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Urban Environments: Issues on the Peri-Urban Fringe

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Abstract

This chapter reviews current thinking about environment-development issues in the transitional zones between distinctly urban and unambiguously rural areas, known variously as rural-urban fringes/transition zones, or peri-urban zones/areas or interfaces (PUI). Such concerns reflect the growing real-world limitations of traditional concepts of a simple rural-urban dichotomy. Moreover, recent archaeological research suggests that these phenomena may have ancient antecedents. Present-day fringes/interfaces have become intimately bound up with notions of (more) sustainable urbanization and urban development, with different issues and agendas manifested in different geohistorical zones of urbanization. Following an overview of planning issues in (post)industrial societies, the chapter addresses the complexities of changing peri-urban production and livelihood systems in the context of rapid urbanization in poorer countries, distinctive peri-urban challenges of appropriate and flexible planning and development, and the future prospects for enhanced sustainability in this most challenging category of development-environment interfaces. Possibilities for mutual learning between geohistorical regions are also raised.

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INTRODUCTION

Cities are dynamic human artifacts. Even in long-urbanized regions of the world, they constantly undergo structural change, redevelopment, and growth. Such processes also involve changes in urban relationships with the surrounding territory, most conspicuously on their outskirts. Diverse processes and urban forms in different politico-economic and sociocultural realms make generalization difficult, but in our increasingly globalized world, changes in different regions are increasingly interrelated. Accordingly, this chapter reviews current spatial and environment-development issues in the transitional zones between distinctly urban and clearly rural areas, which have historically been labeled, studied, and understood in different

ways in different parts of the world. Nevertheless, their importance everywhere lies in their dynamic mix of functions and land uses; increasing population densities; growing significance as sources of urban food, construction materials, and other resources; as urban waste disposal or treatment sites; and as recreational zones.

Traditionally, social scientists concerned with urbanization, the relationships between urban areas and their hinterlands, or human activities and behavior within such areas have relied on a simple urban-rural dichotomy. Implicit in this construct was the idea that urban and rural areas were characterized by very different land-use patterns and human behaviors and that the boundaries between these spaces and places were easily discernible and clear-cut. Although urban expansion rarely occurs neatly or uniformly, little attention was devoted to the dynamics of, or implications for, the urban-rural fringe or transition zone, as such areas were (and in North America and Western Europe still are) generally known. A brief exception occurred during the 1970s, when some attention was devoted to the morphometry of urban expansion, to problems of land speculation under capitalist market conditions, and to the implications of haphazard agricultural land conversion to urban uses. There was also some debate about the desirability of, or necessity for, regulation (1–4).

This relative lack of attention is probably best explained in terms of the widespread perception that the urban fringe represented a short-term transitional area that had little enduring interest or importance. Rural and urban areas, and the differences between them, therefore dominated research agendas until quite recently. As a reflection of this legacy, coupled with the lack of any uniform definition of urban fringes or peri-urban zones and the very real data collection difficulties in such rapidly changing areas (see below), no comparative datasets on population or other variables exist. Some individual cities produce occasional estimates but, for the most part, we remain reliant on dichotomized rural versus urban data. This is illustrated in **Table 1**, which

Table 1 Urban population, percentage of population classified as urban, and average annual percentage growth rate of urban population by major world region, 1950–2000^{a,b}

Location	Urban population (million) and percent urban						Percent average annual growth rate	
	1950		1975		2000		1950–75	1975–2000
Africa	33	14.9	103	25.3	295	37.1	4.57	4.21
Asia	232	16.6	575	24.0	1367	37.1	3.63	3.47
Europe	280	51.2	446	66.0	529	72.7	1.86	0.68
Latin America and Caribbean	70	41.9	197	61.2	393	75.5	4.14	2.78
North America	110	63.9	180	73.8	250	79.1	1.98	1.32
Oceania	8	60.6	15	71.7	23	72.7	2.75	1.51

^aSource: Reference 74, tables I.4 and I.3.

^bSuch highly aggregated data may contain cumulative rounding errors, estimates, and other statistical manipulations. They should thus be regarded as indicative only.

presents urban population and growth data for major world regions. Growth rates have been lowest in North America, Oceania, and Europe, which already had high levels of urbanization in 1950. In all regions, urbanization rates during the last quarter of the twentieth century fell relative to the third quarter. However, such aggregated data over 25-year periods conceal both important intraregional and temporal differences. The most explosive urban growth during the 1975–2000 period occurred in primary cities of certain newly industrializing countries of Latin America and especially East and Southeast Asia, sometimes creating new urban forms (see below). Recent urbanization in China and India has been extraordinary. Although cities such as Cairo, Lagos, and Kinshasa in Africa also grew very rapidly, they did not experience substantial industrialization. Accordingly, their urban structures and how they absorbed the new migrants and rising urban-born populations are very different. In such cities (not just in Africa), extensive urban fringe or peri-urban areas have resulted. Overall, today, however, many secondary cities are growing faster than their primary counterparts. Such data and trends provide little direct insights into peri-urbanization because there are no direct or—on the basis of existing evidence—firmly generalizable cross-national relationships.

Changing Realities, Changing Conceptions

The situation changed as recently as the 1980s and early 1990s when, for different reasons in different parts of the world, the longer-term persistence and importance of fringe or urban transition zones became more apparent. In postindustrial societies, urban regeneration, following the major deindustrialization of the 1970s and early 1980s, had two spatially opposite effects. On the one hand, it increasingly attracted middle-class and higher-income people to live in fashionable inner-city districts on brownfield sites. Conversely, the integrated transport and information and communications technology (ICT) revolutions enabled electronics industries to locate in, and professionals reliant on computerised communications to engage in homeworking from, high-amenity rural or semiurban localities, including “edge cities” (4, 5) adjacent to peripheral motorways and beltways.

