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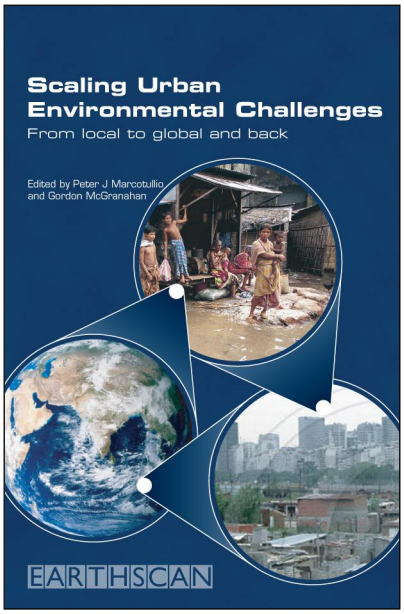

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Urban Transitions and the Spatial Displacement of Environmental Burdens

Gordon McGranahan

Introduction

The environmental implications of economic growth, and the economic implications of taking action to reduce environmental burdens, have been hotly contested for centuries. Even now, many claim that economic growth will inevitably destroy the environment, while others claim that it is the environment's best hope. On this overtly political question, the empirical evidence is mixed, with some environmental burdens increasing with affluence, others declining, and still others sometimes increasing and sometimes decreasing. At least from an urban perspective, however, certain patterns are evident. Specifically, whether looking at the history of currently affluent cities, or comparing different urban settlements today, increasing affluence is associated with more extensive environmental burdens. There are good reasons to think that this relationship was forged politically, and that its interpretation is also highly politicized. Perhaps more importantly, there is no reason to assume that it is immutable, and indeed, several good reasons to hope it can be changed.

Partly because urban economic growth has been accompanied by increasingly extensive environmental burdens, urban environmental burdens tend to amplify economic inequalities. This is not merely because the affluent are better able to buy protection from environmental hazards, and to buy access to distant environmental goods and services. Such market purchases undoubtedly exist, but for the most part they simply reflect rather than amplify economic inequalities. The spatial patterns of extra-market environmental burdens do amplify economic inequalities, however. The environmental justice movement in the US has emphasized one aspect of this: how the spatial

concentration of environmental risks (e.g. in the form of hazardous waste sites) places a disproportionate burden on already disadvantaged national groups such as African Americans. This chapter emphasizes another aspect: how the displacement of environmental risks from affluent settlements, and the failure to displace them from deprived settlements, places a disproportionate burden on internationally disadvantaged groups such as urban slum dwellers.

The first section of this chapter provides a summary account of how environmental burdens shift with affluence, building on a presentation made some years ago in the context of a comparative study of environmental burdens in Accra, Jakarta and Sao Paulo (McGranahan and Songsore, 1996; McGranahan et al, 2001). The basic thesis is that increasing economic activities not only create more extensive environmental burdens, but also provide the capacity to address local environmental burdens – or at least to provide protection for the more affluent residents. In some cases addressing the local environmental burdens adds to the larger scale burdens, as when sewers are used to transfer waste from urban neighbourhoods to local waterways, smokestacks are installed to disperse smoke, waste is collected and then dumped on the outskirts of a city, or resources are sourced from greater distances to prevent local degradation. The more extensive environmental burdens are more delayed in their impacts, and are more likely to undermine life support systems than to affect human health directly.

The resulting relationship is summarized crudely in Figure 2.1 (p22) with three curves, indicating how the severity of different environmental burdens changes with increasing affluence. One curve shows the decline of local burdens, a second shows the rise and fall of city-regional burdens and a third shows the rise of global burdens. The table attached to Figure 2.1 gives examples of burdens at each of these scales, relating to water, waste and air pollution. Thus, in the case of air pollution, indoor air pollution represents a local burden (and tends to decline with increasing affluence), urban ambient air pollution represents a city-regional burden (and tends to first increase and then decline as affluence increases), and carbon emissions represent a global burden (which tends to increase with affluence).

The economic literature on the relationship between economic status and the environment has focused on the second curve mentioned in the previous paragraph. This relationship has come to be known as the 'environmental Kuznets curve', after the Nobel Prize-winning economist who suggested that economic growth first increased inequality, and then helped to bring about its decline. As described in the second section of this chapter, the large empirical literature on the environmental Kuznets curve does not support the claim that all or even most environmental burdens follow this pattern. On the other hand, this literature does provide valuable insights into the variety of different relationships that environmental burdens do have with economic status. Some of these studies have also identified the tendency for the less local, immediate and health-threatening burdens to continue to increase with average income.

The next section examines an evaluation of environmental and epidemiological transitions based on the recently completed Global Burden

of Disease study (Smith and Ezzati, 2005). This evaluation provides a more explicit corroboration of the claim that household environmental burdens tend to decline with affluence, that global burdens increase, and that intermediate burdens tend to first increase and then decline. By using health as the metric, the authors of this evaluation are also able to examine the aggregate incidence, at least for the subset of environmental burdens for which they have evidence. Overall, the environmental health burden is found to decline with increasing average income.

Health is only one possible metric with which to measure the severity of environmental burdens. The following section compares two often competing perspectives (economic and ecological) and conjectures about how the aggregate burdens would look if the metrics of economic costs and ecological footprints (EFs) could be applied to the various urban environmental burdens. Urban EFs clearly increase with affluence, while it is plausible that the aggregate economic cost of ecological burdens may first increase and then decline. In effect, the three curves for local, city-regional and global burdens, illustrated in Figure 2.1, could be mimicked by curves of the aggregate urban environmental burden from the perspectives of health, economy and ecology, respectively.

The following section tries to bring the politics more explicitly back into a discussion that may often be politically motivated, but is typically expressed in empiricist terms. Firstly, the curves relating economic growth and environmental burdens often reflect political struggles, and their successes and failures. Secondly, they reflect various forms of environmental displacement, with different political and ethical implications – there is clearly a difference, for example, between cross-border pollution, driving polluting enterprises to cross borders through environmental regulations, and creating an international trade regime that shifts the competitive locations for polluting enterprises. Thirdly, they reflect a process through which global 'commons' are being appropriated, leaving little environmental space for economic laggards.

The final three sections briefly review the sanitary revolution of the 19th century, the pollution revolution of the 20th century, and the global urban environmental challenges of the 21st century. These accounts illustrate how 'turning the curves' is indeed a political process. Also, depending on one's viewpoint, the sanitary and pollution revolutions can be seen as stunning victories in the face of enormous urban environmental challenges, partial victories in wars no longer vigorously fought once the benefits to the affluent had been secured, or abject failures that have helped to create new and bigger environmental burdens. There is some truth in each of these viewpoints. Much can be learned from the sanitary and pollution revolutions, but they provide no easy answers. Indeed, this is certainly not the time for complacency, or pinning one's hopes on economic growth. Looking to the future, not only is a new global challenge fast approaching, but the conventional approach to addressing local and city-level challenges is being undermined.

