

Reconceptualizing Land for Sustainable Urbanity

Christopher G. Boone, Charles L. Redman,
Hilda Blanco, Dagmar Haase, Jennifer Koch,
Shuaib Lwasa, Harini Nagendra, Stephan Pauleit,
Steward T. A. Pickett, Karen C. Seto, and Makoto Yokohari

Abstract

Current systems to classify land are insufficient, as is the delineation of Earth's surface into discrete categories of land covers and uses, because they ignore the multiple functions that land provides and the movement of people, materials, information, and energy they facilitate. To address sustainability challenges related to urban lifestyles, livelihoods, connectivity, and places, new conceptualizations are needed which have the potential to acknowledge and redefine the extent, intensity, and quality of urbanity on Earth. This chapter proposes a framework which focuses on people and institutions as agents of change and examines changes in urban lifestyles and livelihoods over larger regions, regardless of whether an area is delineated as "urban" or "rural." It views urbanization and the urban era to be an integrated system and provides a multivariable approach to urbanity. It discusses a new land ethic and highlights challenges that exist to facilitate a sustainability transition.

Introduction

Standard urban-rural land classification systems are insufficient for analytical or planning purposes. The delineation of Earth's surface into discrete categories of land covers (e.g., forest, rural) and uses (e.g., recreation, agriculture) ignores the multiple functions those areas may provide and the movement of people, materials, information, and energy they facilitate (Cadenasso et al. 2007; McHale et al. 2013). The Earth's surface is far from static, and new conceptualizations are needed which incorporate an understanding of the *processes* that shape, take place on, and are facilitated by land. This is especially urgent in an era of rapid urbanization and globalization, where the structure

and function of lands may affect one another even at great distances and at near instantaneous speeds, a phenomenon known as teleconnections (Seto et al. 2012b). These teleconnections are amplified by urbanization, with the result that even seemingly remote areas may have urban characteristics. For these reasons, traditional concepts of urban and rural have become increasingly less useful in describing the function and structure of land as places of human activity.

In this chapter we propose a conceptualization of land that measures and analyzes *urbanity*, the urban-ness of places, and the economic activity and population characteristics of the land. We define urbanity as how people support themselves through various livelihoods, the material culture and patterns of consumption representing different lifestyles, their spatial connectivity, and how they identify with the places where they reside and upon which they rely. The magnitude and qualities of livelihoods, lifestyles, connectivity, and place create the degree of urban-ness of intertwined human experiences and land configurations. Key terms used in this chapter can be summarized as follows:

- **Urbanity:** urban-ness of land defined by the physical and functional characteristics that support and facilitate urban-like livelihoods, lifestyles, connectivity, and places.
- **Livelihood:** means of securing necessities for life, such as occupations, access to resources and information, reliance on social networks, or supporting institutions.
- **Lifestyle:** way of life that defines and reinforces self-identity. In the urban era it is often defined by and associated with occupation, socio-economic status, consumption, behaviors, and other activities that distinguishes individuals or groups from others.
- **Connectivity:** ability to connect between nodes in a network, and the magnitude, speed, direction, kinds, and infrastructure of those connections.
- **Place:** an area or location defined by physical or social characteristics that create meaning (sense of place) and distinguish it from other areas or locations.

It is possible to define a continuum of urbanity that is not defined by administrative boundaries of cities, but by the activities and functions that occur in places even far removed from what are traditionally understood as urban areas.

In this chapter we demonstrate how the concept and elements of urbanity can be used to assess and visualize the potential for sustainability of places. We explore the notion of a new land ethic in an urban era, one that includes the elements of urbanity as a potentially positive set of attributes, and how explicit attention to ethics informs our choice of human well-being, ecological integrity, and social equity as sustainability dimensions.

Conceiving Land as Places for and Defined by Human Activity, Relations, and Experience

Urban areas are often conceptualized in a discrete manner; for instance, statistics that extend over an area of 2–4% of the terrestrial world are used to describe urbanization, when in fact these numbers refer to areas of urban land cover (Seto et al. 2009). This delineation refers to the morphological face of urban land, the densely built-up areas with comparatively high population density. As urban areas grow, updates of the urban space are usually made by remote sensing methods to detect and classify land use. The problem is that these discrete and cover-based approaches are unable to capture the complexity of processes, outcomes, and impacts of urbanization, which are spatially related, scale dependent, and operate across large and interconnected regions through distal teleconnections (Seto et al. 2012b). We have attempted to develop a framework to conceptualize urban areas, focusing on people and institutions as agents of change, and examining changes in urban lifestyles and livelihoods over larger regions, regardless of whether an area is administratively or morphologically delineated as “urban” or “rural.” This framework draws on approaches that perceive urbanization and the urban era as an integrated system, where humans, energy, and matter flows are involved with urban lifestyles, livelihoods, connectivity, and place. The conceptualization provides a multi-variable approach for defining the degree of urbanity.

