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FALL 2009
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PARSONS THE NEW SCHOOL FOR DESIGN

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What constitutes an improvement in the green infrastructure of cities? Is greening the urban landscape mostly about designing it to display more “greenish” things, or can we ask landscapes to be highly functional as well? And if so, what ecological and sociological functions are most important to pursue when designing urban landscapes? The current priority on climate change mitigation through carbon sequestration and storage in both government and industry is replacing the more recent ecological focus on maximizing biological diversity, though both provide important functions. However, the average citizen may be more concerned with the beauty or openness of a particular green space rather than the city’s need for it to perform critical ecosystem functions, such as the capture of storm water. How should urban designers, planners, and policymakers decide which functions to maximize, and what will be lost in prioritizing one over another? Below I discuss the New York City Human Ecosystem Project, which includes two specific research projects, the NYC Urban Forest Restoration Study and the StEM Project, in the context of the need to maximize ecological functions and services in urban areas over both the short- and long-term. Both projects are designed to study the interaction between social, political, and management goals and the potential of urban ecosystems to meet these goals.

On Earth Day 2007 New York City’s Mayor, Michael Bloomberg, announced an ambitious multi-decadal plan, PlaNYC 2030, to make New York City more sustainable by 2030. PlaNYC includes 127 ambitious sustainability initiatives including a goal to plant one million trees in New York City by 2017. Since then the MillionTreesNYC (MTNYC) campaign has allocated $400 million over ten years to the NYC Parks and Recreation Department (NYC Parks) to expand the City’s urban forest by 2000 acres by adding another 400,000 trees to public and private land and planting 220,000 street trees, which will, with additional partnerships including the New York Restoration Project, collectively add 20 percent more tree canopy cover to the city. Since its launch, public, private, and non-profit organizations have rallied nearly 4,000 citizen volunteers to plant trees across New York City in what has become an unprecedented tree planting campaign and citywide environmental movement. Now in its third year, the city has already added over 200,000 young trees to existing urban parks, private lands, and city streets (Figure 1). But what will this extra tree canopy do for New Yorkers, other bio- logical species, and the climate? Is the time duration of a small-scale urban trigger such as a citywide tree planting campaign sufficient to increase long-term sustainability in New York City’s ecosystems? In the case of enlarging and restoring urban forests to make NYC more sustainable, many of the publically touted benefits of trees will not be felt until well after 2017. Indeed, it is not yet clear that merely planting trees will achieve any of the ambitious goals set forth in PlaNYC. The one million new trees must first survive the early years of city life in order to function as intended. Planting lots of trees, especially a million trees, will potentially provide New Yorkers important health, economic and environmental benefits. However, there are many assumptions behind the rhetoric to this effect seen on MTNYC billboards and placards across NYC. A solid understanding of the benefits of tree planting for urban sustainability requires careful socio-ecological study, something we have very little of in New York City. Additionally, the momentum behind the MTNYC campaign has made it slow to organize and carry out related research in a scientifically rigorous manner because the campaign has had other priorities, namely its need to meet ambitious annual planting goals (~100,000 trees/year). This has meant that research has been relegated to a status lower than getting trees planted. Though city officials and park managers understand that evaluation of existing planting strategies and site designs are critical to the long-term success of the MTNYC campaign, providing mechanisms, incentives, and opportunity for such research has been slow, even though the motivation
clearly exists amongst Parks personnel. This is not surpris- ing given the pressure put on small departments to deliver results in short periods of time.4 To their credit, MTNYC has a specific Research Sub-committee of their Advisory Board and has already hosted, in collabor- ation with The New School, MillionTreesNYC, Green Infrastructure, and Urban Ecology: Building a Research Agenda with The New School, a series of open forums where nearly too researchers and practitioners to develop a research strat- egy for the MTNYC campaign. One of the outcomes of this research workshop was a critical examination of the goals of MTNYC and the available resources employed to meet them. The result was a consensus that we need to understand urban ecosystems much better than we do. It also became clear that there is an important role for The New School as a center for research and primary research in order to broaden and increase the accessibil- ity of knowledge on the urban forests and environmental stewardship.