A stylized account of urban environmental transitions

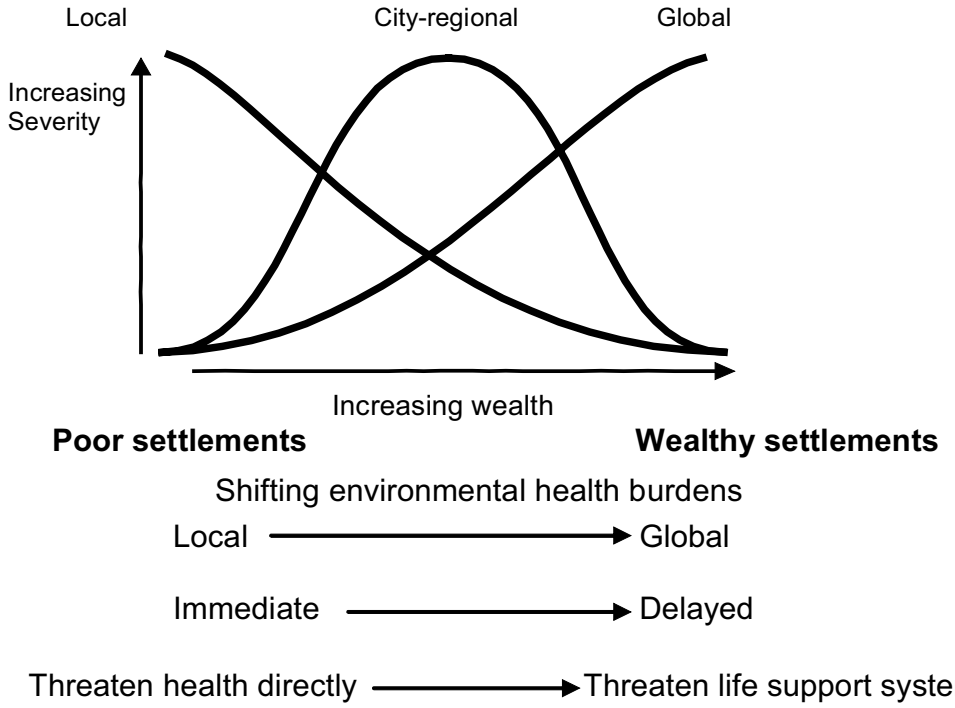
The urban environmental transition characteristic of the cities that became affluent over the course of the 19th and 20th centuries can be represented as a stylized set of empirical observations, as in Figure 2.1 (McGranahan and Songsore, 1994; McGranahan et al, 2001). Along the horizontal axis is economic affluence, which can be represented roughly by the average income in the city. Along the vertical axis is the severity of environmental burdens, which can be measured with a number of very different metrics, such as the health burden, the economic costs or the EF. The shapes of the curves are only meant to represent general direction, distinguishing between environmental burdens that decline with affluence, those that increase, and those that first increase and then decline. Similarly, the metrics of severity are not intended to be comparable across the curves.

In the table attached to the bottom of Figure 2.1, the left column provides examples of local burdens that decrease as income rises, the right column shows global burdens that steadily rise with per capita income and the middle column shows burdens that go through an inverted 'U'.

The empirical claim we are trying to make with Figure 2.1 is that household and neighbourhood environmental burdens tend to decline with increasing affluence, while international and global environmental burdens tend to increase, and intermediate-scale burdens are inclined to increase and then decline. We suggest that these forms apply both to the historical trajectories of currently affluent cities and to the differences among contemporary cities, though the details of the relationships differ among cities, and change over time.

An environmental burden can be defined as a threat to human well-being, resulting from human activities that damage the environment (IIED, 2001), and the scale of an environmental burden can be taken to relate to the typical distances between the damaging activities and their human consequences. Commonly cited household and neighbourhood scale environmental burdens include inadequate sanitation (allowing faecal-oral diseases to spread locally), indoor air pollution, work-related environmental hazards, and accumulations of waste in and around people's homes. Commonly cited city and regional burdens include ambient air pollution, surface and groundwater pollution and overuse, and open waste dumping. Commonly cited international and global burdens include greenhouse gas emissions, the emissions of ozone-depleting substances, the depletion of globally accessible resources, the international movement of hazardous wastes, biodiversity loss and virtual water consumption.

Defining and measuring these relationships precisely is very difficult, but for a first approximation the forms presented in Figure 2.1 conform to conventional wisdom: the 19th and 20th centuries saw a steady improvement in household and neighbourhood environments, a steady increase in activities contributing to international and global environmental burdens, and more



Examples of urban environmental burdens of different scales in relation to air, water and waste			
	Local	**City-regional**	**Global***
Air	Indoor air pollution	Ambient air pollution	Contributions to carbon emissions
Water	Inadequate household access to water	River water pollution	Virtual water consumption
Waste	Unsafe household and neighbourhood waste handling	Unsafe or ecologically destructive disposal of collected wastes	Aggregate waste generation

Note: * The global burdens are defined here as the water consumed, carbon emitted and waste generated in producing and supplying all the goods and services consumed in an urban centre. Virtual water consumption has been defined to include such consumption, and to follow the same terminology, one could refer to virtual carbon emissions and virtual waste generation.

Source: Adapted fromMcGranahan et al (2001)

Figure 2.1 *A stylized urban environmental transition*

ambiguous (and some would say first rising and then falling) changes in urban and regional environmental burdens (for evidence from the US, see Tarr, 1996; Melosi, 2000). They also conform to conventional wisdom concerning international differences in urban environmental burdens. Indeed, the initial curves upon which Figure 2.1 was originally modelled (which displayed the share of urban population without sanitation, urban concentrations of sulphur dioxide and carbon dioxide emissions) were based on cross-country data (World Bank, 1992).

We also argue, as indicated at the bottom of Figure 2.1, that the spatial shifts described by the curves also involve shifts through time, and shifts from burdens that harm human health directly to burdens that undermine the often more distant life-support systems upon which humans depend. Both of these claims also conform to conventional wisdom. Ecologists working with scale issues have observed that 'big' processes also tend to be 'slow' (see Millennium Ecosystem Assessment, 2003, chapter 8, 'Dealing with Scale'), so it is to be expected that global processes such as global climate change should involve delayed impacts. What is perhaps more surprising, and may reflect the social side to these shifts, is that even environmental health impacts that have not involved such obvious shifts in scale tend to be more delayed in more affluent settings, with long-term risks of exposure to carcinogens taking over from short-term risks from infectious diseases. More generally, where there have been scale shifts, it also makes sense that there should be a shift from predominantly environmental health risks towards risks that are more threatening to life-support systems: more dispersed urban pollution or resource demands are less concentrated in and around humans, so a larger share of their impacts does not affect people directly.

Unfortunately, as they are formulated, it is difficult to evaluate these claims in a rigorous manner. There are insufficient data on the economic and environmental history of cities to undertake a detailed statistical analysis of the environmental transitions of economically growing cities in the 19th and 20th centuries. Moreover, several of the concepts are not well defined; identifying what constitutes an urban environmental burden, and how its severity ought to be measured, is open to debate. However, there has been an enormous amount of empirical work undertaken on what has come to be termed the environmental Kuznets curve – the inverted U-shaped curve associated with city-regional burdens in Figure 2.1. In addition, there has been important empirical work on environmental health transitions, which relates closely to several of the claims of Figure 2.1. The three curves displayed in Figure 2.1 suggest an alternative to the single environmental Kuznets curve, and to the conventional environmental risk transition with its two (traditional and modern) curves.