The standard morphological and land-cover driven delineations and the new urbanity-driven delineations of urban areas presented here differ considerably, both in terms of the spatial extent they cover and the degree of continuity and interlinkages between places. Consequently, within the new framework, global maps of urbanity would differ substantially from standard definitions of urban areas. Further, the multiple variables of the conceptualization—lifestyle, livelihood, connectivity, and place—permit the detection of areas of high urbanity within administratively defined rural areas as well as areas of low urbanity within morphologically or administratively determined urban areas, recognizing the reality of gradients and heterogeneity of such distributions in many parts of the world (Figure 16.1).

Urbanity: Elements and Processes

Our proposed conceptual framework of land change and urbanization is dynamic, relational, and spatially heterogeneous, as opposed to static, dichotomous, and gradient based. It focuses on people and institutions as agents of change, rather than on administrative boundaries as locations for dense demographic settlements. The framework aims to identify explicitly how these agents of land change and urbanization are connected at multiple scales. Furthermore, it allows users to diagnose the implications of urbanization for environmental

integrity, social equity, and human well-being in ways that help us to identify pathways for sustainable urbanization. Improving understanding of the implications of an urbanizing world for global land use, including the detection of phase transitions, is another goal of the framework.

Urbanization can be characterized as simultaneous processes across three dimensions. First, urbanization is a process whereby livelihoods become less agrarian, less dependent on local production, and less directly linked to the use of natural resources through such activities as fishing, hunting, or forestry. Second, urbanization involves changes in lifestyle, including such features as degree and mode of mobility, social identity, behavior, personal values, consumption choices, and modes of action. Third, urbanization increases the number, diversity, distance, dynamism, and redundancy of connections of the locality, its inhabitants, its economies, and ecosystems to distant places. Although places and people have been connected throughout history by trade and migration, urbanization today is changing the nature, frequency, and intensity of these teleconnections (Seto et al. 2012b). In short, we suggest that:

- Urbanization results in increased teleconnections, and vice versa.
- Land change is increasingly driven by nonlocal actors through these teleconnections.
- Understanding land change through a new framework of global land use in an urban era can help us identify planetary responsibility and Earth stewardship.

The key point is that to understand contemporary urbanization and land change, we must first understand how these processes are continuously distributed and connected through space and across time, in contrast to prevailing frameworks that are largely place based and discrete in space and time. The approach will avoid using nominal, contrasting categories, such as rural versus urban, and it differs from other approaches that assess change along neatly defined urban-rural gradients.

We summarize the insights above as a continuum of urbanity, emphasizing the dimensions and factors around which actors work their effects. Actors influence urbanization through the creation and use of livelihoods, the generation and expression of lifestyles, and the creation and exploitation of built environments, infrastructures, and teleconnections. Their actions take place in ecological and cultural contexts embodied in specific places, and those places are in turn affected by the actions (Figure 16.2).

Actors, Livelihood, and Lifestyles

People and institutions (actors) create and depend on livelihoods and the institutions that support livelihoods, such as markets, governance structures, and laws. Urban areas typically have a great diversity of actors and livelihoods, historically related to industry but increasingly to service and information

