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AQ FEATURE

Extreme Sustainable City Makeover: New York

BY **Michael Sorkin**

How to make a city self-sufficient, neighborhood by neighborhood.

Read sidebars on water management and citizen engagement.

Most of us are familiar with the concept of the "ecological footprint." Originally developed by Canadian academics Matthis Wackernagel and William Rees, the idea embodies a series of algorithms (numerous versions are available on the web) that convert a wide variety of consumption inputs into a single quantity: area. Using this model, one can compare how much of the Earth's surface is required to build a car, heat a house, produce a meal, sink the carbon from a coal-burning power plant, etc.

The information yielded by the calculations is revelatory, and sometimes shocking. For example, some simple footprinting produces the scary conclusion that if everyone on Earth were to consume at the rate at which we do in the U.S., the surface area of an additional three or four planets would be required to support us all! This vividly begs the questions both of the equitable distribution of resources globally and throws the matter of self-sufficiency into high relief at the local level.

The real issue, though, is what to do. Too many solutions are caught up in negotiations about how to apportion responsibility and blame. China pollutes massively, but less per capita than the U.S. does. Negotiations also break down in the effort to find suitable economic instruments to address environmental harm, such as the cap-and-trade regime, which monetizes emissions but doesn't actually do anything to lower them.

Part of the problem with taking suitably radical steps is that questions of both politics and efficiency intervene. As the variety of essentially failed environmental summits since 1992 have demonstrated, cooperative global action by nation states is elusive. Even at the individual level, most countries are incapable of mitigating their pollution, generating their energy indigenously and cleanly, or curbing their consumption.

What Is to Be Done?

There are strong reasons for looking to cities as a primary component of the transition to a sustainable environment and economy. Given the dysfunctionality of many national governments and the frequently callous and irresponsible behavior of many transnational corporations, cities are logical spaces for democratic governance, resistance to predatory economic behavior, and environmental organization and action.

Cities, in their physical and social density, are uniquely sustainable environments. They deploy their infrastructures with special efficiency and concentrate activities that are unusually productive—and there are many systems only cities can support. For example, although it seems counterintuitive, New York City is not simply a roaring hive of activity but is also at the top of U.S. cities in energy efficiency. There is a single reason for this: New Yorkers are the greatest mass transit users in the United States. Subways, which only make sense economically when there is a sufficient density of population to support them, also offer other environmental advantages: reducing vehicular pollution, limiting the extent of other infrastructures, and contributing to the conviviality and convenience of the walking city.

For a number of years, Terreform, our non-profit research organization, has been working on a thought experiment. Given the idea that cities are—from both the political and the technical sides—such excellent elements of both accountability and organization, we set out to imagine a redesign for New York City that would create an ecological footprint precisely coterminus with its political boundaries. Relying on the great urbanist Jane Jacobs, we have drawn heavily on the idea of import substitution for economic logic, a process she held was central to urban development in general and one with profound implications for urban environmental behavior.

Envisioning a green N.Y. skyline: Artist rendering of a midtown Manhattan skyline dotted with food hubs. Image: Courtesy of Terreform

With all this in mind, we began the New York City (Steady) State project half a dozen years ago. Our intention was to see if we could effectively redesign and retrofit the City of New York for complete self-sufficiency, to test whether a city as complex as ours could be self-sustaining and to discover the degree to which we could unburden the planet. Our larger purpose was to compile an encyclopedia of the forms and technologies that might be used by other cities around the world that seek to take greater responsibility for their environmental impact.

We focused our work on a series of specific "respiratory" functions of the city: air, temperature and micro-climate, water, energy, movement, manufacturing, waste production, and building. Embedded in each of these categories are profound implications for social and other distributive arrangements in the city. The core of our study is an attempt to assess the implications for urban life of each of these activities, all of which also have deep architectural, planning and technological implications. One of our guiding propositions is the idea that urban autonomy will be best achieved through local organization, which we feel is potentially more resilient, malleable and personal. While cities' functions must necessarily be defined by efficiencies of scale, our endeavor begins with the belief that the sort of transformation we are seeking should be disaggregated and visible, and should offer the possibility of community engagement and control.

Thus, we see the neighborhood as the key component of urban organization. Neighborhoods are political entities that enable meaningful democracy not only by face-to-face contact but also by the shared interest of people working to secure and improve a tangible commons. Our proposal is for neighborhoods that are maximally autonomous, meaning that each would contain not simply housing but would "harmonize" its resident population with numbers of jobs and commercial, recreational and cultural facilities—including schools, parks, sources of energy, and means of waste remediation.