From an environmental Kuznets curve to multiple curves of urban environmental transition

The single-minded pursuit of economic growth is often criticized for causing inequality and environmental damage, though proponents claim that this is a temporary aberration. In the middle of the 20th century, Nobel prize-winning economist Simon Kuznets observed, on the basis of what he described as 'perhaps 5 per cent empirical information and 95 per cent speculation', that in the course of economic development income inequalities first increased and then decreased (Kuznets, 1955, p26). He suggested that Marxists' concerns about the immiseration of the working classes in the 19th century were based on a misguided extrapolation of rising inequality: they failed to foresee that with continued economic development, inequality would eventually decline. The term 'environmental Kuznets curve' was coined in the 1980s in response to the finding that (some) environmental problems display a similar pattern, initially increasing with economic growth and then declining. It was controversial because some proponents of the environmental Kuznets curve, and even more opponents, saw it as an attack on environmentalists – who, like Marxists, could be accused of attacking capitalism and economic growth on the basis of a misleading extrapolation of the rising part of an inverted U-shaped curve.

The environmental Kuznets curve has been the topic of over 100 peer-reviewed publications (Yandle et al, 2004). It has been applied to a wide variety of environmental burdens, and in the course of these studies it has been confirmed, rejected, interpreted, reinterpreted, explained, and explained away in innumerable different ways (for recent reviews, see: Stern, 2004; Yandle et al, 2004; Nahman and Antrobus, 2005).

From the time when the environmental Kuznets curve was first popularized in the World Development Report of 1992 (World Bank, 1992), it should have been evident that not all environmental burdens exhibit the same type of relationship with per capita income, either cross-nationally or over time. Indeed, as noted above, the contrasting curves for sanitation, urban air pollution and carbon emissions first employed in developing Figure 2.1 were taken from that report (McGranahan and Songsore, 1994; McGranahan et al, 2001). Similarly, it should have been clear that there is a great deal of variation in environmental burdens that is not related, either causally or statistically, to economic status. It would be foolish to estimate the environmental burdens of a city or town on the basis of its economic status alone, or to expect the relationship between environmental burdens and economic status to be stable over time.

More specifically, as the basis for claiming that economic growth is inherently good for the environment, or as a representation of how economic growth affects the environment generally, the environmental Kuznets curve has been largely discredited (Ekins, 1997, 2000; Stern, 2004). On the other hand, there is now a rich empirical literature, much of which is of interest even if the notion that there is a single curve, or a single shape of curve, is rejected. Indeed, the analysis generated in the course of these studies provides

numerous insights directly relevant to the claims of Figure 2.1. In particular, it has been observed that the burdens that increase with income, and show less sign of declining even at comparatively high income levels, tend to be of larger scale (Cole et al, 1997), have more delayed impacts (Lieb, 2004), and do not affect health as directly (Gergel et al, 2004).

Perhaps the only empirical analysis to compare explicitly environmental indicators for burdens at different scales found that 'meaningful EKCs [environmental Kuznets curves] exist only for local [city-level] air pollutants whilst indicators with a more global, or indirect, impact either increase monotonically with income, or else have predicted turning points at high per capita income levels with large standard errors' (Cole et al, 1997, p401). Examining other empirical studies reinforces this conclusion (though it should be noted that the same or overlapping data sets are often used in different studies). For example, in a table summarizing 34 different empirical studies (Lieb, 2004), environmental Kuznets curves were found in most of those, examining urban-regional pollutants such as sulphur dioxide (15 out of 23), particulates (13 out of 15), oxides of nitrogen (11 out of 12), carbon monoxide (5 out of 6) or river pollution (6 out of 7). In contrast, most of those examining carbon dioxide (11 out of 17) found monotonically rising emissions. Similarly, all three studies that examined aggregate waste generation found a monotonically rising burden.

These same results have also been interpreted in terms of the timing of their impacts. Indeed, the table of 34 empirical studies referenced in the previous paragraph was actually constructed to provide evidence for the claim that the more immediate flow pollutants conformed to the environmental Kuznets curve, while the more delayed stock pollutants did not (Lieb, 2004). They could also be distinguished in terms of their direct health impacts, with the more local and immediate burdens having more immediate health impacts than the more global and delayed burdens.

What are missing from these examples are the very local, immediate and health threatening environmental burdens, such as bad sanitation and indoor air pollution. Although downward sloping curves were estimated for both household sanitation and household water supplies in the early analysis presented in the 1992 World Development Report (World Bank, 1992), there has been little subsequent analysis of the household environmental burdens (an exception being Kumar and Viswanathan, 2004). This may be because few would dispute that they generally decline with economic growth. However, as described in the following section in relation to the sanitary revolution, the evidence that economic growth automatically brings environmental improvement is not compelling even for these household burdens. There is evidence, for example, that in many of the early industrializing cities, economic growth was accompanied by increasingly unhealthy living environments until local groups and governments took vigorous action (Szreter, 2005). Moreover, as with other environmental burdens, the smooth curves hide a great deal of variation, much of which almost certainly reflects policies and actions representing the interests of those worst affected, or designed explicitly to

curb environmental damage. However, as an empirical description rather than a causal attribution, it is safe to say that the most serious and health threatening household environmental burdens have tended to decline as average incomes have increased.

A health perspective – environmental health burdens and risk transitions

If the empirical literature on environmental Kuznets curves implicitly supports the stylized facts of Figure 2.1, a more comprehensive and explicit empirical corroboration comes from a different quarter: an analysis of the epidemiological and environmental risk transitions based on the Global Burden of Disease database and the accompanying Comparative Risk Assessment project (Smith and Ezzati, 2005). Work on the Global Burden of Disease estimates has been going on since the early 1990s. The database has been adopted by the World Health Organization (WHO), and is the first consistent global set of data on mortality and morbidity, including estimates of the burden of disease for more than 150 causes of death and illness. The comparative risk assessment brought together over 100 investigators in an attempt to attribute burdens of disease to 26 important risk factors, using the Global Burden of Disease database. A number of these risk factors were environmental, and allow environmental risks to be compared across areas of different average income.

The epidemiological transition, as popularized in the 1970s, focused on a shift from infectious (traditional) to non-infectious (modern) diseases said to accompany development, but has since been elaborated into more complex categories. The environmental risk transition was proposed more recently, and was initially based on two curves representing traditional and modern risks (Smith, 1990; Smith and Lee, 1993), corresponding at least roughly to traditional and modern diseases. In the more recent analysis being examined here (Smith and Ezzati, 2005), the environmental risk transition has been extended by employing a three-fold framework, adapted from Figure 2.1, distinguishing between household, community and global health risks. The health risks estimated and attributed disease burdens were:

Household environmental risks – poor water sanitation and hygiene; indoor air pollution from solid fuel use; exposure to malarial mosquitoes.
Community environmental risks – urban outdoor air pollution; lead pollution; occupational risks; road traffic accidents.
Global environmental risks – climate change.

The authors found that 'the simplistic conclusions commonly drawn about the epidemiologic transition, in particular the increase in chronic diseases with development, are not supported by current data; in contrast, the conceptual framework of the environmental risk transition is broadly supported in a cross-sectional analysis' (Smith and Ezzati, 2005).