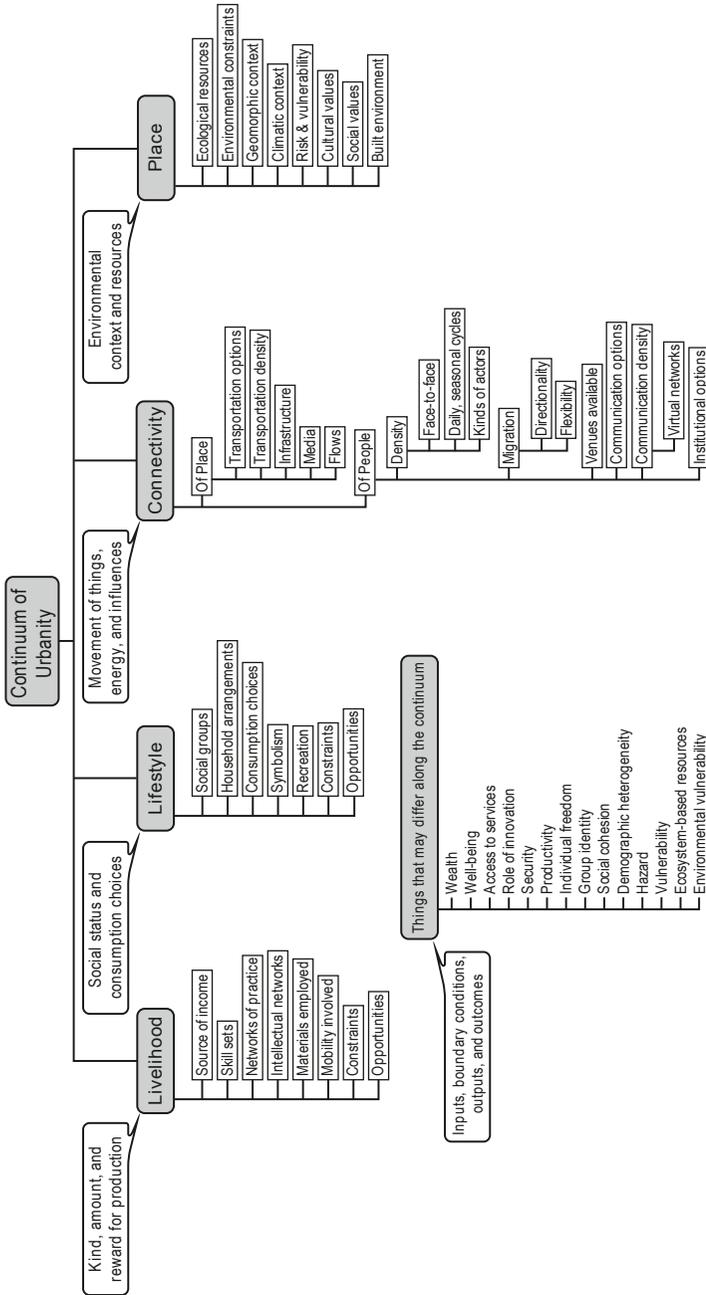


Figure 16.2 The continuum of urbanity, as defined by characteristics of livelihoods, lifestyle, connectivity, and place. Listed are sample phenomena to consider when building a functional model of urbanity. These items inform the addition of detail to the flow model (Figure 16.3) linking livelihood/lifestyle, comprising individual actors and institutional actors, and connections to other systems. These are the proposed specific elements of measuring access to the degree of urbanity.

economies. These contrast with livelihoods associated with natural resource extraction and management, forestry, and agriculture.

In pursuing different livelihoods, individuals influence, and are influenced by, the lifestyle groups with which they associate, the skills they possess, the networks of practice or support where they are embedded, and the mobility involved. Lifestyle is a way of life that expresses and reinforces self and group identity. Lifestyle is strongly tied to socioeconomic status, occupation, consumption patterns, behaviors, worldviews, and a variety of demographic factors. Urban lifestyles, often associated with high levels of consumption (typically nonlocally produced products) and nonagricultural occupations, are one dimension of urbanity.

Connectivity

To characterize the urbanity of a site, including the system it supports and the actors affecting it, the kinds, number, direction, and strength of connections between that system and other systems nearby or at a distance must be evaluated. Connections may include flows of energy, water, food, waste, pollution, financial investment, personal remittances, tourists, migrants, information, knowledge, communication, and construction materials. In addition to the entities moving between sites, the necessary infrastructure is also a component of connectivity.

Connectivity extends linkages from the city region to global scales. Connectivity can set in motion interdependencies and influence between places. The diversity of goods available in urban markets is one manifestation of connectivity. It is important to note that connectivity does not necessarily imply the existence of linear gradients; it can encapsulate sharp changes and reversals in gradients, as well as encompass a significant degree of spatial heterogeneity. Connectivity can decrease and break down due to natural and social disturbances, such as natural disasters and political constraints. These changes in connectivity can affect intensity of urbanity and ultimately urban sustainability, an idea elaborated below.

Place

Place is the biophysical and social particulars of specific areas that give it meaning and distinguish it from other areas. Place incorporates social, built environment, and ecological capacities and constraints. Spaces where urbanity develops reflect social and biophysical-environmental capacities, flows, and constraints at any given time. These set the larger context for the development, maintenance, or decline in urbanity in specific sites or regions.

Actors driving urbanization set in motion trajectories of change, often without adequately taking into account the impacts of such change on social and ecological capacity of the urbanizing places. Change in social and

biophysical-environmental context, as well as the type and degree of connect- edness, can impact the sustainability of urban locations, with the expansion or collapse of one location giving rise to distributed, often unanticipated conse- quences for other locations due to their complex connectivity (Figure 16.3). Thus, such a framework should enable one to identify previously unconsidered “tipping points,” thresholds, and trajectories that have implications for sustain- ability. Below we present three examples of how such a framework can be applied to understand land change in the urban era.

