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# *Designing Cities for People*

As I was being driven through Tel Aviv from my hotel to a conference center in 1998, I could not help but note the overwhelming presence of cars and parking lots. It was obvious that Tel Aviv, expanding from a small settlement a half-century ago to a city of some 3 million today, had evolved during the automobile era. It occurred to me that the ratio of parks to parking lots may be the best single indicator of the livability of a city—an indication of whether the city is designed for people or for cars.<sup>1</sup>

Tel Aviv is not the world's only fast-growing city. Urbanization is the second dominant demographic trend of our time, after population growth itself. In 1900, some 150 million people lived in cities. By 2000, it was 2.8 billion people, a 19-fold increase. As of 2008, more than half of us live in cities—making humans, for the first time, an urban species.<sup>2</sup>

In 1900 only a handful of cities had a million people. Today 431 cities have at least that many inhabitants. And there are 19 megacities with 10 million or more residents. Greater Tokyo, with 36 million residents, has more people than all of Canada. The New York metropolitan area's population of 19 million is nearly equal to that of Australia. Mexico City, Mumbai (for-

merly Bombay), São Paulo, Delhi, Shanghai, Kolkata (Calcutta), and Dhaka follow close behind.<sup>3</sup>

The world's cities are facing unprecedented challenges. In Mexico City, Tehran, Kolkata, Bangkok, Beijing, and hundreds of other cities, the air is no longer safe to breathe. In some cities the air is so polluted that breathing is equivalent to smoking two packs of cigarettes a day. Respiratory illnesses are rampant. In many places, the number of hours commuters spend sitting in traffic-congested streets and highways climbs higher each year, raising frustration levels.<sup>4</sup>

In response to these conditions, we are seeing the emergence of a new urbanism, a planning philosophy that environmentalist Francesca Lyman says “seeks to revive the traditional city planning of an era when cities were designed around human beings instead of automobiles.” One of the most remarkable modern urban transformations has occurred in Bogotá, Colombia, where Enrique Peñalosa served as mayor for three years. When he took office in 1998 he did not ask how life could be improved for the 30 percent who owned cars; he wanted to know what could be done for the 70 percent—the majority—who did not own cars.<sup>5</sup>

Peñalosa realized that a city with a pleasant environment for children and the elderly would work for everyone. In just a few years, he transformed the quality of urban life with his vision of a city designed for people. Under his leadership, the city banned the parking of cars on sidewalks, created or renovated 1,200 parks, introduced a highly successful bus-based rapid transit (BRT) system, built hundreds of kilometers of bicycle paths and pedestrian streets, reduced rush hour traffic by 40 percent, planted 100,000 trees, and involved local citizens directly in the improvement of their neighborhoods. In doing this, he created a sense of civic pride among the city's 8 million residents, making the streets of Bogotá in this strife-torn country safer than those in Washington, D.C.<sup>6</sup>

Peñalosa observes that “high quality public pedestrian space in general and parks in particular are evidence of a true democracy at work.” He further observes: “Parks and public space are also important to a democratic society because they are the only places where people meet as equals. . . . In a city, parks are as essential to the physical and emotional health of a city as the

water supply.” He notes this is not obvious from most city budgets, where parks are deemed a luxury. By contrast, “roads, the public space for cars, receive infinitely more resources and less budget cuts than parks, the public space for children. Why,” he asks, “are the public spaces for cars deemed more important than the public spaces for children?”<sup>7</sup>

In espousing this new urban philosophy, Peñalosa is not alone. Some cities in industrial and developing countries alike are dramatically increasing urban mobility by moving away from the car. Jaime Lerner, when he was mayor of Curitiba, Brazil, pioneered the design and adoption of an alternative transportation system that is inexpensive and commuter-friendly. Since 1974 Curitiba's transportation system has been totally restructured. Although 60 percent of the people own cars, busing, biking, and walking totally dominate, accounting for 80 percent of all trips in the city.<sup>8</sup>

Now planners everywhere are experimenting, seeking ways to design cities for people, not cars. Cars promise mobility, and in a largely rural setting they provide it. But in an urbanizing world there is an inherent conflict between the automobile and the city. After a point, as their numbers multiply, automobiles provide not mobility but immobility.<sup>9</sup>

### The Ecology of Cities

The evolution of modern cities was tied to advances in transport, initially for ships and trains. But it was the internal combustion engine combined with cheap oil that provided mobility for people and freight that fueled the phenomenal urban growth of the twentieth century.

Cities require a concentration of food, water, energy, and materials that nature cannot provide. Collecting these masses of materials and later dispersing them in the form of garbage, sewage, and pollutants in air and water is challenging city managers everywhere.

Early cities relied on food and water from the surrounding countryside, but today cities often depend on distant sources for basic amenities. Los Angeles, for example, draws much of its water from the Colorado River, some 600 miles away. Mexico City's burgeoning population, living at an altitude of over 9,000 feet, depends on the costly pumping of water from 100 miles

away that must be lifted over 3,000 feet to augment inadequate water supplies. Beijing is planning to draw water from the Yangtze River basin some 800 miles away.<sup>10</sup>

Food comes from even greater distances, as illustrated by Tokyo. While the city still gets its rice from the highly productive farmers in Japan, with their land carefully protected by government policy, its wheat comes largely from the Great Plains of North America and from Australia. Its corn supply comes largely from the U.S. Midwest. Soybeans come from the U.S. Midwest and the Brazilian *cerrado*.<sup>11</sup>

The oil used to move resources into and out of cities often comes from distant oil fields. Rising oil prices will affect cities, but they will affect even more the suburbs that surround them. The growing scarcity of water and the high energy cost of transporting it over long distances may begin to constrain the growth of some cities.