URBAN ENVIRONMENTAL STEWARDSHIP

Young urban trees, those most at risk of mortality dur- ing the first five years, are exactly the trees that are being planted in the re-greening effort currently underway across New York City (NYC). Afforestation5 plantings in city parks and on deeded or existing parkland are typi- cally small trees that are 5-15 cm tall and 1-2 cm in diameter. MTNYC volunteers and contrac- tors strategically plant these susceptible trees in the fall and spring months to avoid harsh drought conditions in the summer. However, expectations are that without ade- quate care, many of these trees will fail to survive the first year.

Street trees are similarly stressed, living in extremely harsh conditions where they are tucked into “tree pits” cut into sidewalks, with little room for roots to expand. With thousands of young street trees already being planted, it is crucial to establish the required level of stewardship as soon as possible. Turning young trees into large trees with the appropriate characteristics is not something that can be done by the department alone, even with a well trained, well-funded NYC Parks department. New Yorkers will have to take more responsible environmental and protective behavior if they want a cleaner, healthier, more sustainable city, a fact which is already clear to a small group of motivated indi- viduals at MTNYC. NYC Parks, Trees New York, other area non-profits, and more recently SEM6.

Individuals, small community organizations, and busi- nesses all need to play an increasingly important role in helping cities like NYC care for the street trees, parks, waterways, and open spaces that make up the urban envi- ronment. The SEM (Stewards, Environmental Mapping) Project was initiated in 2006 at the New School’s Tishman Environment and Design Center to address the need for research on, and increased steward- ship of, the urban forest. Since then SEM has been work- ing to develop the ecological and digital infrastructure to both track and motivate urban forest stewardship through the most up-to-date, publicly available, interactive and understandable data sets. This is a large challenge for any urban trees. SEM’s overarching goal is the development of a robust community-based urban forest steward- ship network to more fully grow and promote a healthy, mature forest throughout all five boroughs of New York City’s neighbor- hoods. To achieve this the SEM Project employs a technical focus at the scale of the individual street tree. By focus- ing on the small scale of an individual tree, we intend to influence the functioning of the urban forest at the scale of the entire city by linking socio-ecological relationships through web-based mapping, coupled human ecosystem research, community organization, and efficiently and engagingly designed information architecture.

SEM is important because our street trees are essential to urban ecosystems. They affect the dynamics of urban heat, are important in carbon sequestration and storing atmospheric carbon dioxide, and are active in many other ecosystem services. SEM’s evolving mapping and data management tools are therefore designed to empower NYC’s volunteer and professional environmental stewards to help them focus on their efforts and collaborate on the large project of caring for and assessing, in real-time, the state of the city’s forest. Urban environmental stewards with complimentary inter- ests in urban forest research, including the SEM project, will use SEM’s platform to connect and share resources, ultimately facilitating increased structure and functioning of urban ecosystems.

Creating opportunities for social networking amongst stewards in order to develop more vibrant and lasting community-based stewardship efforts; and 4) Building a group decision making network that is optimized for the social networking and mapping professionals (including a critical partnership with OpenGeo.org), and web


8 — The studio was run in collaboration with Parsons Bachelor of Fine Arts in Interior Design’s Architectural Design Program faculty Natalie Fears, Michael Morris, and Seth Boyden, and Parsons graduate students Adam Pearson, Colleen Greene, and Eloise Dufresne, who together collaboratively led the studio to develop a “tree buddy” plan for each tree and the environment in which it will be planted.

9 — The Open Space Institute works to protect and preserve open space at http://www.osi.org/
conditions for trees living in city streets. Street trees are particularly susceptible to stress due to the small spaces in sidewalks where they are forced to grow, their highly com- pressed and acidic soils, and the many injuries they suf- fer from living in such close proximity to urban life (see Figure 3).

Young trees (<5 years) are probably the most at risk planners, and designers alike are asking: How do we simultaneously accommodate more urban dwellers and design cities as sustainable ecosystems (CASE)?

