Net-positive Design and Development

JANIS BIRKELAND

The burgeoning interest in urban green-grey infrastructure is bringing together many disciplines, ranging from urban ecology to sociology. This convergence of views promises to direct attention toward basic sustainability issues that have fallen between professional boundaries. In the past, the built-environment design fields (urban, building and landscape design) tended to regard the others as black boxes. Despite collaborative practices, professional territories contributed to 'closed-system thinking'. For example, sometimes architects do not think outside the building envelope, landscape architects do not think outside property lines and planners do not think outside urban borders. Consequently, some green-building rating tools count indoor air quality as an 'ecological gain'. Yet an ecological gain, when the human population and consumption are growing, must increase space for nature, ecosystems and biodiversity habitats. One illustration of gaps that occur due to conceptual boundaries is where landscaping fails to offset the impacts of the structures that support it.

Designers of buildings, public spaces and infrastructure projects increasingly use green roofs or walls to help purify the air and provide other environmental amenities (Velazquez, 2008). While greenery may compensate for some ground area covered by the construction, building surfaces do not provide adequate vegetation to treat a building's harmful emissions (such as volatile organic compounds, solvents and adhesives), let alone cleanse the polluted outside air that infiltrates the building. Often industrial air-conditioning systems in green buildings expel more heat and dirty air than the on-site landscaping can internalise. In dense urban centres, little landscaping occurs other than street trees and barren public plazas. These elements cannot absorb all the pollution from transport infrastructure, let alone produce enough oxygen for inhabitants, which requires several trees per person (Villazon, 2015).[1] Therefore, urban landscaping seldom compensates for carbon emissions, pollution or 'ecological waste' – that is, the cumulative ecological damage caused during resource extraction, construction and ecosystem restoration time (Birkeland, 2007).

Consequently, urban vegetation, at each scale, falls short in oxygen production, carbon sequestration, pollution absorption and other environmental functions. Buildings draw down from the urban environment, and cities draw down from their bioregions. Positive Development (PD) aims to reverse this linear, negative relationship between humans and nature by, in part, increasing total space for the 'public estate' and 'ecological base' (Birkeland, 2008). PD theory reconceives cities as landscapes that support their bioregions like reefs support their oceans. This concept goes beyond the early definitions of sustainability, as well as subsequent

Janis Birkeland is Honorary Professorial Fellow and Associate of the Thrive Research Centre, Faculty of Architecture, Building and Planning, University of Melbourne, Victoria 3010, Australia.
Email: Janis.lynn.birkeland@gmail.com

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REPORT

watered-down versions. Sustainability initially meant achieving inter- and intra-generational equity and ecological preservation. Since then, over 50 per cent of biodiversity has been sacrificed and disparities of wealth have skyrocketed (World Wide Fund for Nature, 2014). The original ecological base can no longer meet the demands of a growing population. Therefore, ecological regeneration is not enough. A development that reduces natural or social support systems more than 'no development' closes off future options and survival prospects.

Despite inspired euphemisms like 'human–nature partnership' and 'co-evolution', nature simply cannot evolve fast enough. Therefore, humans must evolve intellectually. New forms of conceptual, physical and institutional structures must be designed to increase ecological carrying capacity and universal life quality (Birkeland, 2003). Thus far, sustainable design has aimed only to leave the environment 'better than before construction' and/or to restore landscapes to a pre-construction state (Hes and du Plessis, 2014). This focus merely reduces *relative* resource and energy flows by improving on typical buildings, site conditions and construction practices. To be sustainable, development must instead reverse the global rates of degradation and inequity (Birkeland, 2005) by increasing the 'natural' environment beyond pre-human conditions and providing more urban public space. PD is development that gives back 'more than it takes' from society and nature, ideally at each scale (Birkeland, 2008). This means that the 'positive ecological footprint of nature' must exceed humanity's negative footprint. With a new, different building and landscape design paradigm, net-positive outcomes are possible.

Almost any building cluster or urban block could be retrofitted to be eco-positive, assuming whole-system accounting that deducts perverse subsidies and externalities. By combining passive and renewable energy systems, multifunctional design, integrated ecosystem services and net-positive offsetting, a development could potentially overcompensate for unavoidable impacts and address social issues in the surrounding area. For instance, substantial building-integrated, vertical space for permanent vegetation can sequester more carbon than emitted during construction and operation, without additional floor area or 'extra' costs (Renger et al, 2015). Similarly, building-integrated 'eco-services', which include both intrinsic and instrumental values of nature, can provide select combinations of two-dozen natural systems that support building, environmental and ecosystem functions (Birkeland, 2009c). External landscaping can create micro-ecosystems and biodiversity incubators that support or re-seed their particular bioregions. Transport infrastructure combined with nature corridors could assist their bioregions, such as with roads covered with 'green scaffolding' for algae-based biofuel production, solar cells, air purification, biodiversity bridges and habitats (Pearson et al 2014).