Research in Southeast and East Asia during the 1990s distinguished a new form of metropolitan urbanism, reflecting some of the same transport and technological changes, rapid industrialization, and dramatic increases in standards of living as a result of the region’s transformed role within the world economy. Dubbed extended metropolitan regions (EMRs), they are characterized by rapid urban

Brownfield sites:

urban land recycled for different uses, e.g., residential after industrial; brownfield (re)development avoids or reduces the need for greenfield development

ICT: information and communications technologies

EMR: extended metropolitan regions

Polycentricity: the characteristic of a (large) city having several different commercial centers or central business districts (also sometimes known as polynuclear cities)

Peri-urban interface (PUI): zone of (dynamic) transition or interaction between urban and rural areas; usually used in the context of rapidly urbanizing poor countries

NRSP: Natural Resources Systems Program of the DFID

Rural-urban fringe: outer edge or transition zone between urban and rural areas; generally used in North American and European contexts

growth and polycentricity as well as the spread of urban activities and land uses into rural areas in novel ways. These create complex mosaics of juxtaposed activities previously regarded as incompatible, e.g., computer assembly workshops adjacent to rice paddy fields or coconut groves, and urban activities and urban-oriented leisure activities, e.g., golf courses abutting rural villages. This complexity led to the original designation of “*kotadesatie*” (city-villagization), quickly superseded by “*desakota*” (city-village) when the phenomenon was described in Indonesia (6–10). Latin America’s large metropolises, which have a longer history of intense integration into the world economy, have also evolved into comparable forms of “urban archipelago,” characterized by diffuse boundaries and weakened official planning controls (11).

Elsewhere in Southeast Asia, in South Asia, sub-Saharan Africa, Latin America, and the Caribbean, rapid and spatially polarized urbanization under neoliberal conditions has created often wide and persistent, if dynamic, transition zones that combine various rural and urban conditions. Moreover, their importance for the cities that they surround in absorbing urban migrants, as sources of food and other resources and as key areas for the disposal of urban wastes was increasingly appreciated. They are also typically zones of mixed land use and livelihoods. On account of these characteristics, and the interactions between such areas and the cities, they came to be known as peri-urban zones or interfaces (PUIs) and have become major research foci in their own right. This review addresses this spatial evolution and its environmental implications.

In other European or Europeanized languages, the PUI concept is expressed somewhat differently, e.g., *halfstedig* (half or semiurban) in Dutch; *urban-ländlichen Zonen* (urban-rural zones) in German; and *buitestedelik* (outer city or beyond the city) in Afrikaans (12, 13, p. 5); in many other languages, the concept does not yet exist. Probably, the largest PUI research program to date has been funded by the

U.K. Department for International Development (DFID) as part of its Natural Resources Systems’ Programme (NRSP), 1995–2006 (13–16). There is a tendency, not least in Germany and the United States, to equate the rural-urban fringe or PUI with suburbanization (see below), but these are not identical or equivalent processes. Although there is clearly an overlap in both concepts and actual usage of the terms, suburbs would more helpfully be distinguished as principally residential areas already forming part of the built-up urban area, the outermost edge of which constitutes the start of the urban fringe. PUIs would then comprise distinctive zones of mixed character beyond the suburbs—as defined in the next subsection below.

Crucially, fringe or PUI areas should be treated as integral elements of urban systems (i.e., as extensions of cities) in both functional and planning terms, because they and their environments are integral to the growth and operation of growing cities. Accordingly, their integration into urban planning systems would facilitate holistic and systems-oriented planning. This is likely to be achieved, however, only when the challenges of urban management and planning constraints on resources, capacity, and political priority, as well as a multiplicity of administrative boundaries are overcome. Even academics often still exclude fringe and peri-urban zones from their urban focus. The authoritative U.S. National Academies of Sciences’ book, *Cities Transformed: Demographic Change and Its Implications in the Developing World*, is a conspicuous case in point (17). At the same time, however, urban fringes or PUIs remain partially rural and to that extent also remain relevant to rural development and livelihood policies. However, this rural element will decline over time in rapidly urbanizing contexts, including EMRs. In postindustrial societies, the rates of urban growth are generally slow. Hence, the mixture of land uses and activities may be more stable, although even rural activities, e.g., smallholder farming and horse-riding stables, tend to be more urban than rural oriented.

Defining the Peri-Urban Zone/Area or Interface

As indicated above, I distinguish PUIs or rural-urban fringes from suburbs, although some sources use the latter term to embrace the former in the United States and parts of Europe. Unsurprisingly, definitional approaches have differed both over time and according to the conceptual or theoretical perspectives of the respective authors. Initial approaches focused on measuring the PUI but were frustrated by the very dynamics of the processes producing PUIs because the actual location and width of the interface change constantly and even vary around a city at any one point in time on account of topographical features and anthropogenic barriers. Empirically, diameters of 30–50 km appear common for large cities; in metropolitan regions, they might be wider. Hence, recent definitions are process oriented, focusing not only on the progressive incorporation of new areas into the urban sphere of influence (a feature of many rural areas too) but also on changing land uses, the reach of infrastructure, access to services and markets, and exposure to the impacts of urban production processes and pollution.