What makes this presentation qualitatively different from that implied by Figure 2.1 is that there is a common measure of the severity of environmental burdens – the health burden. This allows the different risks to be directly compared and summed.

The resulting estimates indicate that:

- **household environmental health risks** account for much the largest burden, and decline with per capita income;
- **community environmental health risks** tend to be highest at middle incomes, and lower at the extremes, conforming roughly to an environmental Kuznets curve;
- **global environmental health risks** account for a very small share of the overall risk, and their **contribution** increases with income, while their **impact** (where the health risks are encountered rather than where the emissions occurred) declines;
- the **combined contribution** declines with income, and the **combined impact** declines even more steeply.

Source: Based on Smith and Ezzati (2005)

While even the health analysis presented above is far from comprehensive (as it omits a great many risks) and far from accurate (as it is based on some very rough estimates), it is worth conjecturing how the results would be likely to change if a different metric were used to measure the severity of environmental burdens.

Economic and ecological perspectives and alternative metrics

Two of the more common perspectives on environmental burdens are the economic and the ecological. From an economic perspective, the obvious metric with which to measure environmental burdens is economic cost (where the burdens are valued in monetary units, using market prices or their closest surrogate). From an ecological perspective the metric of choice is more likely to be physical, as with, for example, the EFs (where burdens are valued in hectares of productive land, using physical estimates of appropriated or compensatory land requirements). Before examining how applying these metrics might alter the result suggested by the health metric, that the aggregate burden actually falls with increasing affluence, it is worth considering some of the differences between economic and ecological perspectives. Despite the efforts of many researchers, and journals such as *Ecological Economics*, communication between these disciplines tends to be poor, with environmental burdens identified and measured very differently.

Humans and their markets are at the centre of the economist's world, and peripheral to the ecologist's, and their views of why and where environmental

problems arise vary accordingly. For most ecologists, markets are **external** forces that drive people to disrupt, disturb and degrade natural ecosystems: in effect, market-based activities are **externalities**, and urban settlements and the people in them are external to the natural ecosystems they threaten. For most economists, on the other hand, it is the absence of markets that explains environmental problems. Thus, the concept of **externalities**, which practising economists regularly use to explain environmental problems, refers to the impacts one person's activities have on another person's well-being that are 'external' to markets, and hence are not reflected in market prices or incorporated in negotiations.

Similarly, ecologists and economists have very different conceptions of the spatial dimensions of production. From an economic perspective, most production now takes place in urban areas. Urban activities account for most value added, and for most final consumption. From an ecological perspective, on the other hand, the bulk of production is taking place in rural areas. William Rees compares urban settlements to cattle feedlots and anthills, maintaining their keystone species at very high densities, but only containing a small share of the biophysical processes needed to sustain them (Rees, 2003). These settlements have what he termed a large 'ecological footprint'. Thus, it has been estimated that on average the people living on a square kilometre ($1km^2$) of built-up land rely on about $25km^2$ of other land and water (of average biological productivity) to provide themselves with the food, fibre, timber and energy (WWF, 2004).

In short, the difference between economic and ecological perspectives is such that the different definitions of a burden are as important as the different metrics through which burdens are measured. From an ecological point of few, urban areas consume far more than they produce, and this excess consumption is the most obvious environmental burden urban areas impose. For a mainstream economist, urban centres engage in trade that benefits all parties, and environmental burdens are likely to be associated with un-traded and un-negotiated environmental impacts or externalities. Thus, from an ecological perspective, virtually all the resources an urban area consumes, as well as the wastes it produces, can be considered a burden (and the scale of these burdens depends on how far the resources come from), while from an economic perspective the clearest environmental burden is pollution (and the scale depends on how far the pollution travels).

In terms of the three curves in Figure 2.1, this helps to explain why it is ecologists who are associated with the claim that environmental burdens increase with affluence, and economists who are associated the environmental Kuznets curve.

A measure of environmental impacts closely associated with ecologists is the equation sometimes referred to as the Commoner-Ehrlich equation or IPAT: Impact = Population times Affluence times Technology (Ekins, 2000; York et al, 2003b). Unless affluence is associated with much lower populations or much more efficient technology, the equation will describe an unambiguously positive association between an affluence indicator such as gross domestic

product (GDP) per capita, and the environmental impact. This is not so much because of the form of the equation, or even the causal relations implied, but because the intention is to measure the physical size of the impact, rather than the size of its consequences on human health or the economy. Local burdens such as bad sanitation and indoor air pollution involve changing environmental conditions, but only to a relatively small degree: what gives them a large health impact is that they are concentrated in the same locations as people.

As with an ecological perspective, though for different reasons, an economic perspective will tend to give less emphasis to local environmental burdens that concentrate in poor areas than does a health perspective. Local environmental burdens do often involve economic externalities (one household's bad sanitation is another household's health risk) but also directly reflect income poverty (people living on insufficient incomes cannot afford sufficient water and sanitation, partly for the same reason they cannot afford sufficient shelter and food). From an economic perspective, there is little to be gained in labelling a symptom of poverty an 'environmental' burden if it simply reflects a lack of income. Moreover, in contrast to a health metric, which always gives the same health risk the same weight regardless of the income of those affected, an economic metric implicitly gives less weight to risks faced by poor people, who have fewer economic resources with which to express their preferences. (Most people rightly object to the fact that economists tend to value the health and lives of the poor less than those of the rich, but it must be recognized that such valuation is implicit in other market prices, in the market-based decisions that result from these prices, and in public decisions based on narrow cost–benefit analysis alone.)

Unlike an ecological perspective and ecological impact measures, an economic perspective and economic costing does not give a great deal of weight to global environmental burdens. As noted above, economics is inclined to treat resource extraction for foreign consumption as benefiting the exporting as well as the importing countries, even if economists do recognize a 'natural resource curse' which often afflicts exporting countries (Sachs and Warner, 2001; Bulte et al, 2005). Thus, economics sees little or no burden, where from an ecological perspective there is a major global burden. Moreover, by discounting future costs, economics implicitly gives less weight to burdens whose impacts are long term, which includes a disproportionate share of global burdens.

In short, if aggregate burden estimates were to be constructed using disability adjusted life years (DALYs) lost, EFs and monetary units, one would expect differences in the resulting curves not only because of the different metrics, but also because of the perspectives with which they tend to be used. To a first approximation, the health metric is the most likely to fall with increasing income, the ecological metric to be the most likely to rise with increasing income, with the economic metric somewhere in between, and most likely to first rise and then fall.

These are only some of the differences that can result from applying different perspectives or metrics. Even if the same burden is measured in the same units, significant differences can result from decisions about how burdens should be

Table 2.1 *Carbon dioxide emissions per capita for Beijing and Tokyo*

	Beijing (1997)	Tokyo (1995)
CO_2 emitted in city (tonnes per capita)	6.4	4.9
CO_2 emitted in providing goods and services consumed in city (tonnes per capita)	8.3	12.1

Source: Data provided by Shobhakar Dhakal, based on research presented in Dhakal (2004)

attributed. For example, a city can be allocated all of the carbon emitted within its boundaries, or the carbon emitted in producing all of the goods and services consumed within its boundaries. As illustrated in Table 2.1, the choice matters is how cities are ranked. On a per capita basis, about 30 per cent more carbon is emitted in Beijing than in Tokyo. On the other hand, the carbon emitted in supporting the consumption that takes place in Tokyo is about 46 per cent more than for Beijing. The choice of which accounting procedure to use has a practical dimension (e.g. it depends on whether one is looking for measures to curb carbon-intensive consumption patterns, or measures to replace carbon-intensive technologies). But it also has a political dimension.