This has many obvious implications. It would mean, for one, that the question of transportation would first be addressed on the demand side (where environmental research must always begin). If everything necessary for daily life were within walking distance from home, the need for extensive transportation infrastructures would be reduced. Likewise, it would end the often destructive class divisions and distinctions among neighborhoods. Establishing a community as the center of economic activity would require providing living space for a mixed group of wage earners, ranging from janitors and teachers to farmers, IT workers and entrepreneurs. The idea of harmonization is crucial and is meant to suggest a balanced idea about design and planning, rather than a coercive insistence on assigning people to specific places within the city.

At the other end of the scale, it's also clear that local autonomy can never be achieved in certain key functions, and these help to establish the place of all cities in a global environment and to set the parameters of urban networks. The planet will always depend on the Amazon Basin to produce a vast portion of its oxygen to sink lots of its carbon. To support another primal need, New York City has made remarkable provision for harvesting drinking water from watersheds and reservoirs it owns upstate, and for transporting it through massive pipes (one of which has recently been completed at the cost of billions—a remarkable project of truly Roman grandeur).

But we handle our water poorly when it arrives. New York, like many other cities, has a combined sewer system. That is, both sewage and storm water are gathered by the same pipes. During intense storms, the system is overwhelmed. Huge quantities of raw waste are dumped directly into the city's rivers, fouling environments far downstream. The sustainable solution doesn't involve simply disentangling the pipes to create two separate systems. It implies rethinking waste as an asset, which in turn underlines the imperative of transforming our culture from a focus on consumption and disposability to a more respectful and canny attitude to global resources.

Indeed, by designing systems that are cyclical rather than linear, the very idea of waste can become an anachronism. In the case of water, rain should be collected and recycled, whether gathered on rooftops and conveyed to cisterns, or percolated through bio-swales (landscape elements that provide drainage) and newly permeable ground to recharge the aquifer. At the same time, human waste need not be carried to the massive treatment installations that characterize the city of today; it can be remediated at more local scales—via "living machines," biological remediation systems that operate at building, block and neighborhood levels, and that can recover waste's potential to transmute into water, fertilizer, fuel, and other raw materials.

As we do not anticipate placing the city under a dome *á la* Bucky Fuller, moving toward self-sufficiency is complicated by the need for mobility and transportation inside and outside municipal boundaries. It is far easier for a city to move to a post-fossil-fuel, post-combustion environment than it is for larger entities of governance and organization, such as the nation state. The city will not have a literal wall, but its edge should be the starting point for a conceptual transformation—an organizational boundary within which people will move differently. One possibility is that New York could be ringed (at various distances)—as Venice is—with intermodal transfer points. Cars would be left outside those boundaries and travel within them would instead be based on more public or shared transportation.

This will have additional knock-on effects. Without cars, there will be no need for wide motorways within the city. The vast spaces they currently occupy can be converted to other uses—agriculture, greenways, housing, etc.—and the vast quantities of steel and concrete used to build them can be recycled for use by the city's future construction and industry.

More than a Theory

Although we are doing our project in a literal-minded way, it is informed by the techniques of "patch dynamics," a form of ecological study that is founded in the essential arbitrariness of the boundary of the area being investigated. As with the political boundaries of the city, the patch functions as a kind of controlled experiment that can reveal an order of relationships that might otherwise be obscured by the expansiveness of the systems and their interactions.

Cities are, after all, complex ecosystems, and a large measure of the interest in our project is looking at the way in which a boundary that is the result of a collusion of both physical barriers—two of the city's boroughs, Manhattan and Staten Island, are islands—and political barriers—the other three boroughs, the Bronx (on the U.S. mainland), and Brooklyn and Queens (part of the Long Island land mass) are hemmed by borders without such material justifications. These borders have economic, cultural, morphological, and political implications. The question of the permeability of the urban membrane—which must certainly be transparent to ideas and to people—is at the very center of our investigation.

We have recently completed work on one of the fundamental topics in our project: food, a growing obsession in the United States. Our preoccupation includes consumption—witness the status of chefs and the burgeoning of our locavore culture—as well as production and nutrition. This interest stems, in part, from anxiety about the domination of the food chain by agribusiness, with its energy-intensive, mono-cropping, highly polluting practices and its displacement of family farming. There are also technology-induced fears—the result of the use of pesticides, fertilizers and GMOs. At the same time, trade agreements such as the North American Free Trade Agreement (NAFTA) have depressed local production to the benefit of predatory corporate producers. Finally, obesity rates are now greater than those of malnourishment. Ironically, both heavily correlate with poverty.