The NRSP's definition subdivided the PUI into an inner zone of direct impact and an outer zone of influence (14, 18). However, even the boundaries between these zones are indistinct, irregular, and dynamic. It is therefore more useful to conceive of an urban-rural continuum or gradient outward from the city across the PUI. The slope of the gradient is variable around the city, across the PUI, and over time, although urban or rural islands may occur within the PUI for various reasons (13, 16, 19). Moreover, the dynamic blends of land uses, activities, population, institutional arrangements, and rural versus urban-oriented allegiances have been characterized as forms of hybridity (16, 20).

HISTORICAL ANTECEDENTS

Aside from the distinctive rate and scale of present-day urbanization, there is conceptually no reason to assume that comparable processes

have not taken place since antiquity. Newly completed archaeological mapping of the extensive but little-known settlement complex surrounding the dramatic Khmer monuments at Angkor in Cambodia has demonstrated conclusively that it represents

... a low-density urban complex like the Classic Maya cities of the Yucatan peninsula such as Tikal ... a cumulative settlement palimpsest,¹ with an organic and polynuclear form arising from social and environmental processes operating over more than half a millennium ... the large-scale infrastructure gave coherence to the scatter of traditional residential units and 'created' Greater Angkor as a corporate entity ... The critical point is that the smaller component of the settlement pattern (the local temples, the occupation mounds, the ponds, and the durable and highly structured web or agricultural space that binds them) occurs with remarkable consistency within $\approx 15\text{--}25$ km of the current high-water mark of the [northern edge of Tonle Sap] lake ... the boundary of the urban complex of Angkor, as it can be loosely defined from the infrastructural network, encloses $\approx 900\text{--}1000$ km². (21, p. 14279)

Accordingly, the researchers conclude that, at its peak in the eleventh to thirteenth centuries CE, the "hydraulic city" of Greater Angkor represented the most extensive currently known preindustrial urban complex anywhere in the world. They also urge similar mapping of other ancient tropical monumental complexes and their surrounding urban settlements. Research to establish the chronology of settlement and detail the nature of landscape modification at Angkor is continuing. However, enough is already known to suggest that the extent and substantial nature of landscape modification probably spawned "very serious ecological problems

¹In keeping with the classical origins of the term, palimpsest is used metaphorically to refer to the sequential rebuilding on parts of the same site over time, giving rise to a complex urban mosaic of structures dating from different periods.

Greenfield sites:

natural or agricultural land converted to housing or other urban land use, usually at the urban fringe or in peri-urban areas

including deforestation, overpopulation, topsoil degradation, and erosion" (21, p. 14281). These would have had profound implications for this highly integrated system, especially in the context of unpredictable floods or wars.

For present purposes, two decisive points of relevance therefore emerge from this new historical evidence. First, the sense of dynamic, low-density urban expansion over a time span of centuries linked to land-/waterscape modification and the urbanization of nature implies progressive outward movement of Greater Angkor's urban fringe or PUI as a mosaic of low-density settlement interspersed with agriculture and other rural activities. The same may have happened in other ancient cities. If so, the peri-urban phenomenon is not new, just our identification thereof and the significance now attached to it. Second, what we would today call environmentally unsustainable practices may have been implicated in the decline of Greater Angkor. There may be lessons here too for present-day mega-urbanization.

URBAN FRINGES OF POSTINDUSTRIAL CITIES

Concern with urban expansion and haphazard development at the urban fringe in the 1960s and 1970s coincided with the rise of counterurbanization, the process in which mainly wealthier residents, facilitated by widespread car ownership and/or efficient public transport, sought to escape large congested and polluted cities to live in the surrounding countryside. This trend spawned much new greenfield development and forced up the price of housing in desirable rural villages and towns within daily or weekly commuting range, often displacing poorer local people (1, 3, 4). More recently, the ICT revolution has reduced the need for daily commuting and enabled some categories of professionals to live in deep rural areas or even in cities far removed from their employment base.

Diseconomies of scale and changing production technologies have dramatically altered geographies of production over the past 30-odd years. Much heavy and manufacturing indus-

try has relocated to lower-cost countries, driving many historically industrial cities to the brink of economic collapse and generating high unemployment and poverty, especially among working-class (blue-collar) people. Subsequent urban regeneration, driven by the rise of high-tech industries, the explosion of business and personal services, and the new consumerism, took the heat out of counterurbanization (3) and sought—with varying degrees of success—to reinvent inner cities and disused harbor areas as desirable living environments for younger professionals and one-person households, in particular, and for tourists. Successful examples of waterfront redevelopment include San Francisco, Vancouver, Toronto, Baltimore, London, Bristol, Liverpool, Sydney, and Singapore.

Rising incomes and aspirations for large family homes on extensive plots in greener areas, linked to the spread of out-of-town urban leisure facilities, shopping malls, and even new industries in growing edge cities or beltway agglomerations have renewed pressure on and beyond the urban fringe or rural-urban transition zone. Recent literature on the subject reflects theoretical and methodological shifts, current public and planning concerns with environmental quality, and increasingly also aspects of sustainability.

In the United Kingdom, concern currently centers on how and where to develop and absorb the three million new homes required in terms of the government's indicative plan to accommodate the ongoing decline in average household size and increase in the overall population (22). Brownfield (re)development and densification within existing urban areas will not be adequate, so local authorities across the southeast of England, where a disproportionate share of the burden will fall, have been instructed to identify and prepare substantial new greenfield sites in line with indicative targets. This is causing great public concern about the economic and, especially, the environmental consequences. Key among these are the congestion and pollution consequences of increasing vehicle ownership and use within densifying urban

areas as well as the inevitable loss of large areas of high-quality agricultural and forest/amenity land to greenfield development (e.g., 23). At another level, the government's high-profile commitment to increasingly sustainable development has focused attention on the need for enhanced and more proactive public transport development in order to facilitate reduced reliance on private car usage. One aspect of this involves the United Kingdom meeting its Kyoto Protocol targets and leading current efforts to formulate an internationally agreeable post-Kyoto regime on climate change.