Against this backdrop, Richard Register, author of *Ecocities: Rebuilding Cities in Balance with Nature*, says it is time to fundamentally rethink the design of cities. He agrees with Peñalosa that cities should be designed for people, not for cars. He goes even further, talking about pedestrian cities—communities designed so that people do not need cars because they can walk or take public transportation wherever they need to go. Register says that a city should be seen as a functioning system not in terms of its parts but in terms of its whole. He also makes a convincing case that cities should be integrated into local ecosystems rather than imposed on them.<sup>12</sup>

He describes with pride an after-the-fact integration into the local ecosystem of San Luis Obispo, a California town of 43,000 residents north of Los Angeles: “[It] has a beautiful creek restoration project with several streets and through-building passageways lined with shops that connect to the town’s main commercial street, and people love it. Before closing a street, turning a small parking lot into a park, restoring the creek and making the main street easily accessible to the ‘nature’ corridor, that is, the creek, the downtown had a 40 percent vacancy rate in the storefronts, and now it has zero. Of course it’s popular. You sit at your restaurant by the creek...where fresh breezes rustle the trees in a world undisturbed by car noise and blasting exhaust.”<sup>13</sup>

For Register, the design of the city and its buildings become a part of the local landscape, capitalizing on the local ecology. For example, buildings can be designed to be heated and cooled partly by nature. As oil prices rise, urban fruit and vegetable production will expand into vacant lots and onto rooftops. Cities can largely live on recycled water that is cleaned and used again and again. The “flush and forget” water system will become too costly for many water-short cities after oil production peaks.<sup>14</sup>

### Redesigning Urban Transport

Urban transport systems based on a combination of rail lines, bus lines, bicycle pathways, and pedestrian walkways offer the best of all possible worlds in providing mobility, low-cost transportation, and a healthy urban environment.

A rail system provides the foundation for a city’s transportation. Rails are geographically fixed, providing a permanent means of transport that people can count on. Once in place, the nodes on such a system become the obvious places to concentrate office buildings, high-rise apartment buildings, and shops.

Whether the best fit is underground rail, light-rail surface systems, or both depends in part on city size and geography. Berlin, for example, has both. Megacities regularly turn to underground rail systems to provide mobility. For cities of intermediate size, light rail is often an attractive option.<sup>15</sup>

As noted earlier, some of the most innovative public transportation systems, those that shift huge numbers of people from cars into buses, have been developed in Curitiba and Bogotá. The success of Bogotá’s BRT system, TransMilenio, which uses special express lanes to move people quickly through the city, is being replicated not only in six other Colombian cities but in scores elsewhere too, including Mexico City, São Paulo, Hanoi, Seoul, Istanbul, and Quito. In China, Beijing is one of eight cities with BRT systems in operation.<sup>16</sup>

In Mexico City, the latest extension of the Insurgentes Avenue BRT corridor from 13 miles to 19 miles and the addition of 26 new articulated buses enables this line to carry 260,000 passengers daily. By 2012, the city plans to have 10 BRT lines in operation. And in southern China, by the end of 2009 Guangzhou will put into operation its BRT, which is designed to

carry more than 600,000 passengers each day. In addition to linking with the city's underground Metro in three places, it will be paralleled throughout its entirety with a bike lane. Guangzhou will also have 5,500 bike parking spaces for those using a bike-BRT travel combination.<sup>17</sup>

In Iran, Tehran launched its first BRT line in early 2008. Several more lines are in the development stage, and all will be integrated with the city's new subway lines. Several cities in Africa are also planning BRT systems. Even industrial-country cities such as Ottawa, Toronto, New York, Minneapolis, Chicago, Las Vegas, and—much to everyone's delight—Los Angeles have launched or are now considering BRT systems.<sup>18</sup>

Some cities are reducing traffic congestion and air pollution by charging cars to enter the city. Singapore, long a leader in urban transport innovation, was one of the first to tax vehicles entering the city center. Electronic sensors identify each car and then debit the owner's credit card. This system has reduced the number of automobiles in Singapore, providing its residents with both more mobility and cleaner air.<sup>19</sup>

Singapore has been joined by three Norwegian cities—Oslo, Bergen, and Trondheim—as well as London and Stockholm. In London—where until recently the average speed of an automobile was comparable to that of a horse-drawn carriage a century ago—a congestion fee was adopted in early 2003. The initial £5 (about \$8 at the time) charge on all motorists driving into the center city between 7 a.m. and 6:30 p.m. immediately reduced the number of vehicles, permitting traffic to flow more freely while cutting pollution and noise.<sup>20</sup>

In the first year after the new tax was introduced, the number of people using buses to travel into central London climbed by 38 percent and vehicle speeds on key thoroughfares increased by 21 percent. In July 2005, the congestion fee was raised to £8. Then in February 2007, the charging zone was extended westward. With the revenue from the congestion fee being used to upgrade and expand public transit, Londoners are steadily shifting from cars to buses, the subway, and bicycles. Since the congestion charge was adopted, the daily flow of cars and minicabs into central London during peak hours has dropped by 36 percent while the number of bicycles has increased by 66 percent.<sup>21</sup>

In January 2008, Milan adopted a “pollution charge” of \$14 on vehicles entering its historic center in daytime hours during the week. Other cities now considering similar measures include San Francisco, Turin, Genoa, Kiev, Dublin, and Auckland.<sup>22</sup>

Paris Mayor Bertrand Delanoë, who was elected in 2001, inherited some of Europe's worst traffic congestion and air pollution. He decided traffic would have to be cut 40 percent by 2020. The first step was to invest in better transit in outlying regions to ensure that everyone in the greater Paris area had access to high-quality public transit. The next step was to create express lanes on main thoroughfares for buses and bicycles, thus reducing the number of lanes for cars. As the speed of buses increased, more people used them.<sup>23</sup>

