

Ecological wisdom in the new urban era

The 21st century is increasingly referred to as the urban era. By 2050, two thirds of humanity will squeeze into congested urban environments. More than 90% of this urban growth will come from Asia and Africa, with three countries – India, China and Nigeria – accounting for 37% of the increase (United Nations, World Urbanization Prospects: The 2014 Revision. United Nations Department of Economic and Social Affairs, New York, 2014). By 2050, estimations indicate that India will add as many as 404 million people to its burgeoning cities and towns. Of the world's ten largest cities, three are located in India – Delhi, Mumbai and Kolkata. Three of the world's ten fastest growing cities are in India as well – Ghaziabad, Surat and Faridabad.

This unprecedented urban growth has brought with it a host of environmental challenges. Within cities, air pollution has emerged as one of the leading causes of death. Flooding is a common sight in Indian cities during monsoons, recently reaching alarming levels in Bengaluru, Chennai, Gurgaon and Mumbai. In what is one of the most obvious, yet ignored signs of urban dysfunctionality, the same cities that flood in the monsoon are subject to drought in the summer. Water supply comes at a huge energy cost: most cities pump their water from distant reservoirs often across an elevation gradient, and from deep borewells in the ground. As cities import water, food and energy from distant sources, and send their waste to landfills outside, they impact distant rural environments.

Climate change combines with the environmental problems posed by rapid urbanization, to create wicked challenges for India that will be difficult to address in the coming decades. We are already seeing early warning signs, making coastal cities vulnerable to flooding, and extreme events such as hurricanes wreak havoc on coastal cities (e.g. with Hud-Hud in Visakhapatnam). Unpredictable rainfall is leading to the growing phenomenon of 'climate refugees' from dry parts of India streaming into cities across the country. Many Indian cities face increasingly severe conditions of water stress. Earlier this year, South Asia experienced an unprecedented heat wave, exacerbated by the late monsoon, concreted heat islands, desiccation of urban water bodies, and rampant felling of trees.

Nature plays a vital, yet underappreciated role in cities, helping to buffer residents from the worst effects of environmental degradation (Nagendra, H., *Nature in the City:*

Bengaluru in the Past, Present, and Future, Oxford University Press, New Delhi, 2016). Urban ecosystems provide vital environmental services – wetlands clean up pollution and recharge depleted groundwater, and trees play a major role in reducing air pollution. Ecosystems also provide physical resources including fruits, grazing material, medicinal plants and fuelwood, that form extremely critical sources of subsistence and livelihood for the most marginalized of urban residents. They fulfill important psychological needs of stress relief. And, importantly, urban ecosystems act as social nodes where people congregate, helping to reduce the fragmentation of social life in cities, and to create cohesive communities with strong social bonds that foster a sense of urban wellbeing.

In general, ecologists have tended to ignore cities, focusing most of their attention on areas where the human presence is less dominant. Urban scholars have also paid scant attention to the role of nature, focusing instead on issues such as finance, infrastructure and poverty. Yet, cities cannot run well, without attention to ecology. And global biodiversity cannot survive, if we ignore the impact of cities on the rest of the world. For instance, the amount of urban land located close to (within 50 km of) protected areas has increased substantially with the growth of cities.

It is surprising that urban policies pay scant attention to urban ecosystems and environments, apart from superficial discussions of the need to clean rivers, provide universal sanitation, or plant trees. Even if the political will and policy attention was sufficient, which it is not at present, our knowledge is insufficient. For instance, we know little about the kinds of plant traits that are important for selection of species for appropriate plantation in cities, where multi-functionality is required to combat various environmental challenges. Urban hydrology is another area where we need to develop new knowledge, as urban water bodies move from being seasonal, rain-fed and spatio-temporally variable to perennial, sewage-fed, and geographically surveyed and fixed. These are just a couple of examples. Indeed, urban ecological research has largely focused on cities in north America and Europe, and all cities in the global south represent knowledge gaps: India is no exception.

What directions must such research take? Urban systems are complex, dynamic and multi-scalar in nature.