French peri-urban areas [the term actually used by Jean (20)] are also hard to define more precisely than being intermediate between the city and countryside on account of their complexity, but they reflect urban dynamics. As in Anglophone countries, debates and policies have evolved over the past 30 years. However, their contemporary importance lies in their estimated population of some 10 million spread across 10,400 communes in 1999. Jean attributes peri-urbanization to a familiar set of structural factors but shaped by the particular nature of French urban local government and financial administration, and the "thirty glorious years" of post-World War II growth (20). In sharp contrast to the Anglophone countries, however, Jean's account does not highlight environmental problems or direct concerns in current debates and policy agendas, which center instead on the nature of urban agglomerations, service inequalities, efforts to promote intercommunal structures and identities, and debates over peri-urban subsidiarity to urban spaces:

Les espaces périurbains, confrontés à des situations singulières, tant sur le plan social que fiscal, peuvent être tenté de développer des «intercommunalités individualistes», de communes riches, localisées entre «les pays» et «les agglomérations» ce qui invite à réfléchir à l'articulation entre les diverses structures intercommunales afin de renforcer leur cohérence et leur efficacité, en évitant de renforcer le clivage rural/urbain. (20, p. 123)

In Germany, as elsewhere, quite substantial spatial reconfigurations have occurred through processes of suburbanization, which are not entirely synonymous with peri-urbanization. In terms of spatial planning approaches, there has been renewed attention to the delimitation and nature of city regions, discerning polycentric and patchwork structures and in-between cities (24–26). Attention has also been devoted to sociocultural expressions and interpretations of life worlds at the urban fringe (27).

In the United States, issues at the urban fringe are well represented in discussions of land-use planning. Particular concerns are the enhancement of economic tools—including the value of spatial perspectives—for the preservation of agricultural land, seeking to understand and predict losses of rural agricultural and forestry land to urban development, and to underscore the importance of rural amenities (28–35).

Recent American Farmland Association data show a loss of two acres of farmland to development every minute in a situation where one-third of U.S. farms and 16% of farmland were situated within metropolitan boundaries in 1993, producing a significant proportion of the country's agricultural output (36, p. 276). The economic, social and environmental consequences—not least for sustainability—are profound. Although it would be all too easy to become defensive of traditional rural style agriculture and to experience conflict with urban pressures, Erling (36, p. 276) sees a more positive and proactive approach as more helpful:

Because so many forces come together in this space, the urban-rural interface is also the place with the most potential for positive change, a change that comes in the form of multifunctional urban agriculture. Encouraging multifunctional urban agriculture means developing creative and ingenious new approaches to producing food amid competition for land use. For instance, agriculture frequently competes for space with wildlife habitat and urban development. Combining

functions within a land area, in a sense, doubles the total available area. It also means finding new ways to introduce food production to everyday lifestyles, as well as remembering and honoring the way culture and landscape have been influenced by agriculture in the past. Farmers on the urban fringe who are able to keep their land protect it and encourage smart growth within the city. Meanwhile, they serve numerous other functions in the community.

Multifunctional peri-urban agriculture and the search for sustainability in changing contexts are themes identified in various countries, including Portugal's capital, Lisbon (37). As Johnston & Swallow (34, p. 2) point out, the recent popularity of conservation and "smart growth" in the United States is often interpreted as constituting,

... a reaction to contemporary patterns of land conversion, characterized by an increase in dispersed, low-density rural and urban-fringe development... economists generally recognize it as a symptom of the market's failure to internalize the full range of nonmarket benefits associated with farm, forest and open space... Associated landscape changes may impose often unforeseen service costs on communities, reduce local production of high-value or specialty crops, disrupt social or community structure, and cause a loss of ecosystem services and other rural amenity benefits...

The economic and econometric tools that they and their contributors seek to refine are aimed essentially at internalizing costs and benefits in the belief—derived from neoclassical welfare economics—that this represents the best and most effective way to tackle and eliminate such externalities. More generally, the literature reflects concerns with—and experimentation to improve—public awareness, perceptions, and participation in assessments of amenity values and conservation priorities at the rural-urban fringe (e.g., 38–40).

IN SITU URBANIZATION AND ENVIRONMENTAL PROBLEMS IN CHINA

Over the past 25 years or so, China has been experiencing arguably the most rapid, dramatic, and far-reaching process of urbanization in human history. It therefore merits separate attention, despite both similarities and differences from experiences elsewhere. The transformation of Beijing and the principal eastern sea-ports, most notably Shanghai, Tianjin, and the cluster in the Pearl River Delta (with a population well over 30 million) (41, p. 27), has received the most attention. Today, the Yangtze River Delta has a population of some 140 million (T.G. McGee, personal communication, December 11, 2007). However, urbanization has been occurring countrywide, albeit in highly differentiated forms, reflecting the distinctive national and regional political economies.

In part, this reflected policy shifts from the Mao era—when heavy and other strategic industries were deliberately dispersed in western and central regions for security reasons and in order to minimize regional wage inequalities—to the increasingly economically liberalized program of the reformist regime under Deng Xiaoping. For instance, industrialization of the coastal region was a key initial priority of the latter, formalized in the Seventh Five Year Plan (1986–1990), with the Ladder-Step Doctrine to spread industrialization to the central and western regions thereafter (41). Inland port cities on the Yellow and Yangtze rivers, like Chongqing and Wuhan, along with numerous landlocked cities in the central region, have indeed subsequently experienced rapid expansion, industrialization, and modernization. The western region now lags far behind and is substantially poorer than the others. The state has, in recent five-year plans and other initiatives, shown growing awareness of the need to address regional disparities to help stem the flow of rural-urban migrants and avoid social unrest (41, 42).