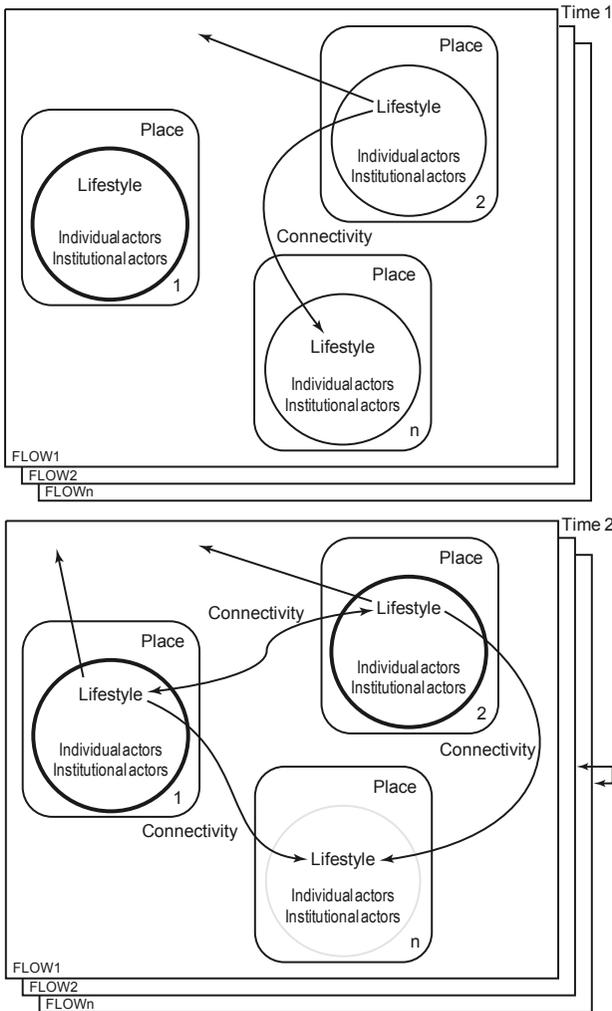


Figure 16.3 Stylized change in urbanity over time. Changes in lifestyle, livelihoods, or connectivity may change degree of urbanity directly or indirectly between places. Thicker dark lines indicate increased urbanity.

British Second Homes in Portugal

Our framework suggests that a high degree of urbanity connects traditional urban places in the United Kingdom with areas in Portugal that were traditionally labeled as rural. The shared urbanity of these seemingly different places is established by teleconnections between them.

Through the media or personal travel, wealthy individuals in the United Kingdom become aware of the pleasures of a sunny, warm place. This creates a desire, reflecting the lifestyle of these people, to have a second home in Portugal. The actors who originate this demand are distant urban dwellers with high incomes and livelihoods capable of satisfying the demand. Through modern communication networks, they contact developers and mediators, who often participate as actors outside the immediate vicinity of either the rural Portuguese or the city-dwelling U.K. residents, to connect buyers and sellers to satisfy the desire to possess a second residence in a sunny place along the Portuguese coastline. In addition, changing livelihoods and lifestyles on the Portuguese coast generate a stock of vacant houses that are associated with the out-migration of young generations, due to dwindling or no interest in rural life and livelihoods (farming). The houses are bought by British urbanites from local actors (farmer families), mediated by the developers, leading to further changes in livelihood along the Portuguese coast, as the lifestyle of the second homeowners requires infrastructure development for health, transport, and leisure. This, in turn, leads to increased consumption of energy, water, and land, higher levels of air pollution and noise, and it affects ecosystems and biodiversity. As the livelihoods of the local population change, unemployment in the agricultural sector rises as a result of land competition. In the service sector, by contrast, new jobs and sources of income are created through the presence and needs of new homeowners. This further impacts and changes the lifestyle of the local population. All in all, the new type of connectivity between the two places and their actors leads to a higher degree of urbanity along the Portuguese coastline and creates “urban patterns” that did not exist there before—patterns which nonetheless differ from a traditional “city” (Bell et al. 2010).

The change in urbanity along the Portuguese coast has causal teleconnections back to the United Kingdom. Flows of investment and people between the new vacation settlements and U.K. residences creates a temporary vacancy of houses in Britain, which opens the door to new influxes of students and tourists, providing income to the second homeowners and impacting livelihoods and lifestyles in British cities. Second homeowners return to Britain with new diets and habits from Portugal, which increase a demand for imported new foods to satisfy a Mediterranean-style diet.

The new patterns of actors at both places and the impacts on livelihoods can be detected and measured using prevailing, traditional spatial conceptualizations. However, to understand more fully the process of land change

in an urban era, the multiple and interacting variables of urbanity are useful. The framework helps tease apart this complex example to show how urbanity extends over great distances based on teleconnections of different actors located far from each other, and following or adjusting their own livelihoods and lifestyles.