A third innovative initiative in Paris was the establishment of a city bicycle rental program that has 20,600 bikes available at 1,450 docking stations throughout the city. Access to the bikes is by credit card, with a choice of daily, weekly, or annual rates ranging from just over \$1 per day to \$40 per year. If the bike is used for fewer than 30 minutes, the ride is free. Based on the first two years, the bicycles are proving to be immensely popular—with 48 million trips taken. Patrick Allin, a Parisian and an enthusiastic user of the bikes, says they are great for conversation: “We are no longer all alone in our cars—we are sharing. It's really changed the atmosphere here; people chat at the stations and even at traffic lights.”<sup>24</sup>

In writing about the program in the *New York Times*, Serge Schmemmann draws a “lesson for all big cities: this is an idea whose time has come.” At this point Mayor Delanoë is working hard to realize his goal of cutting car traffic by 40 percent and carbon emissions by a similar amount by 2020. The popularity of this bike sharing program has led to its extension into 30 of the city's suburbs and has inspired cities such as London to also introduce bike sharing.<sup>25</sup>

The United States, which has lagged far behind Europe in developing diversified urban transport systems, is being swept by a “complete streets” movement, an effort to ensure that streets are friendly to pedestrians and bicycles as well as to cars. Many American communities lack sidewalks and bike lanes, making it difficult for pedestrians and cyclists to get around safely, particularly where streets are heavily traveled. In Char-

lotte, North Carolina, transportation planning manager Norm Steinman says: “We didn’t build sidewalks here for 50 years. Streets designed by traffic engineers in the ‘60s, ‘70s, ‘80s, and ‘90s were mostly for autos.”<sup>26</sup>

This cars-only model is being challenged by the National Complete Streets Coalition, a powerful assemblage of citizen groups, including the Natural Resources Defense Council, AARP (an organization of 40 million older Americans), and numerous local and national cycling organizations. The complete streets movement is the product of a “perfect storm of issues coming together,” says Randy Neufeld, Chief Strategy Officer for the Active Transportation Alliance. Among these issues are the obesity epidemic, rising gasoline prices, the urgent need to cut carbon emissions, air pollution, and mobility constraints on aging baby boomers. The elderly who live in urban areas without sidewalks and who no longer drive are effectively imprisoned in their own homes.<sup>27</sup>

The National Complete Streets Coalition, headed by Barbara McCann, reports that as of July 2009, complete streets policies are in place in 18 states, including California and Illinois, and in 46 cities. One reason states have become interested in passing such legislation is that integrating bike paths and sidewalks into a project from the beginning is much less costly than adding them later. As McCann notes, it is “cheaper to do it right the first time.” A national complete streets bill was introduced in both houses of Congress in early 2009.<sup>28</sup>

Closely related to this approach is a movement that encourages and facilitates walking to school. Beginning in the United Kingdom in 1994, it has now spread to some 40 countries, including the United States. Forty years ago, more than 40 percent of all U.S. children walked or biked to school, but now the figure is under 15 percent. Today 60 percent are driven or drive to school. Not only does this contribute to childhood obesity, but the American Academy of Pediatrics reports fatalities and injuries are much higher among children going to school in cars than among those who walk or ride in school buses. Among the potential benefits of the Walk to School movement is a reduction in obesity and early onset diabetes.<sup>29</sup>

Countries with well-developed urban transit systems and a mature bicycle infrastructure are much better positioned to

withstand the stresses of a downturn in world oil production than those that depend heavily on cars. With a full array of walking and biking options, the number of trips by car can easily be cut by 10–20 percent.<sup>30</sup>

### **The Return of Bicycles**

The bicycle has many attractions as a form of personal transportation. It alleviates congestion, lowers air pollution, reduces obesity, increases physical fitness, does not emit climate-disrupting carbon dioxide, and is priced within the reach of billions of people who cannot afford a car. Bicycles increase mobility while reducing congestion and the area of land paved over. Six bicycles can typically fit into the road space used by one car. For parking, the advantage is even greater, with 20 bicycles occupying the space required to park a car.<sup>31</sup>

World bicycle production, averaging 94 million per year from 1990 to 2002, climbed to 130 million in 2007, far outstripping automobile production of 70 million. Bicycle sales in some markets are surging as governments devise a myriad of incentives to encourage bicycle use in order to reduce air pollution and traffic congestion. For example, in 2009 the Italian government began a hefty incentive program to encourage the purchase of bicycles or electric bikes in order to improve urban air quality and reduce the number of cars on the road. The direct payments will cover up to 30 percent of the cost of the bicycle.<sup>32</sup>

China, with 430 million bikes, has the largest fleet, but ownership rates are higher in Europe. The Netherlands has more than one bike per person, while Denmark and Germany have just under one bike per person.<sup>33</sup>

The bicycle is not only a flexible means of transportation; it is an ideal way of restoring a balance between caloric intake and expenditure. Regular exercise of the sort provided by cycling to work reduces cardiovascular disease, osteoporosis, and arthritis, and it strengthens the immune system.

Few methods of reducing carbon emissions are as effective as substituting a bicycle for a car on short trips. A bicycle is a marvel of engineering efficiency, one where an investment in 22 pounds of metal and rubber boosts the efficiency of individual mobility by a factor of three. On my bike I estimate that I get easily 7 miles per potato. An automobile, which requires at least

a ton of material to transport one person, is extraordinarily inefficient by comparison.