**THE URBAN DILEMMA**

The need to understand the intricacies of urban ecosys- tems emerges from two trends. 2 First, urban ecosystems are expanding due to urban sprawl. Hence, most people’s experience of nature is urban. 14 It is hard to overstate this fact. It follows then that cities must manage to better exemplify environmental principles 22 and find ways of existing in long-lasting sustainable relation- ships with their urban environment. Second, cities have a disproportionate impact on both regional and global systems. 23 For example, the sprawl of many cities threatens agricultural lands and puts stress on neighboring wild and managed areas. 24 There are already some 10,000 square kilometers in the United States that are impervious to water 25 and urban lands affect a much larger area than this by altering climate, hydrology, and atmospheric chemistry. 26 Among the many human activities that cause fires, deforestation, and developed cities to lose their ability to function on the larger scale, greatest local species extinction rates 27 and frequently eliminates a large majority of native species. 28 Certainly, the increased energy use in human and around cities is significant with a wide range of implications to the larger scale. 29 At the same time, densely populated cities like NYC can be a net benefit to global ecosystems because they provide services that can limit the human impacts of resource-intensive systems 30 and improve and adaptively use socio-ecological the- rmal patterns. All these facts point to the need for a different manner of urban living, which in turn requires that we develop a more nuanced understanding of urban ecosys- tems 31 that arguably began in New York City with the estab- lishment of a long-term urban-rural gradient study in the late 1980s by McDonnell and Pickett 32. It has taken the intervening period to develop the supporting the- ry and for the dialogue between different disciplines to materialize and develop into something truly unique. 33 A long-term study of NYC as a coupled natural-human sys- tem could yield important advances in urban ecosystem theory while adding significantly to the growing empiri- cal, socio-ecological study of the city as an ecosystem. A recent collaboration between The New School, Columbia University, Rutgers University, the U.S. Forest Service, and NYC Parks will begin examining the dynamics of forest systems in urban NY and the social-ecological theoretical process that influence the functioning of urban ecosys- tems generally. New York City is only now beginning to ini- tiate such a study, which is to say, a large, interdisci- plinary, socio-ecological study of the city as an ecosystem.

**THE STUDY OF URBAN ECOSYSTEMS**

Urban ecosystem research is still a nascent field of scien- tific inquiry. Urban ecology has progressed primarily from the focused long-term study of two cities, Baltimore and Phoenix, over the last two decades, which are now produc- ing important empirical observations of the relationship between urbanization and ecosystems. 33 These two long-term ecological research (LTER) sites now define the urban condition and highlight that whether the studies from these cities, in particular the Baltimore Ecosystem Study (BES), are indeed generalizable and applicable to New York City. The first-on-the-ground studies as human ecosys- tems arguably began in New York City with the estab- lishment of a long-term urban-rural gradient study in the


Urban ecosystem research approaches are often focused on emphasizing socioeconomic, ecological, or physical features as patch delimiters. The eventual goal in NYC is to integrate approaches and develop a synthetic patch delineation scheme for the entire study area, including all five boroughs. The patch dynamics approach will be used as an organizing framework for integrating data in the NYCHE Project across scales in order to determine relationships between social and ecological drivers of change. To address the core research questions of the NYC Urban Forest Restoration Study, team members began by defining ecological and physical patches at the plot scale as the most effective place to begin collecting fine resolution ecological data on the dynamics of urban forests. Of course, the spatial structure of human, natural, and physical patches in urban areas changes through time due to social, economic, behavioral, transitional, and other forces. Therefore, it was recognized early on that it is crucial to investigate the temporal dimension through long-term research to understand the linkages, feedbacks, controls, and cycles in patchiness in urban ecosystems.

METHODOLOGICAL APPROACHES TO STUDYING HUMAN ECOCOLOGICAL SYSTEMS

Long-term study of forest restoration and regeneration is critical to understanding New York City as a human ecosystem because so much of the system is forested, or about to be forested. Research activities such as the NYC Urban Forest Restoration Study are plot-based, ground scale approaches are crucial to evaluating both the success of the current tree planting effort, but also to provide recommendations for future design and management strategies at much larger scales. This research capitalizes on the NYCHE Project at The New School, are studies in how to leverage ecologists must commit to interdisciplinary dialogues and practitioners working in urban areas already have. Urban ecosystem research has the potential to provide important data on how best to maximize various ecological functions and services of the green infrastructure of the city.

Analysis of current vegetation at the plot scale is a fundamental part of the patch analysis approach that is being used to characterize the spatial structure of the urban ecosystem. Researchers in this study are collaboratively monitoring tree survival, growth, and time to canopy closure, but more importantly they are also assessing the rest of the vegetated community either preexisting in sites, or recruited to sites over time. Veger potential analysis is important to biodiversity, aesthetic, climate moderate pollution and water absorption functions of soil in the urban ecosystem and will thus provide a basis for further ecosystem function studies in the future. This study will supply the critical ecological data for comparison across patches within the NYC park system, yet will also allow comparison of forest dynamics between New York City and other urban centers. By looking at a large number of heterogeneous sites across the city, researchers hope to begin to build, literally from the ground up, a comprehensive picture of the ecological dynamics of New York City as a cohesive ecosystem.