Meat Production and Dietary Preferences in Saudi Arabia and Uganda

Let us now consider the connectivity and resulting changes in urbanity between Uganda and the Middle Eastern States of Saudi Arabia, United Arab Emirates, Qatar, and Kuwait. The number of tourists and pilgrims to the Middle East has increased over the years, and this has increase the amount of urbanized land in the Middle East as well as the demand for meat and meat products, reflecting an important part of the lifestyle influenced by culture and religion. Actors are individuals and institutions. Demand for meat in the Middle East has triggered a relational connection to Uganda, one of the many meat-producing countries that provide meat to urbanizing Middle Eastern countries. The primary actors in Uganda are the farmers, particularly those in the cattle zones of Western Uganda as well as northeastern subregions, which produce 40% of the meat products in Uganda (UBOS 2012). Contractual arrangements between Ugandan farmers and Middle Eastern intermediaries have increased meat production in response to meet the quota of meat protein required in the consuming region. In the process of complete transactions and exportation, the production place not only experiences increased income, it is also influenced by Middle East connections. This results in changing Ugandan lifestyles to include greater meat protein consumption, changes in housing, changes in dietary composition, and connections with other parts of the world through mobile communication and television. These changes not only drive the urbanity in the production place but also increase confidence in consumption to expand and urbanize more. This relationship can trigger or enhance other regional relations between the production place and source areas at various scales along different dimensions, among which imports from the Middle East are significant (UBOS 2012). Import data shows increased goods and services flowing from the Middle East to Uganda and is further evidenced by cargo and passenger airliners plying the route.

Rurality within Cities in Bangalore, India

Rapid urbanization in the south Indian city of Bangalore has led to a huge expansion in the city's boundaries, with a more than tenfold increase in area since 1949 (Sudhira et al. 2007). Bangalore is located in a fertile agricultural catchment with a number of villages that have a history extending over several centuries. As the city expanded, it engulfed a number of these small village

settlements within its boundaries, and they now constitute part of the city. Although administratively considered as part of the city, some of these areas are termed slums because of the obvious differences in house construction, livelihoods, and lifestyles (Gopal 2011). Other villages, even though not administratively defined as such, have retained a strong cultural identity through celebrations of iconic festivals, such as annual temple processions that celebrate the worship of local (typically female) village deities (Srinivas 2004).

Conventional urban classification approaches map the spatial boundaries of an entire city, within which statistical information is sometimes collected at the level of administrative subunits. Such a discrete approach runs the risk of homogenizing information across different types of land use and livelihoods within a city like Bangalore. For instance, a recent residential layout called HRBR (Hennur Road Banaswadi Road) in eastern Bangalore contains within its core a remnant of the village that was originally located here: Kacharakannahalli. Software engineers with highly urbanized lifestyles, who gain their livelihoods from the city's famous information technology industry, live here in high-rise apartment complexes adjacent to a small group of families of original inhabitants who rear pigs (Nair 2005). While the city attempts to impose its notion of standardized urban form on the landscape it engulfs, the villages located within the city are instantly recognizable, with features such as a central village square with a peepal (*Ficus religiosa*) tree on a platform that serves as a meeting place for the village (Srinivas 2004; Nair 2005).

As this example of Bangalore demonstrates, there is a need for more continuous approaches of urban representation in many parts of the world. Just as many areas classified as rural are often urban in lifestyle or livelihoods (as in the example of Portugese coastal villages), in many parts of the world, areas that are classified as urban exhibit many forms of rural life, especially in terms of their cultural character and lifestyle, but often even in terms of their livelihoods, rearing of livestock, or practice of other traditional rural occupations such as agriculture. The example provided here of Bangalore has resonance elsewhere, with similar observations of rurality in urban livelihoods being noted in areas as diverse as Kampala (Ishagi et al. 2003) and Mexico City (Losada et al. 1998). Similar to the case of Bangalore, an expansion of the city limits in Mexico City has engulfed a number of peripheral villages, with the result that traditional livelihoods, such as livestock rearing and agriculture, have intersected with Western forms of urbanization, such as pet rearing and hobby gardening. The result is new, hybrid lifestyles and livelihoods that do not fit neatly into discrete rural or urban categories (Losada et al. 1998).

Summary

These examples show how the continuum of urbanity can be applied. We do not claim that the empirical examples were discovered as a result of the new framework we propose. Indeed, components of these narratives have in some

cases been well known for some time. Rather, these examples highlight that what has traditionally been considered to be discrete territories—the rural and the urban—are in fact intimately connected, even over very long distances, and through the decisions of actors who are initially engaged in vastly different lifestyles, livelihoods, and who have different places of primary residence or diverse perceptions of the place where they ultimately come to interact. The examples illustrate the need for and the value of a new framework (Figure 16.2) in which urbanity is not spatially restricted to traditionally recognized cities or dense, older suburbs. These narratives can be considered to be emerging models that call for a conceptual framework to unify and compare their details and similarities. They show that the characterization of the interaction between so-called rural and urban systems in the globalizing world involves more than a collision of lifestyles, contrast in livelihood, divergent senses of place, or even a matter of teleconnection. A complete understanding of the interactions and dynamics of these complex systems requires that all four components of the urbanity framework be exercised. Furthermore, the bidirectionality of influences between the traditionally urban and the traditionally rural is seen in several of the examples. The existence of this framework invites a search for new examples of the urban continuum and the comparison of cases throughout the world under different conditions, defined by the attributes of place.