The capacity of the bicycle to provide mobility for low-income populations was dramatically demonstrated in China. In 1976, this country produced 6 million bicycles. After the reforms in 1978 that led to an open market economy and rapidly rising incomes, bicycle production started climbing, reaching nearly 90 million in 2007. The surge to 430 million bicycle owners in China since 1978 has provided the greatest increase in mobility in history. Bicycles took over rural roads and city streets. Although China's 14 million passenger cars and the urban congestion they cause get a lot of attention, it is bicycles that provide personal mobility for hundreds of millions of Chinese.<sup>34</sup>

In the United States, nearly 75 percent of police departments serving populations of 50,000 or more now have routine patrols by bicycle. Officers on bikes are more productive in cities partly because they are more mobile and can reach the scene of an accident or crime more quickly and more quietly than officers in cars. They typically make 50 percent more arrests per day than officers in squad cars. Fiscally, the cost of operating a bicycle is trivial compared with that of a police car.<sup>35</sup>

Colleges and universities are also turning to bicycles. As campuses are overwhelmed by cars, traffic congestion, and the need to build more residential facilities, they are being forced to take innovative measures to discourage cars. Chicago's St. Xavier University launched a bike-sharing program in the fall of 2008. This program is patterned after the one in Paris, except that students use their ID cards instead of credit cards. Emory University in Atlanta, Georgia, has introduced a free bike-sharing system, also based on ID cards. Jamie Smith, who manages the program, says, "We like the idea of bolstering the cycling culture here."<sup>36</sup>

Ripon College in Wisconsin and the University of New England in Maine have gone even further. They find it cheaper to give each incoming freshman a bike if they agree to leave their cars at home. Replacing cars with bikes on campus is not only reducing air pollution and traffic congestion, it is also creating a sense of community.<sup>37</sup>

Bicycle messenger services are common in the world's larger cities simply because they deliver small parcels more quickly

than cars can and at a lower cost. As e-commerce expands, the need for quick, reliable, urban delivery services is escalating. For companies that market over the Internet, quick delivery wins more customers.<sup>38</sup>

The key to realizing the potential of the bicycle is to create a bicycle-friendly transport system. This means providing both bicycle trails and designated street lanes for bicycles. Among the industrial-country leaders in designing bicycle-friendly transport systems are the Netherlands, where 27 percent of all trips are by bike, Denmark with 18 percent, and Germany, 10 percent. By contrast, the United States and the United Kingdom are each at 1 percent.<sup>39</sup>

An excellent study by John Pucher and Ralph Buehler at Rutgers University analyzed the reasons for these wide disparities among countries. They note that "extensive cycling rights-of-way in the Netherlands, Denmark, and Germany are complemented by ample bike parking, full integration with public transport, comprehensive traffic education and training of both cyclists and motorists." These countries, they point out, "make driving expensive as well as inconvenient in central cities through a host of taxes and restrictions on car ownership, use and parking.... It is the coordinated implementation of this multi-faceted, mutually reinforcing set of policies that best explains the success of these three countries in promoting cycling." And it is the lack of these policies, they note, that explains "the marginal status of cycling in the UK and USA."<sup>40</sup>

Fortunately, many Americans are working to change this. Prominent among them is Congressman Earl Blumenauer of Oregon. An avid cyclist, he is the founder and coordinator of the 180-member Congressional Bicycle Caucus.<sup>41</sup>

The Netherlands, the unquestioned leader among industrial countries in encouraging bicycle use, has incorporated a vision of the role of bicycles into a Bicycle Master Plan. In addition to creating bike lanes and trails in all its cities, the system also often gives cyclists the advantage over motorists in right-of-way and at traffic lights. Some traffic signals permit cyclists to move out before cars. By 2007, Amsterdam had become the first western industrial city where the number of trips taken by bicycle exceeded those taken by car.<sup>42</sup>

Within the Netherlands, a nongovernmental group called

Interface for Cycling Expertise (I-ce) has been formed to share the Dutch experience in designing a modern transport system that prominently features bicycles. It is working with groups in Botswana, Brazil, Chile, Colombia, Ecuador, Ghana, India, Kenya, Peru, South Africa, and Uganda to facilitate bicycle use. Roelof Wittink, head of I-ce, observes: “If you plan only for cars then drivers will feel like the King of the Road. This reinforces the attitude that the bicycle is backward and used only by the poor. But if you plan for bicycles it changes the public attitude.”<sup>43</sup>

Both the Netherlands and Japan have made a concerted effort to integrate bicycles and rail commuter services by providing bicycle parking at rail stations, making it easier for cyclists to commute by train. In Japan, the use of bicycles for commuting to rail transportation has reached the point where some stations have invested in vertical, multi-level parking garages for bicycles, much as is often done for automobiles.<sup>44</sup>

Sales of electric bicycles, a relatively new genre of transport vehicles, have taken off. They are similar to plug-in hybrid cars in that they are powered by two sources—in this case muscle and battery power—and can be plugged into the grid for recharging as needed. Sales in China, where this technology came into its own, climbed from 40,000 e-bikes in 1998 to 21 million in 2008. China now has close to 100 million electric bicycles on the road, compared with 14 million cars. These e-bikes are now attracting attention in other Asian countries similarly plagued with air pollution and in the United States and Europe, where combined sales now exceed 300,000 per year.<sup>45</sup>

In contrast to plug-in hybrid cars, electric bikes do not directly use any fossil fuel. If we can make the transition from coal-fired power plants to wind, solar, and geothermal power, then electrically powered bicycles can also be fossil-fuel-free.

The integration of walkways and bikeways into urban transport systems makes a city eminently more livable than one that relies almost exclusively on private automobiles. Noise, pollution, congestion, and frustration are all lessened. And we and the earth are both healthier.

### Reducing Urban Water Use

The one-time use of water to disperse human and industrial wastes is an outmoded practice, made obsolete by new tech-

nologies and water shortages. Water enters a city, becomes contaminated with human and industrial wastes, and leaves the city dangerously polluted. Toxic industrial wastes discharged into rivers and lakes or into wells also permeate aquifers, making water—both surface and underground—unsafe for drinking.