Bringing politics back in

There is an unfortunate tendency for curves such as those in Figure 2.1, and indeed many accounts of urban transitions, to obscure rather than illuminate human struggles, triumphs and hardships. Development trajectories and transitions have a ring of inevitability about them. They are suggestive of stages of development, and theories that map out teleological processes, which people can support or resist, but cannot ultimately change. Moreover, they tend to downplay relations between urban centres, and rural-urban relations that are not explicitly represented.

Of course the curves themselves are often manipulated for political effect. Economic growth advocates emphasize local or city-regional environmental burdens so as to ascribe environmental benefits to growth, while critics point to the ever-increasing global burdens to castigate economic growth. The choice of metric can also be political. A health metric is very egalitarian, at least among those whose risks are considered (which often excludes future generations). An ecological metric will tend to give more weight to future generations and non-human species, and will tend to ignore some of the most critical environmental problems of the urban poor. And a conventional economic metric can be misused to privilege the wealthy, by costing burdens using market prices or their equivalent, but ignoring issues of compensation and redistribution.

Equally important, such curves have political interpretations and implications. To at least some degree, the curves reflect the outcome of political struggles involving both economic growth and the environment. For many currently affluent cities, the 19th century sanitary movement and the revolution it engendered explain at least part of the declining sanitary burden. For individual settlements it is often possible to plot out the improving sanitary conditions, and their relation to local and sometimes national politics and policies. Similarly, in many of the same cities, the 20th century environmental movement helped bring about the turning of the curve for many urban and regional burdens. And if the 21st century is to be the century of sustainability, this will undoubtedly require further struggles, scientific innovations and ideological battles. Such a temporal sequencing begs the question of why, given that much of the world still lacks adequate sanitation, the sanitary revolution is typically associated with the 19th century. But it is not the curves that imply that progressive politics is the monopoly of the affluent front-runners – this interpretation is based on seeing the curves through the lenses of the dominant development narrative.

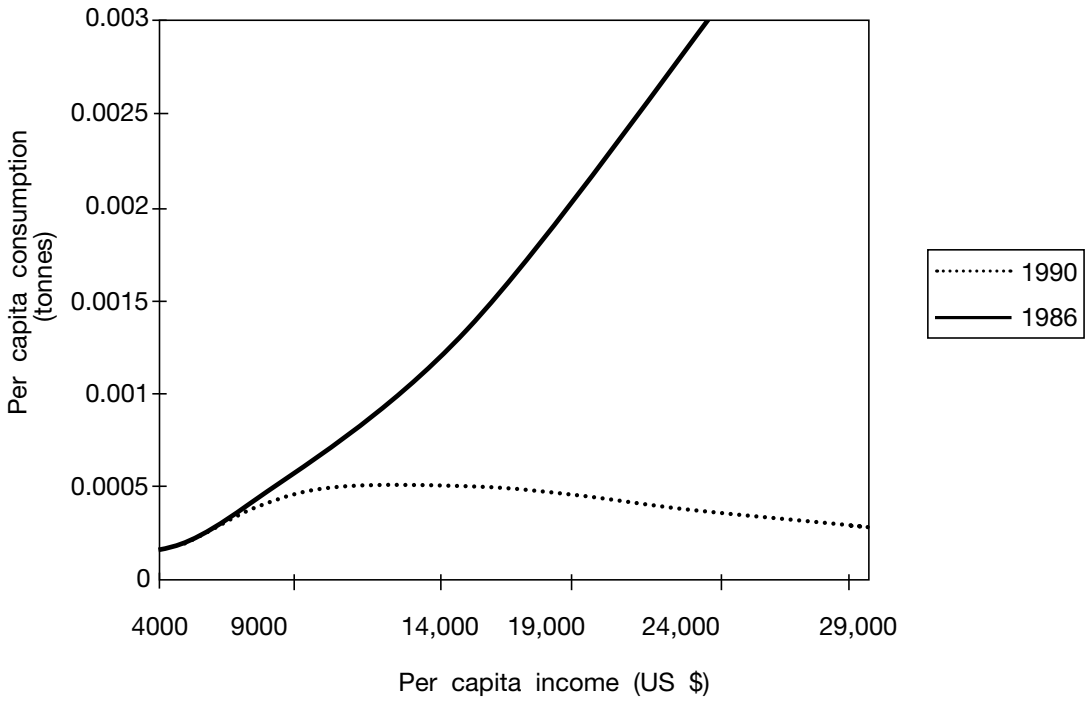
It is impossible to do justice to urban environmental politics in statistics, let alone the national and international statistics typically used in the analysis of environmental Kuznets curves. Nevertheless, it is revealing that researchers estimating or critiquing environmental Kuznets curves have often found that factors that would be expected to influence environmental politics also influence the shape or position of the curve for a number of the local and city-regional burdens. There is less evidence of such influence when it comes to global ecological burdens.

A study focusing on urban air quality and surface water quality found that literacy, political rights and civil liberties are strongly associated with reduced environmental burdens, particularly at low-income levels (Torras and Boyce, 1998). It has also been suggested on the basis of urban air pollution data that the major force behind the declining air pollution concentrations since the 1970s has been public support for environmental protection and the resulting policy measures, and that the declines have been too large to be consistent with income-generated economic shifts alone (Deacon and Norman, 2004). A more recent study looked explicitly at environmental lobbying and the lead content of petrol, and found that environmental lobby groups did affect environmental policy stringency, as did political competition 'particularly where citizens' participation in the democratic process is widespread' (Fredriksson et al, 2005). Other studies have also found political factors to be significant in areas as diverse as deforestation (Bhattarai and Hammig, 2004) and access to water (Deacon, 1999).

On the other hand, a recent study estimating aggregate EFs econometrically found that while both income and the level of urbanization were positively associated with the size of a country's footprint, political rights, civil liberties and state environmentalism were insignificant (York et al, 2003a). This is consistent with the notion that most global environmental burdens are not the object of serious urban or national environmental politics, and that in the

absence of support through global governance mechanisms are not likely to become so.

The fact that the urban environmental burdens of wealthier cities and countries are more likely to cross international borders also has political implications. The transfer of environmental burdens over space and through time is highly political, even if it is not always recognized and subject to negotiation. According to economic reasoning, just as the shape of the local and city-regional curves ought to depend particularly heavily on local and city-regional policy processes, so the shape of global curves ought to depend particularly heavily on global policy processes, and whether they are effective. A revealing example of this, illustrated in Figure 2.2, is in the changing emissions of halons and chlorofluorocarbons (CFCs) in the wake of the Montreal Protocol controlling ozone-depleting substances, often cited as one of the most successful international environmental agreements. In 1986, just prior to the adoption of the Protocol, emissions of both halons and CFCs fit the profile of global environmental burdens: emissions tended to be considerably higher in wealthier countries. By 1990 the relationship conformed more closely to a gentle environmental Kuznets curve, first rising and then falling. This sort of transformation is probably unique, and reflects the ease with which affluent



Source: Cole et al (1997)

Figure 2.2 Consumption of CFCs and halons pre- and post-Montreal Protocol

countries controlled emissions. Just as most global environmental burdens tend to be larger in wealthier countries, so they tend not to have been greatly influenced by global governance mechanisms.