Sustainable Urbanity Informed by Ethics and Values

The way a system is framed, investigated, analyzed, and interpreted is significantly affected by the values and attitudes of the investigators and stakeholders. We must explicitly recognize the implications of this situation for our proposed framework. Land-related analyses cannot solely reflect physical or spatial units. Rather, it is human activities, networks, and attitudes that give meaning to places. These sources of meaning may not be linked permanently to a specific physical space. Hence, our approach to measures of urbanity uses categories of measurement—related to livelihood, lifestyle, connectivity, and place—that reflect our own normative attitude toward land-use analysis. Measured attributes and resultant patterns—either as patches, networks, or gradients—may be manifest in specifiable locations, and these physical locations are likely to change over time and alter shape and boundaries as various attributes are considered. The ecological content of any place (i.e., the resources, fluxes of materials, energy, and biodiversity) and the action of environmental regulating factors are significant to the well-being of people living there.

The second domain where values must be explicitly integrated is in the analysis of how various inputs affect the system's formulation and its position on a pathway toward what we term "sustainable urbanity." The definition of sustainability and its measurement should be coproduced by stakeholders and investigators (Gibson 2006). As a starting position we believe that pathways

toward sustainability involve indicators that can be conceptualized in three dimensions: increase of human well-being, social equity, and environmental integrity. We explicitly do not use the classic three pillars of sustainability (i.e., economy, environment, and society) because the directionality of sustainability dimensions presented here reflects our ethical standpoints, as well as those of others.¹ In addition, we chose these dimensions because they reflect shared normative goals of sustainability. Rather than using society as a dimension, for example, we chose social equity as a sustainability goal toward which we should strive, rather than just a metric alone (such as a Gini coefficient of income distribution).

Most decisions and processes involved in changing urbanity differentially affect indicators in each of these three dimensions. That is, some actions may enhance overall human well-being (e.g., improved health) but not be fairly distributed, thereby diminishing social equity. Other actions may enhance well-being or equity, but diminish environmental integrity. In an ideal world, every action would enhance all three dimensions of sustainability, but in many situations even the best intended actions will require trade-offs (McShane et al. 2011). The key is that as investigators we observe, measure, and analyze situations in terms that are sensitive to impacts in the various and normative aspects of sustainability.

A fundamental aspect of sustainability is concern for the viability of future generations (WCED 1987). How do we develop or conduct human activities in a way that our activities do not threaten but rather enhance environmental quality, social equity, and the well-being of future generations? The conditions of life for future generations is, to some extent, undetermined. With the exception of the near future, we do not know the extent and speed of technological innovation and social change that will influence future livelihoods and lifestyles, connectivity, places, and our use of natural resources. However, certain aspects of our world today will influence prospects for future generations. Although neoclassical economists argue that manufactured capital can be substituted for natural capital (Ayres et al. 2001), the precautionary principle combined with an ethical imperative in an age when humans dominate the planet requires us to err on the side of caution to ensure environmental quality for future generations (Costanza and Daly 1992; Foster et al. 2000). In addition, our concern for future generations leads us to emphasize the importance of social institutions. We are a social species and even more so now, as the world's population becomes increasingly urban. Our lives are mediated by social institutions; different political, economic, and social scales and qualities shape our livelihoods and lifestyles and influence connectivity and our interactions with the natural and built environments. Institutions are the bridge between present and future generations, and concern for the prospects of future generations requires

¹ For example, the Social, Technological and Environmental Pathways to Sustainability Centre, <http://steps-centre.org>

concern for the quality of institutions. Do current institutions advance opportunities for social equity, environmental quality, and human well-being?

Human livelihoods and lifestyles change across time as well as across societies, and the preservation of specific livelihoods and lifestyles is not necessarily an aspect of sustainability (although negative changes in livelihoods and lifestyles within short periods of time can have deleterious effects on populations). However, current livelihoods provide the social resources for near-future generations. From the standpoint of future generations and their sustainability, what is needed to ensure and enhance opportunities for livelihoods, especially for poor populations? Indicators of importance to gauge the prospects of future generations include educational attainment, investment in physical capital stock, percentage of labor force engaged in knowledge creation, as well as degree of environmental degradation (Llavador et al. 2011). The last three indicators are important because physical capital has a long life and is hence a multigenerational resource, whereas knowledge creation is crucial for innovation that bolsters well-being and environmental protection. In general, our ethical concern for future generations can be measured or monitored in terms of current trends, in particular through the directionality of such trends, or whether actions or institutions actually increase or reduce ecological integrity, social equity, and human well-being.