The current engineering concept for dealing with human waste is to use vast quantities of water to wash it away, preferably into a sewer system, where it may or may not be treated before being discharged into the local river. The “flush and forget” system takes nutrients originating in the soil and typically dumps them into the nearest body of water. Not only are the nutrients lost from agriculture, but the nutrient overload has contributed to the death of many rivers and to the formation of some 405 “dead zones” in ocean coastal regions. This outdated system is expensive and water-intensive, disrupts the nutrient cycle, and can be a major source of disease and death. Worldwide, poor sanitation and personal hygiene claim the lives of some 2 million children per year, a toll that is one third the size of the 6 million lives claimed by hunger and malnutrition.<sup>46</sup>

Sunita Narain of the Centre for Science and Environment in India argues convincingly that a water-based disposal system with sewage treatment facilities is neither environmentally nor economically viable for India. She notes that an Indian family of five, producing 250 liters of excrement in a year and using a water flush toilet, contaminates 150,000 liters of water when washing away its wastes.<sup>47</sup>

As currently designed, India’s sewer system is actually a pathogen-dispersal system. It takes a small quantity of contaminated material and uses it to make vast quantities of water unfit for human use. With this system, Narain says, both “our rivers and our children are dying.” India’s government, like that of many developing countries, is hopelessly chasing the goal of universal water-based sewage systems and sewage treatment facilities—unable to close the huge gap between services needed and provided, but unwilling to admit that it is not an economically viable option.<sup>48</sup>

Fortunately, there is a low-cost alternative: the composting toilet. This is a simple, waterless, odorless toilet linked to a small compost facility and sometimes a separate urine collecting facility. Collected urine can be trucked to nearby farms,

much as fertilizer is. The dry composting converts human fecal material into a soil-like humus, which is essentially odorless and is scarcely 10 percent of the original volume. These compost facilities need to be emptied every year or so, depending on design and size. Vendors periodically collect the humus and market it as a soil supplement, thus ensuring that the nutrients and organic matter return to the soil, reducing the need for energy-intensive fertilizer.<sup>49</sup>

This technology sharply reduces residential water use compared with flush toilets, thus cutting water bills and lowering the energy needed to pump and purify water. As a bonus, it also reduces garbage flow if table wastes are incorporated, eliminates the sewage water disposal problem, and restores the nutrient cycle. The U.S. Environmental Protection Agency now lists several brands of dry compost toilets approved for use. Pioneered in Sweden, these toilets work well under the widely varying conditions in which they are now used, including Swedish apartment buildings, U.S. private residences, and Chinese villages. For many of the 2.5 billion people who lack improved sanitation facilities, composting toilets may be the answer.<sup>50</sup>

As Rose George, author of *The Big Necessity: The Unmentionable World of Human Waste and Why It Matters*, reminds us, the “flush and forget” system is an energy guzzler. There are two reasons for this. One, it takes energy to deliver large quantities of drinking-quality water (up to 30 percent of household water usage is for flushing). Two, it takes energy—and lots of it—to operate a sewage treatment facility. Many years ago U.S. President Theodore Roosevelt noted, “civilized people ought to know how to dispose of the sewage in some other way than putting it into the drinking water.”<sup>51</sup>

In summary, there are several reasons why the advanced design composting toilets deserve top priority: spreading water shortages, rising energy prices, rising carbon emissions, shrinking phosphate reserves, a growing number of sewage-fed oceanic dead zones, the rising health care costs of sewage-dispersed intestinal diseases, and the rising capital costs of “flush and forget” sewage disposal systems.

Once a toilet is separated from the water use system, recycling household water becomes a much simpler process. For cities, the most effective single step to raise water productivity is

to adopt a comprehensive water treatment/recycling system, reusing the same water continuously. With this system, which is much simpler if sewage is not included in the waste water, only a small percentage of water is lost to evaporation each time it cycles through. Given the technologies that are available today, it is quite possible to recycle the urban water supply indefinitely, largely removing cities as a claimant on scarce water resources.

Some cities faced with shrinking water supplies and rising water costs are beginning to recycle their water. Singapore, for example, which buys water from Malaysia at a high price, is already recycling water, reducing the amount it imports. Windhoek, capital of Namibia and one of the most arid locations in Africa, recycles waste water for drinking water. In water-stressed California, Orange County invested in a \$481-million treatment facility that opened in early 2008 to convert sewage into safe clean water, which is used to replenish the local aquifer. Los Angeles is planning to do the same. South Florida approved a plan in late 2007 to recycle waste water as drinking water. For more and more cities, water recycling is becoming a condition of survival.<sup>52</sup>

Individual industries facing water shortages are also moving away from the use of water to disperse waste. Some companies segregate effluent streams, treating each individually with the appropriate chemicals and membrane filtration, preparing the water for reuse. Peter Gleick, lead author of the biennial report *The World's Water*, writes: “Some industries, such as paper and pulp, industrial laundries, and metal finishing, are beginning to develop ‘closed-loop’ systems where all the wastewater is reused internally, with only small amounts of fresh water needed to make up for water incorporated into the product or lost in evaporation.” Industries are moving faster than cities, but the technologies they are developing can also be used in urban water recycling.<sup>53</sup>

At the household level, water can also be saved by using more water-efficient showerheads, flush toilets, dishwashers, and clothes washers. Some countries are adopting water efficiency standards and labeling for appliances, much as has been done for energy efficiency. When water costs rise, as they inevitably will, investments in composting toilets and more water-efficient household appliances will become increasingly



attractive to individual homeowners.