More generally, there are a number of ways that pollution can be displaced internationally over space (and through time), which for the most part shift pollution from more to less affluent locations:

1 pollutants with international dispersion;
2 environmental regulations that lead local-scale polluters to move to less effectively regulated locations;
3 changing trade patterns independent of environmental regulation that favour the export of less local-pollution-intensive products (e.g. light manufacturing and service products) and the import of more pollution-intensive products (e.g. heavy industry products).

There is evidence for all of these shifts (see Cole, 2004, for a review of evidence on the second two), each of which has somewhat different political and ethical implications. The first, particularly when uncompensated, clearly goes against the polluter-pays principle as well as ethical principles, and is rarely defended openly, except through claims that the effects are uncertain or were uncertain in the past. The second is more ambiguous. On the one hand, Laurence Summers, then chief economic advisor at the World Bank, wrote a memorandum in which he correctly pointed out that by the economic logic conventionally applied by the World Bank, more polluting industries should be encouraged to move from affluent to poor countries. On the other hand, the furore that resulted when this 'humorous' memo was leaked, reflects how politically contentious such displacement is: the notion that when the wealthy clean up their environments, the poor suffer from pollution as a consequence also goes against a number of ethical principles. The third means through which pollution can be shifted is less contentious, in that it is not the result of intentional measures to reduce pollution in affluent locations, but of a changing comparative advantage. On the other hand, it is linked to trade, and as such does relate to political debate over the environmental impacts of current trade regimes. This distinguishes it from shifts in pollution outcomes that result from changing consumption patterns, including, for example, the increase in service consumption in affluent locations (such shifts were not included in the list on the grounds that they do not, strictly speaking, involve the displacement of pollution).

Somewhat similarly, there are a number of different forms through which resource pressures originating in affluent cities affect less affluent, but often resource-rich locations. Compared to transboundary pollution, there are few resource flows that involve no compensation – expropriating another country's resources without payment typically requires colonial relations of a particularly onerous sort. On the other hand, within the current international trade regime, resource-intensive industries may seek out locations with ill-defined property rights on environmental resources or ineffective state regulation (Chichilnisky, 1994). Moreover, one of the more convincing explanations for the 'natural

resource curse', which is blamed for the slower economic growth in natural resource-intensive countries, is that a reliance on natural resource exploitation shapes political development in harmful ways (Bulte et al, 2005). Valuable but weakly controlled resources can amplify corruption and undermine the sort of good governance needed to achieve economic growth and human development (Leite and Wiedemann, 1999; Bulte et al, 2005). Thus, as with pollution, there are a variety of means through which natural resource pressures can be shifted internationally, some of which are far more damaging to the resource-providing countries than others.

Another important political aspect shaping the relationship between affluence and the scale of urban environmental burdens is that global resources and waste sinks are being appropriated and used to provide for affluent consumers, leaving little environmental space for the conventional economic development of low-income countries. Economic output per capita is a poor indicator of human well-being. The relationships plotted by the curves in Figure 2.1 are empirical generalizations rather than laws of development. Nevertheless, it is politically very salient that low-income countries and cities cannot realistically achieve conventional development unless the more affluent countries change their own consumption and production patterns. Indeed, even if the more affluent did reduce their global burdens considerably, it would be environmentally disastrous for low- and middle-income countries to all develop along the path that the now affluent countries once did. In effect, to the extent that the curves in Figure 2.1 do have implications for conventional urban development, far from implying that low-income cities must follow this pathway to succeed in the future, they imply that both low- and high-income cities must deviate from this pathway.

There are, of course, numerous other politically significant spatial dimensions to urban environmental burdens, and not all involve spatial dispersion. Resource supplies also have a spatial dimension, and in an interesting counterpoint to the tendency for waste and pollution problems to become more diffuse, there is evidence that spatially concentrated 'point resources' are more inclined to bring on the 'natural resource curse' (Isham et al, 2005). More importantly, while the general tendency has been for urban environmental burdens to become globalized, it is easy to forget that some of the most critical urban environmental burdens of the 19th and 20th centuries have actually become far more localized, a process not only driven by political forces, but also with important political consequences.

While the sanitary problems of 19th century cities were grounded in local conditions, they gave rise to city-wide epidemics and international pandemics (Cliff et al, 1998). The public nature of the health threat helped to drive the sanitary reforms. One of the outcomes of the sanitary revolution has been that, even in very low-income urban centres, sanitary health risks have become increasingly localized. In effect, parallel to the spatial expansion of the environmental burdens of urban affluence, there has been a localization of the environmental burdens of urban poverty. This is in itself a reflection of the political nature of the sanitary challenge – the sanitary health hazards

would not have become localized if the threats had emanated from the affluent neighbourhoods.

Despite these qualifications, the spatial displacement of urban environmental burdens is a critical link between local, national and international environmental politics. Moreover, while other spatial issues will often be more important in particular urban centres, the systematic link between economic status and more dispersed urban environmental is one of the most serious challenges to conventional, or even non-conventional development. It is easy to define human development so that it is not closely coupled to economic growth. It is easy to call for sustainable development that is environmentally benign. But it is difficult to even imagine how this is going to be achieved in a world where the poorest urban centres lack the capacity to address their environmental problems, and the wealthy lack the incentive (Lee, 2006).

Urban environmental movements – revolutionary or palliative?

For those parts of the world where economic growth and urbanization is concentrated, the 20th century saw a continuous shifting of urban environmental priorities (McGranahan et al, 2001). What are now localized urban sanitation issues were still the critical concern at the start of the century. Urban pollution and regional resource issues had taken centre stage by the middle of the century, and by its end, global environmental issues were coming to the fore. At the start of the 20th century, industrial cities were still in the throes of a sanitary revolution; by its end environmentalists were calling for a sustainability revolution. As the following account attempts to demonstrate, these environmental initiatives were political, and their achievements were not simply the result of economic growth. On the other hand, there is a question as to whether this series of 'revolutions' should be seen as the progressive resolution of a series of environmental challenges that urban development has thrown up, or whether, to the contrary, they represent the progressive failure to do more than delay and shift urban environmental burdens across space and over time.

An urban sanitary revolution – the example of Britain

Early industrial cities were less healthy than the surrounding countryside. Urbanization and economic growth were extremely disruptive, and the expanding urban working class lived in crowded and unsanitary living environments. In Britain, where documentation is comparatively good, mortality levels in the industrializing cities reportedly 'deteriorated substantially during the second quarter of the 19th century and did not improve significantly thereafter until the 1870s and 1880s' (Szreter and Mooney, 1998; Szreter, 2004). Economic growth created the capacity to improve living environments for the majority, but even rising wages during the early part of the 19th century did not provide

better water supplies, sanitary facilities and hygiene behaviour. Urban settlement is now considered an advantage for delivering environmental health services, but at the time it was a distinct disadvantage. On their own, urbanization and growth did not drive local environmental improvement: indeed, in the absence of concerted action to improve environmental conditions, they drove local environmental degradation.

