

## Planting forests in NYC: Is the goal Restoration, Reforestation, or Afforestation?

Chicago, Los Angeles, Philadelphia, Detroit, New York City (NYC) and many other cities in the United States and around the world are engaging in urban greening projects. Urban greening almost always involves planting trees....lots of trees. New York City, for example, has planted over 750,000 trees to date as part of a project that started in 2007 – a project with the goal of planting 1 million trees in 10 years. Many of these trees will be street trees, which are a major component of any city tree planting program, and even though they don't feel like 'forest,' we qualify them as part of what we call the urban forest. Imagine a canopied forest in a city – a place that actually looks and feels like a forest. Is there even room, though, for a traditional forest in densely populated places like NYC? According to the NYC Department of Parks and Recreation, nearly 40 percent of the city's parkland (total 11,700 hectares) is still natural. Of that, forests make up 2,400 hectares of the total parkland. The rest is rocky shorelines, beaches, wetlands and meadows. Million Trees New York City (MTNYC) is committed to planting trees on an additional 800 hectares of city parkland as part of a reforestation effort. Their plan is to create new, small forests, in the urban setting.

As we ask ourselves how to create a forest in a city, a question you have to ask is: In a place like NYC are we engaging in forest restoration, reforestation or afforestation? Reforestation and restoration always sounds more attractive – it seems as if we are going back to something more natural and authentic. Afforestation means that you create something new, a forest where there wasn't one, or even a different kind of forest. Arguably since New York City was largely forested a mere 400 years ago we could make a case for restoration or reforestation – and that is the prevalent model. However for both of those concepts to be applicable we would assume that we are striving to create an ecosystem that is very much like it was before human intervention radically changed current conditions. Is this really possible, and is it what we are doing or even want to strive towards?

Cities around the world are facing similar issues, with the added complication that the most significant human impacts began to take place a lot longer ago than 400 years. For instance, the city of Leipzig, Germany, a city also engaged in urban greening projects, has been populated for 1,000 years.

Anthropogenic or human caused impacts to an urban environment have a more significant impact on our ability to create a forest than in less populated areas. Indeed, we have a large body of knowledge to rely on for making sure trees are growing in our rural working forests where the main focus is creating usable timber or biomass. Questions about which species to plant on which soil types and how far apart to plant seedlings to maximize growth and productivity have been answered to the extent that foresters talk about creating prescriptions for maintaining our rural forests. Far less is known about creating forests in urban environments because of the profound influence humans have had on urban environments.



Figure 1. Location of afforestation case studies, Givans Creek Woods and Kissena Corridor Park .

These influences include high levels of atmospheric pollutants and chemical contamination in the soil, soils that are made up of construction debris (e.g. asphalt, rebar, concrete etc.) covered by gravel fill, higher temperatures and exotic invasive plant species.

It is because of these radical, inevitable anthropogenic influences on the urban environment that I prefer to think of creating a forest in an urban environment as afforestation. The environment that we work with as foresters in cities is anything but natural. The fact that it is urban means there has been huge change. This novel environment has no analog in the “natural” world and there hasn’t been time for trees to adapt to urban environments in the evolutionary sense. In addition, we need our urban forests to

outperform traditional forests in many important ways. We need them to out compete exotic invasive plant species which are capable of consuming mature established forests and trees.

We need them to absorb storm water runoff from hectares of surrounding sidewalks, streets and buildings. We need them to create soil and sustain themselves in an environment that they never evolved with. We need, therefore, to create something new. In NYC, afforestation projects, the creation of new forests, are occurring in areas such as the Givans Creek Woods in the Bronx. Picture this, a new forest which is bordered to the south and east by Co-op City (the largest cooperative housing development in NYC) and on the west by the New England Thruway, a major highway, and Kissena Corridor Park in Queens, imagine an area that used to be the main line of a railroad in the 19<sup>th</sup> century, then was used as a dumping ground for construction rubble and finally was covered with 8,000 cubic meters of glacial till (Figure 1). The soils at Givans Creek consist of pavement, gravel, ash, mortar, brick, pebbles, road millings, porcelain, glass, concrete, within a matrix of sandy loam with a pH