Two household appliances—toilets and showers—together account for over half of indoor water use. Whereas traditional flush toilets used 6 gallons (or 22.7 liters) per flush, the legal U.S. maximum for new toilets is 1.6 gallons (6 liters). New toilets with a dual-flush technology use only 1 gallon for a liquid waste flush and 1.6 gallons for a solid waste flush. Shifting from a showerhead flowing at 5 gallons per minute to a 2.5 gallons-per-minute model cuts water use in half. With washing machines, a horizontal axis design developed in Europe uses 40 percent less water than the traditional top-loading models.<sup>54</sup>

The existing water-based waste disposal economy is not viable. There are too many households, factories, and feedlots to simply try and wash waste away on our crowded planet. To do so is ecologically mindless and outdated—an approach that belongs to a time when there were far fewer people and far less economic activity.

### Farming in the City

While attending a conference on the outskirts of Stockholm in the fall of 1974, I walked past a community garden near a high-rise apartment building. It was an idyllic Indian summer afternoon, with many people tending gardens a short walk from their residences. Some 35 years later I can still recall the setting because of the aura of contentment surrounding those working in their gardens. They were absorbed in producing not only vegetables, but in some cases flowers as well. I remember thinking, “This is the mark of a civilized society.”

In 2005, the U.N. Food and Agriculture Organization (FAO) reported that urban and peri-urban farms—those within or immediately adjacent to a city—supply food to some 700 million urban residents worldwide. These are mostly small plots—vacant lots, yards, even rooftops.<sup>55</sup>

Within and near the city of Dar es Salaam, the capital of Tanzania, some 650 hectares of land produce vegetables. This land supplies not only the city’s fresh produce but a livelihood for 4,000 farmers who intensively farm their small plots year-round. On the far side of the continent, an FAO project has urban residents in Dakar, Senegal, producing up to 30 kilograms (66 pounds) of tomatoes per square meter each year with

continuous cropping in rooftop gardens.<sup>56</sup>

In Hanoi, Viet Nam, 80 percent of the fresh vegetables come from farms in or immediately adjacent to the city. Farms in the city or its shadow also produce 50 percent of the pork and the poultry consumed there. Half of the city’s freshwater fish are produced by enterprising urban fish farmers. Forty percent of the egg supply is produced within the city or nearby. Urban farmers ingeniously recycle human and animal waste to nourish plants and to fertilize fish ponds.<sup>57</sup>

Fish farmers near Kolkata in India manage wastewater fish ponds that cover nearly 4,000 hectares and produce 18,000 tons of fish each year. Bacteria in the ponds break down the organic waste in the city’s sewage. This, in turn, supports the rapid growth of algae that feed the local strains of herbivorous fish. This system provides the city with a steady supply of fresh fish that are consistently of better quality than any others entering the Kolkata market.<sup>58</sup>

The magazine *Urban Agriculture* describes how Shanghai has in effect created a nutrient recycling zone around the city. The municipal government manages 300,000 hectares of farmland to recycle the city’s “night soil”—human wastes collected in areas without modern sanitation facilities. Half of Shanghai’s pork and poultry, 60 percent of its vegetables, and 90 percent of its milk and eggs come from the city and the immediately surrounding region.<sup>59</sup>

In Caracas, Venezuela, a government-sponsored, FAO-assisted project has created 8,000 microgardens of 1 square meter each in the city’s *barrios*, many of them within a few steps of family kitchens. As soon as one crop is mature, it is harvested and immediately replaced with new seedlings. Each square meter, continuously cropped, can produce 330 heads of lettuce, 18 kilograms of tomatoes, or 16 kilograms of cabbage per year. Venezuela’s goal is to have 100,000 microgardens in the country’s urban areas and 1,000 hectares of urban compost-based gardens nationwide.<sup>60</sup>

There is a long tradition of community gardens in European cities. As a visitor flies into Paris, numerous community gardens can be seen on its outskirts. The Community Food Security Coalition (CFSC) reports that 14 percent of London’s residents produce some of their own food. For Vancouver, Canada’s

largest West Coast city, the comparable figure is an impressive 44 percent.<sup>61</sup>

In some countries, such as the United States, there is a huge unrealized potential for urban gardening. A survey indicated that Chicago has 70,000 vacant lots, and Philadelphia, 31,000. Nationwide, vacant lots in cities would total in the hundreds of thousands. The CFSC report summarizes why urban gardening is so desirable. It has “a regenerative effect...when vacant lots are transformed from eyesores—weedy, trash-ridden dangerous gathering places—into bountiful, beautiful, and safe gardens that feed people’s bodies and souls.”<sup>62</sup>

In Philadelphia, community gardeners were asked why they gardened. Some 20 percent did it for recreational reasons, 19 percent said it improved their mental health, and 17 percent their physical health. Another 14 percent did it because they wanted the higher-quality fresh produce that a garden could provide. Others said it was mostly cost and convenience.<sup>63</sup>

A parallel trend to urban gardening is the growing number of local farmers’ markets, where farmers near a city produce fresh fruits and vegetables, pork, poultry, eggs, and cheese for direct marketing to consumers in urban markets.

Given the near inevitable rise in long-term oil prices, the economic benefits of expanding both urban agriculture and local farmers’ markets will become more obvious. Aside from supplying more fresh produce, this will help millions discover the social benefits and the psychological well-being that urban gardening and locally produced food can bring.