Economic Liberalization

Central to economic liberalization has been the relaxation of central control, especially the Maoist restrictions on foreign direct investment (FDI) and the devolution of responsibilities to lower levels of government. Hence, local entrepreneurship and European- and North American-style place marketing and local boosterism have emerged as key factors in directing the flow of FDI and the fortunes of particular localities.

Following introduction of the household responsibility system to replace collective farms in 1983, rural urbanization and industrialization also commenced. In diverse forms, these processes transformed many villages, especially in relative proximity to large cities where rural population densities were very high (comparable to urban densities in other countries). This spread the availability of nonagricultural incomes and improved living standards, while reducing migration pressures—what Friedmann (41, p. 41) calls *in situ* urbanization.

Closer to fast-growing cities, peri-urbanization has also been documented as a large-scale, industrially driven process (41, pp. 52–54, 43–45). Some aspects and some districts share features with the East Asian EMRs, discussed above (46); indeed, McGee et al. (42) identify Guandong-Hong Kong as an EMR; other districts have become completely urbanized, absorbed by growing cities and sometimes even incorporated as urban administrative districts. The term *villages* is therefore today something of a misnomer, principally identified in territorial-administrative terms and in the memories of older residents.

Environmental Degradation

These diverse urbanization and peri-urbanization processes have had diverse and complex human consequences, but the focus here is on the environmental implications. These have generally been severe and are increasingly recognized officially as unsustainable (41, 47). Urgent remediation and prevention

are therefore essential. Levels of river, soil, and groundwater contamination from often toxic waste are high, resulting in health problems and severe agricultural contamination. Air pollution is chronic, not just in large cities like Beijing, where widespread respiratory illness and the forthcoming Olympic Games have focused attention on the problem, but also in peri-urban and rural areas characterized by often (but by no means always) outdated technologies and lack of controls. As elsewhere, urbanization may increase gross water availability through reduced evapotranspiration and increased runoff, but unless this can be harvested, and is either relatively unpolluted or can be purified, usable water supply is likely to decline (48).

The Chinese government's attitude to industrialization at any cost has changed dramatically in the last two years. Loss of prime agricultural land to urban activities in high-potential areas like the major river deltas—precisely where urbanization has been most rapid and extensive—cannot readily and sustainably be compensated for by bringing lower-potential land elsewhere into production or by intensifying existing production. Pollution abatement measures and greenhouse gas emission reductions are now being introduced energetically. This mirrors China's change of attitude to the climate change debate and acceptance of the implications of the Intergovernmental Panel of Climate Change's Fourth Assessment Report in 2007 (48a). Having long dismissed international campaigns over the social and environmental implications of the massive Three Gorges Dam on the Yangtze River, the government admitted for the first time in late 2007 that the project has been environmentally disastrous for affected rural and urban populations alike, including increased flooding. These hopeful signs bode well if carried through and implemented broadly. Internationally, the political significance of this attitudinal shift is potentially dramatic, having the potential not only to transform negotiations on climate change and a successor to the Kyoto Protocol but also to change attitudes in other rapidly

Livelihood activities:

how individuals or
(more commonly)
households undertake
a variety of activities in
order to meet or
exceed survival needs

urbanizing and industrializing poorer countries, where the environment usually remains a low priority relative to employment creation, economic growth, and antipoverty measures (see below).

PERI-URBANIZATION AND THE ENVIRONMENT IN OTHER LOW- AND MIDDLE-INCOME REGIONS

Environmental issues and problems have featured prominently in processes of peri-urbanization and the nature of PUIs almost everywhere in the global South or developing world (e.g., 13, 14, 49). The diversity of processes precludes full discussion here. Instead, this section is organized thematically in order to elucidate the various categories of development-environment issues that have received attention. Issues of poverty and the struggle to survive and find adequate livelihood activities amid rapid change loom large.

As in postindustrial countries and China, it is important to underscore that PUIs everywhere are not independent or isolated zones but—as defined above—highly dynamic interfaces between urban and rural relations. Forces and pressures acting in the PUI are therefore not only local but national and even international, in terms of human mobility, commodity and financial flows and their valuation, and claims on environmental resources (50). As Douglas (51, pp. 19–20) has suggested, an ecosystem dynamics approach is also compatible with this view:

If . . . human interventions are seen as perturbations of ecosystems, peri-urban environmental change becomes part of the global biogeochemical cycling supporting all life. What makes the peri-urban environment so interesting is the complexity of political, economic and social drivers impacting locally on those biogeochemical cycles and the resulting outcomes for the health, well-being and economic survival of people in peri-urban communities. Ecosystem dynamics can be used to link decisions and actions by one agency to outcomes

and consequences for communities and individuals. In this way, we can allocate responsibilities, identify environmental injustices and assess the consequences . . .

The following brief survey adopts elements of this approach within a structure that highlights the principal categories of environmental issue. This will be linked at the end to the notion of urban ecological footprints introduced by Rees (52). Use of these footprints enables the identification of resource and environmental impacts of a city beyond its perimeter.

Land Conversion

As already indicated with respect to China, one of the most intractable environmental issues everywhere is the inevitable conversion of agricultural and forested land to urban uses, principally housing, commercial and industrial premises, and infrastructure such as roads, power stations and electricity servitudes, waterways, airports, golf courses, other land-extensive recreational facilities, waste dumps, and sewage treatment plants. This reflects the availability of larger tracts of relatively undeveloped and cheaper land, and the ability to site disturbance-causing or polluting facilities away from wealthier and/or dense urban populations because few cities and towns have peri-urban densities approaching those of eastern and central China. In other words, negative environmental externalities may be imposed on the PUI (e.g., 50, 51).