DESIGNING SUSTAINABLE URBAN LANDSCAPES

Can urban trees really achieve the ambitious goals we set for them? It is possible, but only with a concerted effort to find out. Designing sustainable urban landscapes requires at least three issues be addressed.

1. To judge the effectiveness of urban improvements such as tree planting, we need proper and well-designed scientific research. Urban ecological research in New York City must take a front seat in the challenge to make New York City more sustainable. This will require government and private foundations to sponsor research over short and long time frames to provide the fundamental science that policymakers, managers and practitioners need in order to make decisions that can predictably achieve the noble sustainability goals set forth in PlaNYC 2030. Can urban trees really achieve the ambitious goals we set for them? It is possible, but only with a concerted effort to find out. Designing sustainable urban landscapes requires at least three issues be addressed.

2. Designers must make use of available ecological science. Urban ecology is most useful when it is applied to the problems it was originally designed to address. In the era of sustainable living, urban ecosystem research has the potential to provide important data on how best to maximize various ecological functions and services of the green infrastructure of the city, but only if urban designers commit to doing the hard work of understanding and incorporating research results into their creative enterprises. Similarly, urban ecologists must commit to interdisciplinary dialogues that make use of the storehouse of knowledge designers and practitioners working in urban areas already have.

3. The average New York citizen will need to become a more engaged, environmentally aware, and hopefully an activist participant in the urban ecosystem if it is to mature into the environmental cleanup machine it is currently envisioned to be. Projects like the NYCHE Project are an important effort to develop novel methods to reach across traditional divisions between humans and the environment they depend on.

Finally, it is important to evaluate whether the global challenge to plant trees (laudable indeed) is a true cure to our environmental ills or merely another, if better, band wagon that puts a green facade on a continued global cultural practice of unsustainable living. Sustainable living may indeed involve more tree planting, but it also requires a shift from twice a year volunteer planting days to a sustained daily engagement and committed stewardship of the vast diversity of environmental resources we already enjoy. The NYCHE Project and the NYC Urban Forest Restoration Study, both part of the growing NYCHE Project at The New School, are studies in how to leverage the tools and goals of government managers with urban ecosystem research and design in order to maximize the ecological functions and services of the green infrastructure of the city.

commitment from NYC: Parks, current academic collaborators, funders, and a host of volunteers. The methodological approach to evaluating long-term ecological dynamics of highly heterogeneous systems requires simplicity. Local scale study plots need to be large enough to capture relevant dynamics but small enough to be sampled intensively and efficiently on an annual basis. Researchers chose 30m² plots (Figure 3) because they are large enough to satisfy ecological research goals but small enough to fit into forest restoration plantings of the MTNYC campaign. Evaluating park planting and management designs requires clear experimental treatments with adequate replication to be confident that empirical results will reflect real world dynamics, and yet simple enough that they can be replicated across many different sites in very different park settings across the city. To begin, researchers chose a nested plot design with high and low tree diversity treatments in order to allow scientists to evaluate the importance of varying levels of tree diversity on ecosystem function while also evaluating the utility of individual tree species and species combinations. Buffer areas of 2.5m around each subplot were established to minimize edge effects between subplots treatments (Figure 3). Additional plots were designed to adapt to current planting practices of the NYC Parks Department, which in both volunteer and contractor planted forest restoration sites plant trees in 4½’ on center. Tree planting in research plots is spaced similarly with the expectation that as the canopy closes subsequent tree mortality will be a natural process of competition for light, nutrients and water.

Open Letter & Editor’s Introduction


30 — i.e. forest patch origin, plant diversity, and adjacent land use type on species composition and abundance over time.

31 — Pickert STA, Cadetrossi ML, Grove JM, Nihon CH, Poyat VN, Zippern WC, Costanza R. 2001. Urban ecological systems: Linking terrestrial ecologi-


32 — MTNYC hosts large, organized planting days in April and October. You can sign up to plant trees at: http://www.milliontreesnyc.org/

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