### Upgrading Squatter Settlements

Between 2000 and 2050, world population is projected to grow by 3 billion, but little of this growth is projected for industrial countries or for the rural developing world. Nearly all of it will take place in cities in developing countries, with much of the urban growth taking place in squatter settlements.<sup>64</sup>

Squatter settlements—whether the *favelas* in Brazil, *barriadas* in Peru, or *gecekondus* in Turkey—typically consist of an urban residential area inhabited by very poor people who do not own any land. They simply “squat” on vacant land, either private or public.<sup>65</sup>

Life in these settlements is characterized by grossly inade-

quate housing and a lack of access to urban services. As Hari Srinivas, coordinator of the Global Development Research Center, writes, these rural-urban migrants undertake the “drastic option of illegally occupying a vacant piece of land to build a rudimentary shelter” simply because it is their only option. They are often treated either with apathy or with outright antipathy by government agencies, who view them as invaders and trouble. Some see squatter settlements as a social “evil,” something that needs to be eradicated.<sup>66</sup>

One of the best ways to make rural/urban migration manageable is to improve conditions in the countryside. This means not only providing basic social services, such as health care and education for children, as outlined in Chapter 7, but also encouraging industrial investment in small towns throughout the country rather than just in prime cities, such as Mexico City or Bangkok. Such policies will slow the flow into cities to a more orderly pace.

The evolution of cities in developing countries is often shaped by the unplanned nature of squatter settlements. Letting squatters settle wherever they can—on steep slopes, on river floodplains, or in other high-risk areas—makes it difficult to provide basic services such as transport, water, and sanitation. Curitiba, on the cutting edge of the new urbanism, has designated tracts of land for squatter settlements. By setting aside these planned tracts, the process can at least be structured in a way that is consistent with the development plan of the city.<sup>67</sup>

Among the simplest services that can be provided in a squatter settlement are taps that provide safe running water and community composting toilets. This combination can go a long way toward controlling disease in overcrowded settlements. And regular bus service enables workers living in the settlements to travel to their place of work. If the Curitiba approach is widely followed, parks and other commons areas can be incorporated into the community from the beginning.

Some political elites simply want to bulldoze squatter settlements out of existence, but this treats the symptoms of urban poverty, not the cause. People who lose what little they have been able to invest in housing are not richer as a result of the demolition, but poorer, as is the city itself. The preferred option by far is in situ upgrading of housing. The key to this is provid-

ing security of tenure and small loans to squatters, enabling them to make incremental improvements over time.<sup>68</sup>

Upgrading squatter settlements depends on local governments that respond to the problems in these areas rather than ignore them. Progress in eradicating poverty and creating stable, progressive communities depends on establishing constructive links with governments. Government-supported micro-credit lending facilities, for example, can help not only establish a link between the city government and the squatter communities but also offer hope to the residents.<sup>69</sup>

Although political leaders might hope that these settlements will one day be abandoned, the reality is that they will continue expanding. The challenge is to integrate them into urban life in a humane and organized way that provides hope through the potential for upgrading. The alternative is mounting resentment, social friction, and violence.

### Cities for People

A growing body of evidence indicates there is an innate human need for contact with nature. Ecologists and psychologists have both been aware of this for some time. Ecologists, led by Harvard University biologist E. O. Wilson, have formulated the “biophilia hypothesis,” which argues that those who are deprived of contact with nature suffer psychologically and that this deprivation leads to a measurable decline in well-being.<sup>70</sup>

Meanwhile, psychologists have coined their own term—ecopsychology—in which they make the same argument. Theodore Roszak, a leader in this field, cites a study of varying rates of patient recovery in a hospital in Pennsylvania. Those whose rooms overlooked gardens with grass, trees, flowers, and birds recovered from illnesses more quickly than those who were in rooms overlooking the parking lot.<sup>71</sup>

Creating more livable cities thus involves getting people out of their cars and more in touch with nature. The exciting news is that there are signs of change, daily indications of an interest in redesigning cities for people. That U.S. public transit ridership nationwide has risen by 2.5 percent a year since 1996 indicates that people are gradually abandoning their cars for buses, subways, and light rail. Higher gasoline prices encourage commuters to take the bus or subway or get on their bicycles.<sup>72</sup>

Mayors and city planners the world over are beginning to rethink the role of the car in urban transport systems. A group of eminent scientists in China challenged Beijing’s decision to promote an automobile-centered transport system. They noted a simple fact: China does not have enough land to accommodate the automobile and to feed its people. This is also true for India and dozens of other densely populated developing countries.<sup>73</sup>

When 95 percent of a city’s workers depend on cars for commuting, as in Atlanta, Georgia, the city is in trouble. By contrast, in Amsterdam 35 percent of all residents bike or walk to work, while one fourth use public transit and 40 percent drive. In Paris, fewer than half of commuters rely on cars, and even this share is shrinking thanks to the efforts of Mayor Delanoë. Even though these European cities are older, often with narrow streets, they have far less congestion than Atlanta.<sup>74</sup>

There are many ways to restructure the transportation system so that it satisfies the needs of all people, not just the affluent, it provides mobility, not immobility, and it improves health rather than running up health care costs. One way is to eliminate the subsidies, often indirect, that many employers provide for parking. In his book *The High Cost of Free Parking*, Donald Shoup estimates that off-street parking subsidies in the United States are worth at least \$127 billion a year, obviously encouraging people to drive.<sup>75</sup>

In 1992, California mandated that employers match parking subsidies with cash that can be used by the recipient either to pay public transport fares or to buy a bicycle. In firms where data were collected, this shift in policy reduced automobile use by some 17 percent. At the national level, a provision was incorporated into the 1998 Transportation Equity Act for the 21st Century to change the tax code so that those who used public transit or vanpools would enjoy the same tax-exempt subsidies as those who received free parking. What societies should be striving for is not parking subsidies, but parking fees—fees that reflect the costs of traffic congestion and the deteriorating quality of life as cities are taken over by cars and parking lots.<sup>76</sup>

Scores of cities are declaring car-free areas, among them New York, Stockholm, Vienna, Prague, and Rome. Paris enjoys a total ban on cars along stretches of the Seine River on Sundays

and holidays and is looking to make much of the central city traffic-free starting in 2012.<sup>77</sup>

In addition to ensuring that subways are functional and affordable, the idea of making them attractive, even cultural centers, is gaining support. In Moscow, with works of art in the stations, the subway system is justifiably referred to as Russia's crown jewel. In Washington, D.C., Union Station, which links the city's subway system with intercity rail lines, is an architectural delight. Since its restoration was completed in 1988, it has become a social gathering place, with shops, conference rooms, and a rich array of restaurants.