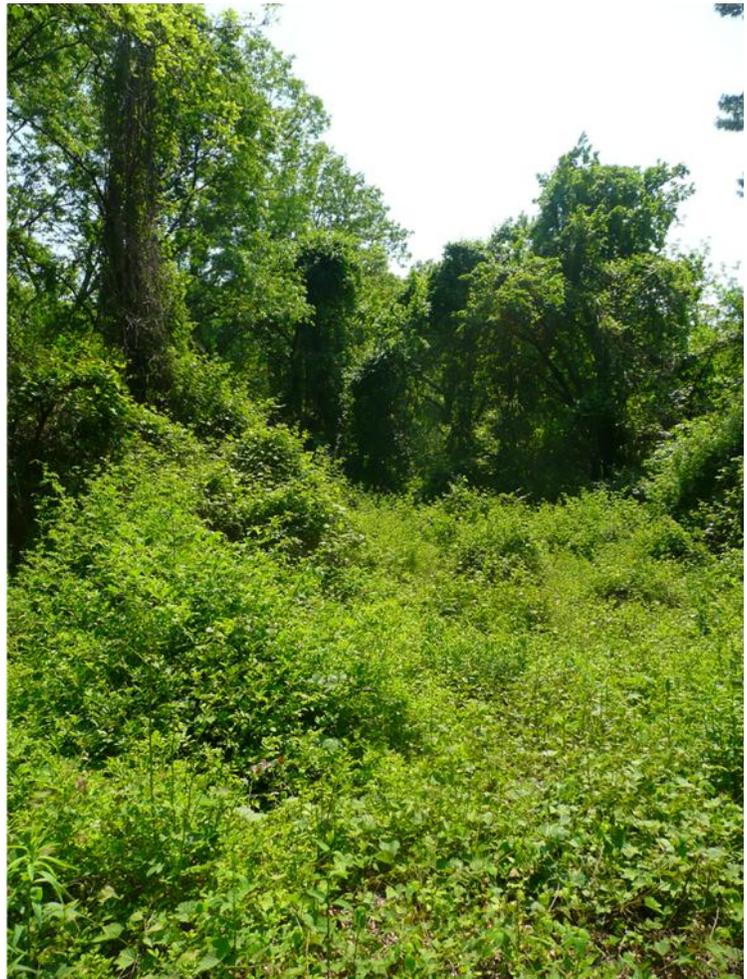


Figure 2. Exotic invasive plant species can take over mature forests and prevent native vegetation from becoming established. These species need to be removed prior to tree planting.

**Table 1. Tree species list for the afforestation case studies described in this article.**

Tree Species	Kissena	Givans
<i>Acer negundo</i>		x
<i>Acer saccharinum</i>		x
<i>Carya spp.</i>	x	
<i>Celtis Occidentalis</i>	x	x
<i>Juglans nigra</i>		x
<i>Juniperus virginiana</i>		x
<i>Populus deltoides</i>		x
<i>Prunus serotina</i>	x	x
<i>Quercus alba</i>	x	
<i>Quercus rubra</i>	x	x
<i>Robinia pseudoacacia</i>		x
<i>Tilia americana</i>	x	

of 7.3. While the soils at Kissena have a pH of 6.0 and are made up of human transported materials with more than 10 percent human artifacts. Prior to planting, these sites were treated with herbicide and exotic invasive plant species were physically removed. Afforestation sites will often be covered in vines and largely inaccessible until cleared (Figure 2). Native tree species (Table 1) were planted 1 meter apart at Givans Creek while at Kissena they were planted at a 2.1 meter spacing. The management goal of planting trees so close together is to achieve canopy closure as rapidly as possible in order shade out exotic invasive plant species. Kissena Park was planted in the fall of 2010 and

during August of 2011 the young trees were growing well (Figure 3), in June 2013 *Prunus serotina* was doing very well in some areas though there is also evidence of other exotic species that are competing for water and light resources (Figure 4).



**Figure 3 Kissena Corridor Park afforestation site. Trees were planted almost 1 year before this picture was taken.**



Figure 4 Kissena Corridor Park afforestation site 2.5 years after planting.

Once young forests are planted in places like these, maintenance in the form of weeding and watering is necessary to keep the trees alive. This is surprisingly hard to accomplish – issues of funding, personnel, and so on, affect all urban forest projects. For instance, NYC Parks and Recreation has an ongoing weeding and watering policy for many but not all of these afforestation areas that will continue for 3 or 4 years after planting.

Cities are under intense pressure to make these

afforestation efforts succeed due to the large investment of capital and the high visibility of these projects. Ultimately, success will be measured by not only the survival of the trees but the ability of the new forest to sustain itself. The tree species used in the afforestation case studies mentioned above (Table 1) include faster growing species like *Prunus serotina*, *Tilia americana* and *Populus deltoides* and slower growing species like *Quercus spp.* Currently afforestation projects are using a mix of native tree species that are selected based on information that we have about how they perform in our rural forests, empirical local knowledge about how they perform in an urban environment and a vision for what we want our new forest to look like when it matures. This approach is more akin to how one might design a garden by planting the flowers, vegetables and shrubs that we want to grow there.

Alternatively we can look at our natural forested ecosystems for clues to how we might create a new forested ecosystem in a city. Abandoned lots or underutilized parks are more like what we see in forested areas that have lost all their trees due to landslides, floods, or fires. The concept of forest succession has long been studied by forest ecologists and refers to the process of changes in species structure beginning with pioneer species and progressing towards a stable self-sustaining climax community of later successional species. Pioneer species are typically not shade tolerant and tend to grow very quickly while later successional species are more shade tolerant and are better adapted to growing under the cover of the pioneers.

If we apply this concept to our urban afforestation projects we might consider a phase one planting of pioneer species that are already adapted to growing in the harsh conditions found

on urban sites with little or no vegetation and low fertility. These fast growing species could achieve canopy closure quickly which in turn could reduce the ability of exotic invasive plant species to establish themselves. In turn maintenance costs could be reduced. Five years later, phase two would involve planting shade tolerant climax species in the understory of the already established pioneer species. The second cohort would be species that are perhaps more desirable for the new forest and they would have the protection of the pioneers planted in phase one.

This multi-phase approach mimics natural succession in important ways that could make the process of urban afforestation less costly and perhaps result in a more sustainable forest in the long term. Of course as I pointed out earlier, the environment we are working in is anything but natural and because of that human intervention is necessary. Perhaps instead of natural succession we need to consider a process of anthropogenic forest succession to aid in the creation of our new urban forests.

Conceptualizing the creation of urban forests as making something new rather than taking on the impossible task of replacing what was once there 400 or 1000 years ago allows for more creative thinking surrounding how we might reach goals of having more green space that is accessible to our urban populations. Green space that is self-sustaining without major maintenance requirements. Places where people in the city can experience the look and feel of a forest without having to leave home.