The consequences—especially for poor PUI inhabitants—of turning fields and forests into bricks and concrete increase in severity as the proportion of agricultural land decreases. It is therefore useful to recall the idea of an urban-rural gradient through the PUI, or an inner and outer zone within it, distinguished above. Conversely, urbanization represents an unparalleled opportunity to improve living conditions, quality of life, and available resources, but the outcome is contingent on local circumstances and is likely to have differential impacts both geographically and socially.

The precise process by which land leases or sales occur reflects local institutional structures, land tenure systems, and the relative power of key stakeholders. Where, as is common in Africa and South and Southeast Asia, peri-urban land is held under some form of communal tenure or state ownership, the chief, elders, village council, or local officials will usually preside over approaches by outsiders to acquire land. Corruption and self-aggrandizement by such leaders are widespread, especially where—as in China—vast profits are available almost instantly. Under traditional customary tenure, the chief or elders received tribute in livestock or agricultural products in return for usufruct rights to land that was ultimately held in trust by and for the community in perpetuity. However, monetization of economies almost everywhere has meant that such transactions now take place with cash and represent *de facto* alienation of land. Displaced households may receive alternative farmland (where this is still available) or a proportion of the money receipts at the discretion of the chief or officials. Even where this occurs, the compensation may be inadequate, and all too often such households become impoverished, no longer able to live from agriculture (13, 14, 53). Where social institutions and controls remain strong or leaders are more accountable, the entire village may prosper through careful investment of the funds and income diversification, as has occurred in peri-urban China (41).

As mentioned above with reference to China, evapotranspiration is reduced, but runoff increases as natural surfaces and land cover are replaced by impervious building and road surfacing materials. Runoff—both from this source and the diversion of or interference with natural drainage hydrology—can create major erosion problems in the absence of adequate storm water drainage and storage facilities (which is the norm), even damaging or undermining houses and infrastructure in the aftermath of intense tropical or subtropical rainfall events. Runoff also commonly becomes contaminated by urban activities and wastes,

necessitating expensive treatment if it is to be impounded and utilized.

Arriving outsiders comprise both rural migrants seeking more affordable land and shelter than is available in town (who are typically poorer or little wealthier than most indigenes and who may find diverse livelihood opportunities in the PUI invaluable) and urban dwellers seeking larger, cheaper plots of land beyond the built-up urban area. Such people may be poor, unable to acquire any reasonable urban base or wealthier people intending to construct large, modern (often western-style) homes on larger plots. A third category comprises urban developers and speculators buying up land for later resale or on which to construct housing or industrial premises, perhaps in association with foreign investors. All have different effects on the PUI in terms of relative numbers and the direct and indirect impacts of their investments, livelihood activities, and intended duration of living or working in the PUI.

Peri-Urban Agriculture and the Environment

Because of their similarities, common role in feeding cities, and the conceptual difficulties of distinguishing them, urban and peri-urban agriculture are commonly assessed together. Given the focus of this article, I address only the PUI. On the one hand, peri-urban cultivation becomes more difficult and precarious when the likelihood of land sale and urban development increases. Loss of cultivable land to a combination of sale and land degradation also reduces local food self-reliance and the ability to sell any surpluses to urban dwellers.

On the other hand, greater proximity and accessibility to the enlarged urban market can create—at least for a time until the arrival of the concrete carpet—new opportunities to intensify peri-urban agriculture and to specialize in higher-value horticultural crops that require greater husbandry (and hence financial outlay and perhaps risk) but result in greater returns. The scale and degree of organization

in such ventures varies from individual farmers or households to groups of neighbors or kin collaborating to clear, tend, and guard fields on which they cultivate individual plots, and even formal cooperatives. Proximity to markets cuts transport costs and improves market information, especially when farmers are able to visit the market regularly or utilize mobile phones and other technologies to keep abreast of fluctuations in supply and prices. However, excessive and often inappropriate use of fertilizer and inorganic pesticides contaminates crops, soils, and groundwater and causes health problems for farmers, unless adequate protective gear is worn, and for consumers. (51, 54–66).

Experiments with composting organic domestic waste (e.g., from food) have demonstrated considerable potential to reduce waste disposal needs and to enhance soil quality for agriculture in peri-urban Kumasi, Ghana, without the financial or environmental costs of commercial fertilizer. However, uptake and commercial sustainability require perseverance and patience in a situation where trading or wage labor provide quicker incomes (67). Aquaculture may also prove feasible and environmentally useful if agricultural waste is utilized as fish feed, as on the outskirts of Kolkota (68). In semiarid and arid zones, where pastoralists become sedentarized either through choice or official policy, their livestock can present new challenges to ensure sustainable livelihoods without excessive grazing and environmental degradation (69). In other contexts, large-scale livestock rearing and fattening on intensive feedlots may occur, taking advantage of proximity to abattoirs, food processing plants, and urban markets for meat. As urbanization progresses, however, such activities tend to relocate beyond the PUI. Unless carefully controlled, environmental consequences of livestock rearing and related activities may include pollution and eutrophication of surface water and wetlands, methane and other gaseous emissions, strong smells, noise, and heavy vehicular traffic (70, pp. 19, 68–71).