The sanitary movement, which addressed a range of local environmental conditions, helped to turn the potential health benefits of urbanization and economic growth into a reality. This movement was built on the work of local organizers and international networkers, scientists and poets, private entrepreneurs and government officials. It captured the imagination of press and public, as well as of intellectual and the bureaucrat. It both benefited from and helped to encourage improvements in governance. The miasma theory of disease, which held that diseases were contracted from noxious vapours, was more important in motivating early sanitary reform than the bacterial theory of disease (Rosen, 1993). Sanitary reformers came in a variety of different political hues, and were not all sympathetic to, let alone supportive of, the working classes or the urban poor groups worst affected by unsanitary conditions (Hamlin, 1998). Yet even without a consensus on the detail of the science or the politics of sanitary reform, a growing number of committed activists and influential public figures fought to improve sanitary conditions.

Many sanitary reforms displaced rather than resolved environmental burdens. Sewers were used to carry faecal material away from local living environments, only to release it into streams and rivers, depriving land of nutrients and creating downstream pollution. Considerable attention went into designing better ventilation, heating and lighting in people's homes, but these same homes often spewed large quantities of smoke into the urban atmosphere. Solid waste was collected from homes, but then dumped on the outskirts of the urban areas.

This was not, however, because nobody was making a sufficiently eloquent case for more comprehensive environmental measures such as recycling waste and reducing pollution at source, rather than creating waste and dispersing pollution. One of the most celebrated poets of the 19th century, Samuel Taylor Coleridge, having noted that 'the river Rhine, it is well known, doth wash your city of Cologne', asked 'what power divine shall henceforth wash the river Rhine?' One of the century's most famous novelists, Victor Hugo, was influenced by Leroux's theory of circulus, which held that human excretions should be collected and used in agriculture to produce food for people to eat, creating a virtuous circle (Reid, 1993). He even prefigured environmental economics, writing in his novel *Les Misérables* that 'Each hiccup of our cloaca [sewer] costs us a thousand francs . . . the land impoverished and the water contaminated' (Hugo, 1987 [1867]). Leading sanitary reformers had similar concerns. Edwin Chadwick, the leading proponent of sewers in Britain, intended the sewers to carry the excreta back to the land, where it could fertilize the farmers' fields. Sanitary reformers were also making similarly modern arguments for reducing

air pollution, pointing out, for example, that smoky stacks should be seen as a symptom of inefficiency rather than of progress (Mosley, 2001).

In effect, the reason urban environmental burdens were displaced was not because nobody was concerned or was suggesting alternatives, but because people and groups promoting such concerns and alternatives were politically unsuccessful. Ardent sanitary reformers, like ardent environmentalists today, were viewed by many as anti-business. Getting people to take action to prevent future or distant environmental impacts was doubly difficult when this threatened industrial interests. But at a more mundane level, whatever the political systems, it is inevitably difficult to implement or sustain measures intended to address uncertain, future and distant problems.

Progress on urban pollution – the example of the United States

Urbanization and industrial growth have also created a number of city-regional environmental burdens, such as ambient air pollution, surface water pollution, and solid waste accumulation. The sanitary movement was sympathetic to these concerns, but prioritized threats to public health in and around people's homes and workplaces. As a result, it actually contributed to some of the city-regional burdens. Indeed, the 19th century sanitary movement set off what one environmental historian termed 'the search for the ultimate sink', and did nothing to curtail the scramble for natural resources (Tarr, 1996). For many contemporary environmentalists, the sanitary revolution was not the solution, but part of a new set of problems. Yet many of the environmental measures taken in the cities of the 20th century were simply a continuation of sanitary reform, often doing as much to displace as to remove environmental burdens, and, by removing the immediate and local risks of increasing economic activities, making it possible for urban environmental loads (e.g. quantities of resources consumed and wastes released) to increase.

Like the earlier sanitary movement before it, the environmental movement of the mid- to late 20th century built on the work of a wide range of groups of different political persuasions, drew heavily but selectively on science, and eventually captured the popular imagination. As with the sanitary reforms, urban groups and governments were initially at the centre of environmental reforms, but were supported by national and international networks. Unlike with sanitary reform, national government and legislation were critical to environmental reform, not just in supporting local action and setting common standards, but in resolving conflicting interests between different urban areas and between urban and rural areas. Even in the US, with its federal system, the environmental movement only really came of age with the national Environmental Protection Agency (EPA) in 1970, the Clean Air Act of 1970 and Clean Water Act of 1972.

In 1911 all major US cities had sewerage systems, with most (88 per cent in 1909) of the wastewater disposed of untreated in waterways. It was not

until 1940 that more than half of the sewered urban population in the US had treated sewage (Melosi, 2000). Cities were loath to invest in systems that would primarily benefit downstream inhabitants. Sanitary engineers were inclined to support the view that water systems should be reworked to cope with sewage-polluted water from upstream cities (Tarr, 1996). With the help of federal funds, a number of sewage-treatment plants were constructed in the inter-war period, but these only made a marginal impact. Concern increased, however, as formerly unsuspected health hazards were identified and new industrial pollutants were added to the water.

By the 1960s, urban-regional environmental concerns were becoming a national issue. In 1972 the Clean Water Act was passed, calling for zero effluents by 1985. While this goal has still not been reached, significant improvements have been recorded in the pollutants targeted. Wastewater treatment is now almost universal. According to the statistics of the EPA, while only about 36 per cent of stream-miles in the US were safe for fishing and swimming in 1972, the current figure is more like 60 per cent (www.epa.gov/earthday/history.htm, accessed on 16 December, 2005).

The story for ambient air pollution is similar, with some of the differences reflecting the different spatial features of water and air pollution. In 1912, 23 of the 28 largest cities in the US had smoke control ordinances, which met with mixed success. Local groups, often largely comprising women, had lobbied for smoke abatement. Experts networked and shared experiences internationally and became increasingly influential in the early decades of the 20th century (Stradling, 1999). When the pressure was on, and local groups and experts collaborated effectively, they could reduce urban air pollution – 'smoke' – appreciably, but often only temporarily (see Pittman, 2003, for an account of St Louis' successful but temporary measures to reduce air pollution in the 1920s). In the 1940s and 1950s, natural gas and oil began replacing coal on a significant scale for domestic heating, as well as industrial, commercial and transport uses, giving respite in some locations and demonstrating the possibility for improvement. Urban air pollution continued to be a serious problem, however, and a series of well-publicized and documented episodes, such as the infamous London smog of 1952 that killed 4000 people, helped to spur a new environmental movement in the 1960s.

As with sanitation, many of the measures initially taken to address local air pollution problems quite literally displaced the burden. Electricity provided a clean fuel in the home, but power plants released air pollution at a distance from the end-users. As electricity grids developed, the distances increased. Further displacement measures were taken when, under the advice of air pollution experts in the 1950s and 1960s, taller emission stacks were increasingly used by the ore smelting and electrical utility industries, to avoid violating local air pollution ordinances. By 1963, some utility stacks had reached a height of 213m. Other measures, including efficiency improvements and cleaner fuels, led to more fundamental reductions in environmental burdens – provided they were not matched by increasing activity levels.