Visualizing Sustainable Urbanity

The three axis model of sustainability (Figure 16.4) can be used to visualize how the components of urbanity (Figure 16.2) relate to sustainability goals. Livelihood, lifestyle, connectivity, and place can be represented by specific features relevant to particular situations. Measurements or estimates of these four main features of urbanity can be assembled on the three axes. For example, livelihood may identify the kind of productive activity with which households engage and how much, if any, income is derived from that activity. The number of livelihoods and their remunerative capacity can be indexed primarily on the human well-being axis of the sustainability visualization, but will also have impacts measurable on the social justice and environmental integrity axes. Similarly, lifestyle can be represented by the diversity of social groups present and the degree of social cohesion within those groups. Equity of access to political power by groups with different lifestyles and decision-making processes can be used to index the axis of procedural social equity. The third axis of sustainability can be assessed by whether the collection of livelihoods and lifestyles in a specified area is associated with degradation of biodiversity or water quality or whether indicators of ecosystem integrity increase.

Our intention is not to provide a purely objective scheme for mapping characteristics of livelihood, lifestyle, connectivity, and place to the three axes of sustainable urbanity. Rather, we consider the proposed method for visualizing

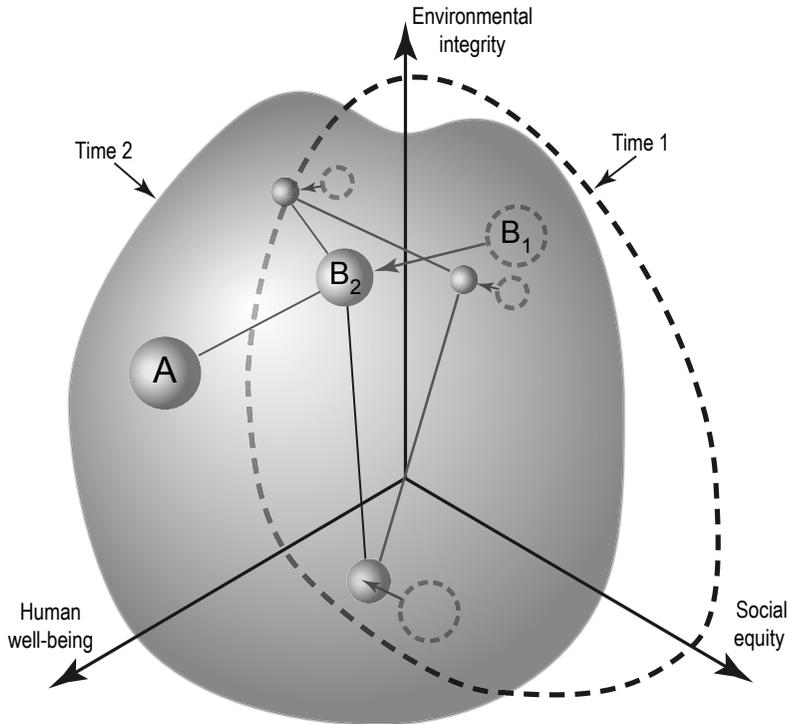


Figure 16.4 Three-dimensional visualization of the sustainability of an urbanity continuum. Each of the small spheres or circles represent a place or set of actors within a system that represents some bounded, connected unit of analysis (e.g., the sustainability outcomes of the consumption patterns of lifestyle groups within a specified region or connected network). This representation also needs to take into account the teleconnected outcomes along the three dimensions. Sphere A represents a new teleconnection, the purchase of land by foreign investors in a small community in Portugal, shown as B_1 (see text). Such a teleconnection can shift the shape of a sustainability bubble from Time 1 to Time 2. The small community in Portugal (B_1) is most greatly affected by the new investment, shifting it to a new space (B_2) that has higher human well-being due to income increases but reduced ecological integrity caused by development and reduced social equity due to increased wealth disparities. Nearby villages (represented by unmarked spheres) shift as well, but with less magnitude than B_1 . Visualizations can change in direction and magnitude either through time or with modifications to the unit of analysis, such as the addition of new nodes and places in the network.

sustainable urbanity to be an approach that is flexible enough to be applicable under a wide range of spatial configurations and thematic settings, allowing the categorization and comparison of different measures and actions under those specific conditions. In addition to flexibility, another aim is to focus on directionalities and visualize trends in the sustainability of an analyzed system.

The challenge is that there are almost limitless ways to measure system characteristics. As in other areas of science, one must prioritize indicator selection

based on hypothesized relevance to the issues and context being addressed. The key is to make the rationale for these priorities explicit and logical, given the underlying assumptions and objectives of the analysis. In a specific application, the selection of criteria representing the different axes of sustainability might be a very small set.