Other Forms of PUI Resource Use

Peri-urban and rural resources have been exploited for urban use throughout urban history. However, the rate and scale of resource depletion and degradation have recently become problematic as the scale of urbanism has grown and as resource scarcity has increased. The most basic such resource is water, abstracted through reservoirs, treatment plants, and a piped reticulation system. However, the spread of boreholes and shallow wells in suburban and peri-urban areas to support growing numbers of people (including a proportion utilizing many water-intensive modern appliances) living where there is no piped supply often lowers the water table below the level of tree roots, causing shade and fruit trees to die. Recharge during the rainy season is commonly inadequate to sustain such long-term pressure on the resource.

Urban and peri-urban construction requires ever larger quantities of sand, gravel and rocks, commonly extracted from modest borrow pits or quarries of varying size in the PUI. Compensation to local landowners varies but rehabilitation of exhausted sites remains rare. Apart from visual disamenity (a low priority to poor residents), surrounding areas can suffer damage from the actual quarrying and as a result of heavy dust deposition. If clays and other soils are suitable for brick or cement making, the scale of operations will increase, and the problems be exacerbated. Water may be abstracted for use in quarrying; the requirements for cement or brick making are heavy. Pools of water in abandoned workings provide ready breeding grounds for disease vectors. Sometimes such workings are used as landfill sites for urban refuse (see below), which may fill the holes but can cause other problems unless the site is appropriately prepared and maintained (51, 64, 71, 72).

Wood, reeds, and grasses are widely used construction, fencing, and roofing materials. Unsustainable harvesting practices damage the environment, and loss of ground cover promotes soil erosion. Overexploitation of particular species contributes to the decline of birds,

mammals, and insects dependent on them and contributes to biodiversity loss.

Waste Disposal and Contamination

The widespread location of polluting infrastructure, such as refuse dumps and sewage treatment plants, in the PUI imposes negative externalities on local residents. These comprise disturbance from large numbers of dump trucks, sewage tankers, and livestock transporters traversing key roads; smell and potentially disease-carrying vectors such as flies, mosquitoes, and rodents; and contamination of soil and groundwater by leachate because few such facilities are adequately designed and maintained. The associated inequity and distributional issues are underscored by the general absence or gross inadequacy of sanitary facilities and other services for peri-urban residents, who are mostly reliant on pit latrines (the inappropriate siting of which also often contributes to groundwater contamination), use of nearby streams or bushland, and unmaintained communal refuse dumps. All of these have negative environmental implications.

Rivers flowing through major urban areas commonly emerge with a heavy pollution load, ranging from raw sewage to household refuse and a cocktail of industrial and chemical effluent, much of it hazardous to health. The lack of on-site industrial waste capture and treatment facilities, and/or the inadequacy of regulations and enforcement to avoid such contamination, arises through naked corporate self-interest, inadequate municipal or government capacity, and often corruption of enforcement officials. Peri-urban residents downstream of cities are thus forced to drink and utilize contaminated water, to eat and catch fish that may have unsafe levels of heavy metals and other toxins in their body tissue, and so forth. Contamination levels are often many times higher than the respective World Health Organization limits. In extreme cases, people are forced to seek alternative, inevitably more costly water and protein sources or to suffer the health consequences (51, 71, 73).

Usually, the poorest households and members of the community, who are least able to resist the changes or to access alternative resources or livelihood activities, are the most vulnerable. The evidence from a wide variety of situations also points to increasing wealth disparities and social differentiation among both indigenous residents and immigrants as peri-urbanization proceeds. PUIs become increasingly closely integrated with urban economies and resource flows, albeit in changing ways and affecting different sets of people at different stages. This underscores the urban footprint concept, namely the extent of the wider area required to support a city and its people.

CONCLUSIONS

This review has broken with convention by seeking to explore environmental issues and problems at the PUI or urban fringe in diverse contexts worldwide rather than just in a particular category of countries or geographical region. Nevertheless, in order to illustrate some of the differences and similarities between groups of countries defined in terms of historical political economies, they have been assessed separately. However, this should not be taken as implying that they constitute somehow internally coherent or homogeneous groupings. On the contrary, their diversity is profound, and the connections across groups are increasing. Moreover, despite that, the evidence surveyed shows that many processes, concerns, and problems are similar, perhaps varying in extent, severity, and likely impact, if only because of the differing resource bases, median living standards, and institutional capacities. In the future, such categorizations may be superfluous. New technologies, e.g., aircraft requiring longer runways and larger terminals, increase the land and infrastructural requirements everywhere; the same applies to the spread of mobile telephone transmitters and elite and middle-class recreational land uses, such as golf courses in the urban fringe/edge city and PUI.

Land-use conflicts and changes to traditional livelihoods are almost inevitable in such

situations of flux and dynamic activity changes. Concerns about the loss of often high-potential agricultural land are universal, although the significance for local or national self-reliance and for households affected may be very different. A smallholder or farmer selling his land to a housing developer in Europe or North America is in a very different position to a subsistence peri-urban household in Africa or Asia having its family plot in communal lands sold from under it by the chief or village elders. Landfill sites and sewage treatment works occur everywhere; however, construction standards and maintenance levels vary considerably, with the greatest redress available to citizens with the greatest means and in countries where the standards are, ironically, highest.

Capitalist globalization is weaving the world ever more tightly into an integrated system driven by profit seeking. Within this context, markets, commodity flows, and human migration operate and articulate at various scales and through diverse spaces. Previously separate areas with distinct identities and activity mixes are becoming linked through ongoing—and, as in China—dramatic urbanization and infrastructural corridors. This applies also to rural, peri-urban, and urban zones of individual countries and which are increasingly forming in EMRs across national borders too, whether along the U.S.-Mexican border, within the European Union, the Singapore EMR (which embraces adjacent parts of Malaysia and Indonesia), or the increasingly integrated network of mushrooming cities spanning the United Arab Emirates. The ways in which these spaces are organized, and how they are lived and experienced by different groups of people, are also evolving. A common feature of PUIs in poor countries is the diversity of livelihood activities required by individuals and households in order to spread risk and gain adequate incomes. This is far less true in richer contexts, where most people have considerable disposable leisure time.