Thus, in thinking about how to introduce food production into our model, we knew that our vision had to embrace food justice, localism and the forms of sociability and organization arising from growing, preparing and eating food. With this in mind, we first investigated the possibility of ensuring that every input to the city's consumption came from within its boundaries. We considered that it would be necessary to grow 100 percent of the basic requirement of 2,000 to 2,500 nutritious calories a day for 8.5 million people. We soon discovered that it was possible to achieve this by deploying the full range of growing environments—including rooftops, building façades, repurposed street spaces, vacant lots, over-decked rail yards, basements, rivers, and by the introduction of—everybody's favorite—vertical farms in substantial numbers. But it also proved impractical.

The idea of generating very high rates of food production within a city's fabric is itself not unreasonable, depending on site and circumstances. Havana, taxed by inefficiency, shortages and the U.S. embargo, is nevertheless "blessed" by low wages and a 12-month growing season. As a result, it has been able to introduce a system of very low-tech "*organiponicos*"—small urban farm plots—that now produce nearly 90 percent of the fruit and vegetables for the city. Many Chinese cities—despite their size—have, until recently, produced the majority of their vegetable and livestock supplies in their near hinterlands, as was the pattern in many European cities well through the nineteenth century.

From the standpoint of climate and density, New York City is a little more challenging.

Our study looked first at the possibility of 100 percent production. Some of the formal results are illustrated here. This required the extensive deployment of vertical farming which, as a purely spatial matter, was do-able and not out of line with other very large-scale building projects, such as the vast archipelago of housing projects that could be built by the city in a matter of decades. By using vacant lots, abandoned buildings, unused space near infrastructure and industrial buildings, the waterfront, and a variety of other found opportunities, the problem was nominally solved.

But only nominally. The production of grains, for example, (which are grown extremely cheaply in the U.S. Midwest) were not economical as an urban enterprise, nor was it immediately clear how the very large-scale style of growing food—a 30-story tower the size of a Manhattan block using advanced hydroponics could feed around 12,000 people—could be organized as a series of smaller-scale enterprises. And, perhaps most telling, we discovered that the amount of energy required to power these farms (including heating, lighting and the energy embodied in construction) demanded an input equivalent to the output of 25 nuclear plants. This, needless to say, was somewhat contrary to the spirit of the exercise!

Sweet Spots

Having proved the marginal possibility of a completely autonomous system, we are now looking at a series of "sweet spots" of greater practicality. We have looked at a scheme for a 100-mile (161-kilometer) hinterland, and at another based on statewide production using a recovered Erie Canal, once the principal water route for goods from the Hudson River to Lake Erie. And we've looked at the way in which agriculture can be more localized in neighborhoods to produce something on the order of 30 percent of demand.

One of our first sketches proposed a "figure-ground" switch—the migration of buildings into street space and the freeing up of block interiors for farming and other public activities. While the image was attractive, the numbers were unimpressive. We estimated that no more than 2 to 3 percent of food requirements could be satisfied in this liberated space. This led us to a serious examination of the underused infrastructure of the city.

We selected several blocks in Queens and, holding the population constant, we calculated solutions that ranged from 100 percent to 30 percent and 10 percent of local food needs. That called our attention to a massive, little-used rail yard nearby that could be used to supplement food production by turning it into an energy farm to harvest solar and wind power. A scheme of growing 30 percent of food demand on the spot yielded both a new, green interior for the blocks and produced a refreshed idea of the urban street, much inspired by Islamic and medieval urbanism, with their tight circulation spaces in which pedestrian and commercial life flourishes.

New York City (Steady) State is an ongoing exercise. We look forward to learning a great deal about both the limits and the expansive possibilities for developing urban autonomy. While cities grown too large can be toxic, degrading and ungovernable, a city conceived with a heightened sense of independence and self-responsibility can also play a role in solving the economic, political and environmental problems confronting the planet.

We are now investigating how to mitigate the urban heat island, how to clean the city's air, how to imagine new architectures that will collect sunlight, gather water, generate energy, and remediate their wastes. By looking at these questions in an ecological way, we are able to generate synergistic ideas and a vision about other questions, including neighborhood forms, the possibility of manufacturing the technologies with locally sourced materials, and the kinds of lives we could (and should) lead in a city that truly takes responsibility for itself and all who live in it.

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  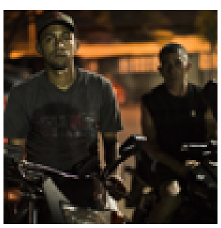

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