Building the Visualization

Measures of the different dimensions of sustainable urbanity can be composed of a set of weighted measurable and observable components, combined in a flexible manner and normalized. Each entity of analysis can then be translated to a three-dimensional shape located in the sustainability space. The kind of entity analyzed is directly related to the four characteristics of urbanity: livelihood, lifestyle, connectivity, and place. The shape of the entity in sustainability space is constituted by the subcomponents of the entity, which can vary in kind and number. Examples for subcomponents are actors or places. Temporal dynamics of the analyzed entity might result in a reallocation of the subcomponents in the sustainability space, inducing changes in volume, surface area, and form of the shape, representing pathways of the system. Based on the direction of the pathways, they can be characterized with regard to change in their sustainability. The flexibility inherent in the proposed concept allows application to different research questions as well as spatial and cultural settings. Whereas other visualization approaches such as spider diagrams allow an easy translation into one specific number, this approach considers the notion that there is not only one solution to problems; problems require interpretations within a variety of spatial and cultural contexts.

Visualization needs to focus on specific analyses and often on subcomponents of analyses. These visualizations would be most effective to represent comparisons such as between cities at a specific time point, differences within a city at a specific time point, or changes in a city or place over a time period. The three-dimensional diagrams and associated three-dimensional shapes (bubbles, spheres) are holistic representations which could be complemented with spider diagrams reflecting single points or units. Different viewers will favor different shapes as optimal pathways toward sustainability. For example, some will favor changes in overall well-being over the other two, whereas others may be most concerned about ecological integrity, and so forth. The figure may also take one of several characteristic shapes which may, in fact, reflect signatures of differing types of change.

The shapes traced out by the indices of sustainability in three-dimensional space in Figure 16.4 make it possible to compare how different degrees of urbanity affect pathways toward sustainability. For example, within an urban area, different neighborhoods or patches, identified by their joint biotic and built structure and the character of their connectivity, will have an

index-derived shape in the visualization. This visualization could be used to assess the potential for each neighborhood or patch to contribute to citywide sustainability. Similarly, different urban areas may have contrasting volumes in the visualization. This allows the sustainability potential of different cities, or even of different metropolitan areas in a regional conurbation, to be compared.

Finally, the visualization can help make comparisons through time. This strategy can be applied to historical data or future projections. The three-dimensional visualization can also portray the pathways of how current degrees of sustainability have emerged. Proposed changes based on municipal or larger-scale sustainability plans can be evaluated for their impact on the sustainability bubble. Whether proposed policies, human interventions, or natural disturbances make an area of interest more or less sustainable can be understood using sustainability bubbles representing before and after conditions. The ability of the proposed visualization to change behavior and decision making toward our stated normative goals constitutes another important research question. Ultimately, this may lead to what we term a “new land ethic” for an urban era, to which we now turn.

A New Land Ethic in an Urban Era

Known for his contributions to the development of environmental ethics, the work of Aldo Leopold focused on conservation and the natural amenities of land. His concept of the “land ethic” (Leopold 1949) focused on humans as stewards of the land but not on the human experience, or on how land shapes the interactions among people as well as between humans and land. Leopold’s land ethic, though broad, does not account for the experience and geographic context of a large and growing percentage of the population that is part of the urbanity continuum.

Thus, there is a need for a new land ethic: not an *urban* land ethic, but a land ethic that encompasses urbanity. A new land ethic for the urban era requires broadening the focus from the land to include two interactions: the interaction between people and places, and the interaction between people with each other. In other words, a new land ethic moves the focus from the role of humans in stewardship of the land (for the sake of the land) to stewardship of the land to enrich the human experience, by improving human well-being, social equity, and the ecological integrity on which all life depends. Under this new ethic, land is no longer conceived as a passive landscape within which the human experience occurs. This new land ethic recognizes that landscapes and the configuration of landscapes—including the built environment and natural landscapes—are fundamental for shaping the human experience. Human development challenges take place on landscapes and in places, and thus we must recognize the role that land plays in enabling, fostering, or constraining human development.

Pathways to Sustainable Urbanity

A reconceptualization of land based on the idea of an urbanity continuum can serve as a useful analytical framework. It has the potential to acknowledge and redefine the extent, intensity, and quality of urban-ness on the surface of the earth, a useful starting point when addressing sustainability challenges related to urban lifestyles, livelihoods, connectivity, and places (e.g., dietary changes, energy consumption, and resource demands). We have argued that an understanding of the elements of urbanity can also be tied to normative sustainability goals and perhaps a new land ethic that works to improve human well-being, ecological integrity, and social equity for all people and places. A formidable challenge that remains will be to develop or to use in new ways the institutions that could facilitate such a sustainability transition. How, for instance, do we plan for a sustainable urbanity continuum that transcends jurisdictions, cultures, or value systems? On the other hand, could the concept of the urbanity continuum circumvent or overcome entrenched institutional obstacles to sustainability? Since the idea of urbanity does not constrain human activity to static and discrete administrative boundaries, it may lead to a more distributed notion of stewardship rather than concentrating solely on local concerns. Teleconnections, embedded in the idea of urbanity, link local with distal actors and places. In doing so, they urge us to think about the stewardship of interconnected people and land. At the very least, the urbanity continuum conceptualization should enable novel pathways to sustainability.