Ironically, perhaps, almost all categories of urban(izing) place are becoming less self-reliant, more dependent on intensive resource

use and modern technologies, and often less sustainable, just as sustainability and the likely impact of global environmental change (GEC) are beginning to feature more prominently on public agendas. Given the dynamic but urbanizing land-use mix and population structure in PUIs, these interface zones will contribute increasingly to GEC over time, as well as experience its impacts. Urban footprints of all but the smallest, most local service centers are actually increasing as resources are acquired from ever-larger areas, even globally. Waste disposal also covers greater distances as it is differentiated and dumped or recycled. Although unrecyclable and organic waste may go no further than a peri-urban municipal landfill site or incinerator, scrap metal and old computers may cross the world for smelting and reclamation of valuable metals.

In view of the diversity of conditions prevailing within and between countries, strategies to improve conditions will necessarily have to be designed for local appropriateness. Certainly, no blueprint or off-the-shelf solutions will be workable. However, a few broad policy implications can be derived from the available evidence and on the basis of the above review.

First, each city's PUI needs to be included within the urban planning system because it forms part of the functional urban area and the urban ecological footprint. Many large cities and conurbations are hamstrung by the lack of a strategic or integrated planning mechanism that transcends their constituent local authority boundaries. Moreover, the fact that PUIs commonly straddle a substantial number of urban and surrounding rural local authorities underscores the necessity of establishing such an integrated metropolitan planning system. This would also facilitate the urgent challenge of addressing GEC at the scale of functional urban areas rather than just the contiguous built-up zones.

Second, effective planning for such an extended geographical area will require adequate and appropriate levels of local authority and metropolitan capacity and resources. In many poorer countries, governance capacity

is totally inadequate. Third, and linked to the second point, is that the PUI's dynamic nature demands a flexibility of planning mechanisms and institutions that is seldom evident even for the fully built-up urban area under any system of governance. In particular, a rather different balance between permissive and restrictive planning and development control is needed. Fourth, fast-growing urban areas in many poor countries are characterized by conflicts between Western-derived and individualized land tenure systems and those of indigenous origin, which have traditionally been based on communal principles. Inclusion of the PUI within the planning system may increase this complexity by including more communal land albeit areas where individualization of tenure is occurring rapidly.

Fifth, many urban mayors or governors and their administrations have little if any commitment to the PUI or concern for issues there.

This reflects their urban orientation plus the lower concentrations of infrastructure, buildings, and voters in the PUI relative to core urban zones. Changing such attitudes is essential and might most effectively be achieved by means of practical and financial demonstration of the interrelationships between urban and PUIs. Following directly from this is the sixth and final implication, namely the imperative of formulating and implementing sustainable strategies to address the often conflicting resource and service demands of rich and poor people, who are commonly concentrated in separate and highly segregated neighborhoods. Although historically, PUI residents have been relatively and/or absolutely poor, outmigration of wealthier people to construct large houses on cheaper land in the PUI often changes the socioeconomic profile of residents, perhaps thereby adding "voice" to PUI constituencies.

SUMMARY POINTS

1. Urban fringe/peri-urban interface (PUI) issues are widespread nowadays but have differing significance and importance according to various factors, including land tenure systems, rate and scale of urbanization, availability of employment, standards of living and median incomes, resources, and the capacity of local governance institutions.
2. Although generally considered a present-day phenomenon, new archaeological evidence suggests strongly that important PUIs/zones may have characterized major (pre)industrial cities in different world regions.
3. In western Europe and North America, counterurbanization during the late 1960s and 1970s focused attention on the urban fringe and beyond; more recent beltway/edge city developments have changed the nature of pressures there and focused attention anew on land-use zoning and planning. Environmental concerns are less prominent in France than the United Kingdom and North America.
4. Chinese urbanization and peri-urbanization has been unprecedented in rate, scale, and distribution, combining mass migration with in situ rural urbanization and industrialization. The huge environmental costs of unbridled economic modernization are now belatedly receiving urgent official attention.
5. Key PUI issues in poor and middle-income countries include the rate and scale of land-use and land-cover change, loss of agricultural land but also some new opportunities for commercial market-oriented cultivation of higher-value crops, unsustainable use and depletion of both renewable and nonrenewable resources, and the environmental and health impacts of urban landfills and waterborne wastes.

6. Intensifying globalization is integrating traditionally rural, peri-urban, and urban spaces increasingly closely, both within and also across national boundaries. Although often still sharp, similarities and differences in the nature of peri-urban environmental issues around the world appear to be becoming more comparable as urban footprints extend. The impacts of global environmental change will also be felt increasingly across these transition zones.

FUTURE ISSUES

1. Strategic/integrated urban planning is needed across numerous local authority boundaries (including different categories of local authority).
2. Ensuring that local/metropolitan government has adequate capacity and resources.
3. Ensuring that planning systems in contexts of dynamic change remain flexible.
4. Conflicts between different land tenure and planning systems need resolution.
5. Political commitment to peri-urban/fringe issues is often regarded as marginal by the respective local authorities.
6. Conflicting resource demands of rich and poor people need to be addressed with sustainable strategies.

DISCLOSURE STATEMENT

The author is not aware of any biases that might be perceived as affecting the objectivity of this review.

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