp.*)
morning glory (*Ipomoea spp.*)	Japanese honeysuckle vine (*Lonicera japonica*)	green and gold (*Chrysogonum virginianum*)
wild lettuce (*Lactuca spp.*)	trumpet creeper (*Campsis radicans*)	(*Asplenium spp.*)
Wood oats (*Chasmanthium latifolium*)	woodland burdock (*Arctium vulgare*)	Virginia dwarfdandelion (*Krigia virginica*)
monkey grass (*Liriope spp.*)	broad-leaf plantain (*Plantago major*)	resurrection fern (*Pleopeltis polypodioides*)
apeace 10	Self-heal (*Prunella vulgaris*)	wild onion(*Allium spp.*)
fall blooming aster	Carolina horsenettle (*Solanum carolinense*)	Virginia pepperweed (*Lepidium virginicum*)
beautyberry (*Callicarpa americana*)	Unknown legume	dock (*Rumex spp.*)
Common ragweed (*Ambrosia artemisiifolia*)	hog peanut (*Amphicarpaea bracteata*)	bottlebrush buckeye (*Aesculus parviflora*)
panic grass (*Panicum spp.*)	burford holly (*Ilex cornuta*)	skullcap (*Scutellaria spp.*)
mountain mint (*Pycnanthemum spp.*)	honeysuckle bush (*Lonicera spp.*)	coleus (*Solenostemon spp.*)
wood sorrel (*Oxalis spp.*)	St. Andrew's cross (*Hypericum hypericoides*)	thorny olive (*Elaeagnus pungens*)
composites	dandelion (*Taraxacum spp.*)	chinese lantern(*Physalis alkekengi*)
clover (*Trifolium spp.*)	wisteria (*Wisterica frutescens*)	winged sumac (*Rhus copallina*)
American lopseed (*Phryma leptostachya*)	milkweed (*Asclepias spp.*)	
Unknown plant	dwarf cinquefoil (*Potentilla canadensis*)	

most abundant in 23% of the plots. **Table 6** lists plants recorded in the study area.

Conclusions

Over the last 5 years a large variety and quantity of herbaceous species and volunteer trees have been able to colonize the area. What was once bare land, aside from mature trees, is now heavily covered in some areas and has some growth in virtually all parts untouched by maintenance. This shows that the way the property has been being cared for is having drastic effects on the park, but can be turned around is nature is allowed to take its course. Although the reforested area does not require much maintenance, it is vital to ensure that the area continues to be left alone by the city crew. Also, about 1/3 of the planted trees are still surviving, which means that it is likely that a number of these will grow to maturity. This reforestation method appears to be an appropriate way to relatively quickly reforest an area that needs some human intervention in order to do so. Many parks are suffering like George Ward Park, in that the trees are not regeneration on their own and are decreasing in numbers each year. This project seems to be a suitable model for other parks and storm-struck regions in need of trees and herbaceous vegetation. There is no way to know yet if the forest will eventually be able to sustain itself and regenerate on its own, but this project will have a major effect on preserving the tree canopy in George Ward Park, and hopefully encourage the restoration of Birmingham's urban tree canopy as a whole.

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