The 1960s also saw growing public concern with air pollution, and a series of national acts meant to provide the basis for curbing air pollution. Environmental impact statements became an important tool. Some of the more technical pollution experts have been concerned with the 'unscientific' approach of the environmental movement, and its governmental agencies; the more industry- and economy-minded have been concerned that the costs of pollution control have been excessive. But there is little doubt that the urban concentrations of smoke and most classical air pollutants have declined considerably since the 1970s. To quote a recent commentator:

> *Since 1976, the aggregate U.S. level of urban ozone, the main component of smog, has declined 31 percent. Airborne levels of sulphur dioxide, the main component of acid rain, have dropped 67 percent. Nitrogen oxide, the secondary cause of urban smog and of acid rain, has fallen 38 percent. Fine soot ('particulates'), which causes respiratory disease, has declined 26 percent. Airborne lead, considered the most dangerous air pollutant when the EPA was founded in 1970, has declined 97 percent. The EPA's 'Pollutant Standards Index,' which measures days when air quality is unhealthy, has fallen 66 percent since 1988 in major cities.*(Easterbrook, 2002)

For both water and air pollution, there has been considerable debate over whether the environmental reforms were excessive and unnecessary, insufficient and palliative, or balanced and appropriate. On its own terms, however, it seems clear that the urban pollution revolution has been a success in most affluent cities, and was very much a political process, like the sanitary revolution before it. Yet again, the real question is not whether urban pollution has been reduced, but whether this reduction hides a more fundamental failure to address a still more extensive set of environmental burdens.

Sustainable cities – one agenda, or many?

From the perspective of affluent cities, the latest generation of urban environmental burdens is even less tangible than previous ones, and less overtly urban. Sanitary problems were at their worst in crowded, low-income neighbourhoods. Urban smog was visible, and even the pollution of local waterways and other city-regional pollution and resource burdens were easy to observe, and infringed on urban lifestyles and livelihoods. It has since transpired that the true sanitary threat came, not from the stench and the stink of urban filth, as many contemporaries believed, but from invisible pathogens that could even pollute the clearest glass of drinking water. Similarly, concerns about health and air pollution have shifted towards very fine particles, largely neglected in early efforts to reduce visible smoke pollution. Nevertheless, the links between visible and often unpleasant environmental conditions and human well-being helped to drive the urban environmental agendas, successfully reducing local and city-regional burdens. The links between urban consumption patterns and climate change, ozone depletion, the loss of distant rainforests, biodiversity loss, and other global environmental issues at least initially would seem to

be far less perceptible, even if they are better founded scientifically than the concerns that drove the early sanitary and environmental movements.

The globalization of environmental burdens has become a major challenge, with global climate change – despite its unique characteristics – taken as archetypal of the latest generation of environmental challenges. With the world population continuing to grow, human production and consumption growing more rapidly still, and economies becoming more tightly interlinked, local actions increasingly combine to create global stress. It is no coincidence that *think globally, act locally* has been the most popular environmental slogan since René Dubos coined the phrase in the run up to the first world environmental conference some 30 years ago (Eblen and Eblen, 2002). It not only captures the increasingly global scale of environmental burdens, but also the importance of addressing these problems in their unique physical, climatic and cultural contexts. Actions in the present are also increasingly seen to be affecting the environment for future generations. *Think of the future, act now* could also qualify as an environmental slogan, and is implicit in most definitions of sustainable development. Again, global climate change is often used as the archetypal example, since most of the burden of current greenhouse gas emissions is likely to fall on future generations – even if the initial effects are already evident.

From a global perspective, however, it is evident that for many urban settlements local environmental burdens remain a priority, while for others the city-regional burdens predominate, and many different priorities vie for attention. Given this complex combination, it is neither possible nor desirable to identify a single environmental agenda. It is quite reasonable that in some settlements the 'brown' environmental health agenda should predominate, in others the 'grey' pollution agenda, and in others the 'green' sustainability agenda (McGranahan et al, 2001; Marcotullio and Lee, 2003). This does, however, create a serious challenge to the emergence of a global movement comparable to the sanitary movement of the 19th century or the predominantly Western environmental movement of the 20th century.

In practice, *think globally, act locally* has been acted out in the economic rather than environmental arena, and from a very different political basis from the one Dubos envisaged. The sharp rise in economic globalization since 1972 has been facilitated by purposeful changes in international trade regimes, and has been driven by the local initiatives of private enterprises. It has been trans-national corporations, not environmentally-minded groups or governments, that have been most successful in developing global strategies rooted in local action. It has been market signals, not public debate on the environment, that have most successfully adapted to the new communications technologies. It has been as financial centres, not as models of environmental sustainability, that cities such as New York, London and Tokyo have come to be defined as global cities (Sassen, 2000).

In retrospect, it is not surprising that the environment and development agenda has not been as successful as the free-market agenda in linking up global strategies with local action. Both agendas are inclined to claim that they will bring benefits to virtually everyone, present and future. But the most direct

beneficiaries of the free market agenda are successful economic enterprises, while the most direct beneficiaries of environmental improvement ought to be future generations and people living in polluted or environmentally degraded areas – hardly the most influential groups in the global policy arena. More generally, the free-market agenda has had more powerful backers (e.g. the US), more powerful implementing agencies (e.g. the International Monetary Fund – IMF), and a more coherent strategy (e.g. structural adjustment as a condition for loans). Equally important, removing market barriers locally supports the expansion of markets globally, while improving local environments can threaten the global environment (e.g. by importing distant resources).

On the other hand, without a better multi-scaled strategy it is hard to see how the urban environmental challenge can be met. The success of past sanitary and environmental reforms provides the basis for limited optimism. As described above, sanitary reforms did manage to go against the tide of free-market liberalism in Britain in the 19th century and it was multi-scalar: the sanitary movement was international, and reforms often relied on national laws, even though the most profound changes were in urban governance. Similarly, environmental reforms went against the tide of free-market liberalism in the US in the 20th century, and were also based on multi-scaled strategies.

It is somewhat misleading to treat the full panoply of environmental burdens now generated by urban activities as an urban challenge, since their resolution does not necessarily lie in urban initiatives. On the other hand, it is a useful counterpoint to the more conventional treatment of environmental burdens, which ignores their urban dimension altogether and partly, as a result, tends to ignore their spatial dimensions. Moreover, a multi-scaled strategy must involve more than striving for global governance to address global issues, national governance to address national issues, and local governance to address local issues. While national governments and the international agencies they construct clearly remain at the centre of national and global governance respectively, urban-based groups can often play an important role at extra-urban scales as well as intra-urban scales, and networking can help bridge different scales. In relation to global burdens, networks of cities, particularly in affluent countries, have shown some promise in promoting local approaches to climate change mitigation, despite all the obstacles (Bulkeley and Betsill, 2003). At the other end of the environmental spectrum, national federations of the urban poor, also networked internationally, have shown promise in addressing the local environmental problems in low-income settlements (D'Cruz and Satterthwaite, 2005).

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