Outmoded institutional frameworks still shape or affect design in subconscious ways. Codes that set minimum or maximum thresholds effectively authorise or legitimise negative impacts up to an 'acceptable' level of harm. Green-building rating tools reward specific negative impacts if those impacts are merely less harmful than current industry norms or 'best practice'. Even biodiversity offsetting often requires compensation only for additional negative ecological impacts (Birkeland and Knight-Lenihan, 2016). When most green buildings are

still based on the old industrial template, more design guidelines, criteria and indicators have no transformative effect. While sustainable design has always aimed to regenerate the environment, community and economy (Lyle, 1994; Van de Ryn and Cowan, 1996; Wann, 1996), it has not entirely escaped the philosophical and institutional legacy of the industrial era: 'Do no harm'. For example, some projects claim to increase urban resilience and adaptability but are not designed to facilitate retrofitting to meet higher standards over time. To enable a fundamental paradigm shift, therefore, PD sets different design standards for physical and institutional structures.

The *ecological* standard in PD is a net increase in space allocated to ecosystems, nature corridors and biodiversity incubators, on both a spatial (floor area) and a temporal (life cycle) basis. Achieving this standard requires design *for* nature, as well as *with* nature (for example, permaculture) or *like* nature (for example, biomimicry) through, among other measures, 'design for eco-services' (Birkeland 2004, 2009a, 2009b). Working with nature is necessary, but it is no longer sufficient. For example, ecosystem services are typically employed only where economic benefits can be shown, such as worker productivity, human comfort and health. Eco-positive rules and standards in regulations and assessment processes might only require the addition of the adjective 'net-positive' – assuming adequate instructions are adopted to demonstrate how to meet the new criteria and measure performance. However, while the term has been frequently adopted, it is being redefined to just mean 'improvement', *not* a net increase in the ecological base beyond industrial or pre-human times.

The *social* sustainability standard in PD is a reduction in regional social inequities and an increase in universal, direct access to the means of survival, health and wellbeing, called the 'public estate'. Social sustainability requires democracy and civic engagement, which, in turn, require urban infrastructure that guarantees resource security, safety and equity. Engineering and economic efficiencies do not always ensure the distribution of essential services.[2] So-called 'sustainable' development often concentrates wealth, reduces cultural diversity and heritage, and increases disparities of equity and opportunity. 'Urban acupuncture' (targeted improvements in disadvantaged areas), such as new community centres or playgrounds, can revitalise communities. However, this does not ensure *universal* access to social-support systems, basic needs such as shelter, food, energy, clean air and water, or safe havens in civil or environmental emergencies. *Direct* access means access uninterrupted by market, electronic, transport or other central delivery systems that can make people politically or economically vulnerable.

Different planning and design methods are necessary if built environments are to become the catalyst for positive social and ecological transformation (Walker and Giard, 2014). It is necessary to rethink green-grey infrastructure from first principles. To that end, my forthcoming book *Net-positive Design and Development* (Birkeland, undergoing peer review) proposes changes to physical and institutional infrastructure. Whereas *Positive Development* (Birkeland, 2008) was a discussion between a paradigm and a sceptic, *Net-positive Design and Development* spells out the theoretical bases and specific methods to implement the reforms. PD builds on fundamental shifts from closed- to

open-system frameworks (mindsets, models, methods and metrics) that increase the natural and social life-support systems and expand future options (Birkeland, 2012). Whereas closed-system models internalise negative impacts, open-system models transcend system boundaries and externalise positive impacts. Whereas decision methods compare and choose among known alternatives, design-based methods create synergistic systems that multiply benefits and options. Whereas measurement tools quantify inputs and outputs, whole-system metrics include both net-positive impacts and cumulative, remote negative impacts.

A new constitution for urban decision-making and design is needed to address fundamental sustainability issues. To that end, the new book reviews PD theory and principles, net-positive criteria and exemplars; ways that design can achieve net-positive social and ecological outcomes (not simply off-site benefits), often with a financial payback; and elaborates on two-dozen new forensic analyses for identifying and addressing deficits in regional ecological and social conditions (Byrne et al, 2014). Then the book will apply an ethics-based prism to a critique of current frameworks of development control or consent processes, guidelines and assessment methods; and propose frameworks, principles and processes for reforming urban environmental governance, with specific means to incentivise, implement and assess net-positive design. These include participatory design processes for making regional ecological and social improvements, and a unique assessment tool for measuring net-positive outcomes.

In conclusion, sustainability is a system design problem, and only by design can sustainable institutional and physical systems be created.

NOTES

1 Estimates of net oxygen production of different trees vary, but over seven trees per person may be necessary (Villazon, 2015).

2 One per cent of the world population has the combined wealth of 99 per cent of the rest, and the world's eight richest men have the same total wealth as the poorest half of the world population (Elliott, 2017).

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