There is much more happening with cities and the reshaping of urban transport than meets the eye. Initial efforts to reverse the growth of urban car populations were based on specific measures, such as charging fees for cars entering the city during rush hour (Singapore, London, and Milan), investing in BRT lines (Curitiba, Bogotá, and Guangzhou), or fostering the bicycle alternative (Amsterdam and Copenhagen). One of the consequences of these and many other measures is that car sales have peaked and are declining in several countries in Europe and in Japan. Total vehicle sales in Japan peaked at 7.8 million in 1990, an economic boom year, and may drop below 5 million in 2009. Similar sales declines have occurred in several European countries and may be starting in the United States. For example, in mid-2008, U.S. automobile scrappage rates exceeded new car sales, a trend that promises to continue through 2009. Adverse economic conditions are a recent factor, but there is a more fundamental set of forces at work.<sup>78</sup>

Owning a car, once an almost universal status symbol, is beginning to lose its appeal. An early 2009 article in *The Japan Times* reports that many young Japanese no longer want to own a car. They see them as wasteful and, particularly in cities like Tokyo, far more trouble than they are worth.<sup>79</sup>

The attitude of young people in Japan appears to be mirrored by growing numbers in other countries, where interest in digital devices may be eclipsing that in cars. Young people are often more interested in their computers, Blackberries, and iPods and in electronic socialization than in "going for a spin" in a car. They have less interest in the latest model cars than their parents' generation had.

There are two ways of dealing with the environmental challenges facing cities. One is to modify existing cities. On Earth Day 2007, New York mayor Michael Bloomberg announced PlaNYC, a comprehensive plan to improve the city's environment, strengthen its economy, and make it a better place to live. At the heart of the plan is a 30-percent reduction in the city's greenhouse gas emissions by 2030. By 2009, PlaNYC—with nearly 130 initiatives—was showing some progress. For example, 15 percent of the taxicab fleet had been converted to fuel-efficient gas-electric hybrids. Nearly 200,000 trees had been planted. Raising the energy efficiency of buildings, a central goal, was under way in dozens of city buildings and many more in the private sector, including the iconic Empire State Building.<sup>80</sup>

The other way is to build new cities from scratch. For example, developer Sydney Kitson has acquired the 91,000-acre Babcock Ranch in southern Florida on which to build a new city. The first step was to help sell more than 73,000 acres of the land to the state government to maintain as a permanent preserve, thus ensuring an abundance of public green space. The heart of the city, intended to be home to 45,000 people, will include a business and commercial center and a high-density residential development. Several satellite communities, part of the overall development plan, will be linked to the downtown by public transportation.<sup>81</sup>

The purpose of the city is to both be a model green community and a center, a national focal point, for renewable energy research and development firms. Among the distinguishing features of this new community are that it will be powered entirely by solar electricity, all residential and commercial buildings will meet standards set by the Florida Green Buildings Coalition, and it will have more than 40 miles of greenways, allowing residents to walk or cycle to work.<sup>82</sup>

Half a world away, in oil-rich Abu Dhabi, construction has begun on another new development, Masdar City, designed for 50,000 people. The government's goal here is to create an international renewable energy research and development center, a sort of Silicon Valley East, that would house up to 1,500 firms, including start-ups and the research arms of major corporations.<sup>83</sup>

Masdar City has several important features. In addition to being powered largely by solar energy, this town of well-insulated buildings plans to be carless, relying on a rail-based, electrically powered, computer-controlled network of individual passenger vehicles. Resembling an enclosed golf cart, these vehicles will be clustered at stations throughout the city to provide direct delivery to each destination. In this water-scarce part of the world, the plan is to continuously recycle water used in the city. And nothing will go to a landfill; everything will be recycled, composted, or gasified to provide energy. How well these pre-engineered cities will perform and whether they will be attractive places to live and work in remains to be seen.<sup>84</sup>

We are only beginning to glimpse where we want to end up. Until now, changes in urban transport systems have been the result of a negative reaction to the growing number of cars in cities. But thinking is starting to change. In 2006, the History Channel sponsored a City of the Future Competition in which architectural firms were given one week to outline a vision of New York in 2106. Terreform, a design studio headed by architect Michael Sorkin, proposed gradually eliminating automobiles and converting half the city's street space into parks, farms, and gardens. The designers envisioned that by 2038, some 60 percent of New Yorkers would walk to work and that the city would eventually be transformed into a "paradise for people on foot."<sup>85</sup>

At this point, Terreform's proposal may seem a little far-fetched, but Manhattan's daily gridlock must be addressed simply because it has become both a financial burden and a public health threat. The Partnership for New York City, representing New York's leading corporate and investment firms, estimates conservatively that traffic congestion in and around the city costs the region more than \$13 billion a year in lost time and productivity, wasted fuel, and lost business revenue.<sup>86</sup>

As the new century advances, the world is reconsidering the urban role of automobiles in one of the most fundamental shifts in transportation thinking in a century. The challenge is to redesign communities so that public transportation is the centerpiece of urban transport and streets are pedestrian- and bicycle-friendly. This also means planting trees and gardens and replacing parking lots with parks, playgrounds, and playing

fields. We can design an urban lifestyle that systematically restores health by incorporating exercise into daily routines while reducing carbon emissions and eliminating health-damaging air pollution.