Research by a small, but growing community of urban ecologists across the world demonstrates the importance of some essential aspects that urban ecology and environmental research consequently demands.

The first of these is multidisciplinary. Cities are complex entities where infrastructure and technology collide with history and path dependence; idealized cutting edge policies face the reality of implementation in socio-cultural settings that are often resistant to change. Urban environmental research requires collaboration between ecologists and colleagues trained in other disciplines – such as political scientists, environmental scientists, chemists, hydrologists, historians and sociologists – to provide a comprehensive understanding of the multifaceted issues that interface with and determine urban environments.

The second is the need for interdisciplinarity. Cities are complex social-ecological systems, where the boundaries between humans, nature and built systems are often difficult to recognize. For instance, studying changes in hydrology in a city requires understanding how the topography of urban landscapes has been transformed over time by building and excavation; how water flows have been altered due to changes in rainfall and the contribution of sewage to urban hydrology; and assessing how the expansion of invasive species and the disappearance of native plants and fish alter the capacity of urban water systems for self-cleaning and renewal. Similarly, research on recurring epidemics, such as dengue in cities, requires knowledge of issues such as waste disposal, mosquito life cycles, urban livestock, human behavioural patterns of exposure, nutritional inequities, rain water harvesting and storage mechanisms, housing patterns, and the distribution of green spaces and wetlands, to develop long-term strategies for management and control.

Multidisciplinary is a necessary condition for interdisciplinarity in urban studies. Multidisciplinary research can be conducted by carving up different pieces of a research investigation and handing them over to specific groups, to be later reassembled into a set of findings. Interdisciplinary research requires close collaboration between groups of scientists from different backgrounds, to develop combined approaches and frameworks for analyses and interpretation. Unfortunately, funding for research of interdisciplinary research is limited, although in recent years, some international funding agencies such as Future Earth via the Belmont Forum have opened calls for interdisciplinary urban research. In India, where collaborations between the social and natural sciences tend to be limited, the clear division of scope of interest of different funding agencies makes it challenging to find financial support for interdisciplinary urban research, at the scale that is required.

The third aspect is perhaps the most challenging – the need for transdisciplinary research. Understanding the basic ecological principles within which cities and urban systems function is of course a matter of deep scientific

interest. But this is also an important applied area, where the need for application is clear, and the opportunities for adaptive intervention and learning are numerous and exciting. This requires collaboration among city planners, community associations, activist groups, civil society, and other groups undertaking interventions, scholars and researchers applying knowledge to action, and poets, writers, artists and other creative people working to motivate action and to increase the sphere of influence.

A good example of a virtual platform, sharing knowledge across the world, is ‘The Nature of Cities’ – www.thenatureofcities.com – an international community of over 500 practitioners, scientists, artists, engineers, ecologists, social scientists, architects, designers, landscape architects, planners, activists, urbanists, entrepreneurs, government officials, who come together to share ideas about ecologically sustainable cities, in virtual round tables, blogs and photo-exhibitions. Another example is that of lake restoration in Bengaluru, where local community groups have worked with the city corporation, engineers, architects, hydrologists, naturalists and ecologists to develop new transdisciplinary knowledge about the science and practice of lake restoration in the urban contexts. The challenge is of sustainability and scaling up. Transdisciplinary initiatives thrive on trust and the development of a common language between very disparate communities. This requires sustained, long-term investment of time, energy and funding, which is difficult to come by.

The new urban era is also the era of climate change. Cities will play an important role in influencing the adaptation and resilience of India in the future decades. Nature may provide one of the most adaptive, socially inclusive and ecologically smart ways to survival in decades to come – but only if we pay sufficient attention. Developing the country’s research ability to tackle our growing urban environmental and ecological challenges will be critical, not only to make our existing cities more healthy and livable, but also to find alternate models for development. This is a mammoth task, and will require large multidisciplinary teams of researchers, collaborating on interdisciplinary projects and conducting transdisciplinary interventions in collaboration with society. Research needs to be scaled up to the level where it can begin to make a much needed difference to the current ‘business-as-usual’ model of urban growth, that is willfully oblivious to the need for ecological wisdom.

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