URBAN ECOLOGIES AT THE EDGE: A CASE STUDY

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ABSTRACT

This paper discusses some central theoretical and methodological constructs in the field of urban ecologies, identifies research gaps in the field, and uses the Victoria Laboratory of Urban Ecologies (VALUE) as a case study illustrating possible directions of future urban ecologies research. It begins by tracing the theoretical roots of urban ecologies before reviewing contemporary urban ecologies studies throughout the world. Two critical gaps in urban ecologies research are identified, suggesting opportunities for future studies. The paper then introduces the research teams and projects of VALUE – a research centre hosted by the School of Architecture and Building at Deakin University. The paper concludes that the research activities in VALUE are at the edge of urban ecologies research due to the interdisciplinary nature of collaboration in and between project teams, which have thus been able to address gaps in urban ecologies research and make important contributions to the field.

BACKGROUD

Theory of Urban Ecologies

Urban ecologies research can be defined as the investigation of living organisms in relation to their environments in towns and cities. Using the ecological approach, as Sukopp has explained it, a city is considered as an ecosystem, "characterized by its history, its structure and function, including both biotic and abiotic components, and the cycling and conversion of energy and materials. Cities also have their own spatial organisation and distinctive patterns of change through time, which result in patterns of species' behaviours, population's dynamics and the formation of communities" (2002, p. 79).

Early studies of urban ecologies were in the tradition of natural history and focused on single biotopes. The investigations often centred on the documentation of flora and fauna, as well as plants and animal migrations directed by human beings (Sukopp, 2002; Pickett et al, 2001). For example, Johnson provided a list of recorded species of a particular area in London in the early 1600s, and the flora of Paris was repeatedly studied in the 17th and 18th century (Sukopp, 2002). Growing from this root, the study of the ecological structure and function of habitats or organisms within cities is still the most common approach used in urban ecological studies. Scholars of urban ecologies have agreed to label this approach as *ecology in cities* (Pickett et al, 2001).

Contrasting to the ecologies in cities approach, an alternative approach to urban ecologies exists in landscape architecture and planning: *ecology of cities*. Using an ecology of cities approach, entire cities are examined from an ecological perspective (Pickett, 2001), so that

research at the scale of whole cities and urbanised areas can be addressed. Research questions have included the assessments of the flux of nutrients, water, energy and organisms throughout entire cities and towns, or the effects of land-use change over time on the distribution and abundance of organisms within a city. As research questions at the scale of whole cities and urbanised areas require multidisciplinary teams and a large amount of resources, relatively little progress has been made in this area. However, there is now growing interest in the ecology of cities approach to develop programs for ecologically sustainable development (ESD) in cities (McDonnell, Hahs, & Brueste, 2009). An example of ecology of cities in ESD is the introduction of the concept of the "ecological footprint." The ecological footprint of an urban area indexes the area required to produce the resources used, and to assimilate the wastes produced, by a defined population at a specified material standard of living. For example, the population of Vancouver, Canada, appropriates the productive output of a land area nearly 174 times larger than its political area to supports its present consumer lifestyle (Rees, 1996).

Contemporary Urban Ecology Studies and Research Gaps

Contemporary research in urban ecologies has come to an agreement that cities are hybrid phenomena that emerge from the interactions between human and bio-geo-physical processes and thus cannot be fully understood by studying their component parts separately (Alberti, 2008; Pickett et al, 2001). Because human and ecological factors work simultaneously at various levels, neither the natural nor the social sciences can explain in their separate domains how integrated human and ecological systems emerge and evolve. Therefore, it is necessary to integrate natural and social sciences into one framework to understand urban ecosystems as coupled human and ecological systems (Albert et al., 2003).

Yet, much urban ecologies research has failed to consider the socioeconomic components of urban systems. For example, research at the Australian Research Centre for Urban Ecology (ARCUE) focuses only on natural systems. Furthermore, it could also be argued that research at the Urban Ecology Research Laboratory (EURL) at the University of Washington, although recognising urban ecosystems as coupled human and natural systems, has made little attempt to investigate the human system in cities. Empirical studies conducted by EURL have monitored landscape patterns associated with urban growth, linked urbanization and vegetation carbon patterns, assessed the impacts of urbanization on near-shore and urban water, and modelled land cover change and casting scenarios for regional growth. The expertise of the research team covers urban design and planning, geographic information science, forest resources, computer science, etc. ("The Urban Ecology Research Laboratory", 2011). While the Baltimore Ecosystem Study (BES) has developed a human ecosystem framework (Machlis, Force & Burch, 1997), and thus has conducted analyses of both the natural and social systems of Baltimore city, the framework needs to be tested and revised before it can be generalised in other contexts.

Modelling Coupled Social-Ecological Systems

Important progress has been made in modelling dynamic ecological systems. For example, Wu and David (2002) have presented a spatially explicit hierarchical modelling approach to studying complex ecological systems, as well as a software platform designed to facilitate the development of models. In order to optimise model complexity and reduce uncertainty, Grimm and colleagues proposed pattern-orientated modelling that systematically uses multiple patterns observed in real systems at different hierarchical levels and scales (Grimm, Revilla, Berger, Jeltsch, Mooij, Railsback, Thulke, Weiner, Wiegand & DeAngelis, 2005).

However, there remains a gap in the knowledge. As Alberti (2008) points out, no one has formally tested hypotheses about the interacting emergent behaviours of the holistic urban ecosystems. Therefore, it is necessary to develop the modelling of ecosystems that effectively incorporate human activity and behaviours. Models that explain how people affect the composition of habitat patches and their patterns will have to integrate historical, political, cultural and economic factors with traditional variables such as competition, predation and nutrient availability, which also control the distribution, abundance and relations of organisms (Collings et al., 2000). As we shall briefly discuss now, research into ecologically sustainable development recognises that models such as these can only be developed by interdisciplinary teams that cross the boundaries between the natural and social sciences.

Urban Ecologies and Sustainability: Multidisciplinary and Interdisciplinary Research at the Edge

In their book *Rethinking Science*, Nowotny et al. suggest that modern research communities are experiencing a transgression of discipline boundaries that echoes the changes that occurred in the scientific revolution of the seventeenth century and the industrial revolution of the nineteenth century (Nowotny *et al.* 2001). Thus, as Thompson Klein suggests (Klein 1996), two claims about knowledge are widely made today:

- knowledge is increasingly inter-disciplinary;
- the crossing of discipline boundaries has now become a defining characteristic of knowledge production.

Contemporary research in the built environment disciplines is not immune from these changes. This is particularly so with research into sustainable built environments, which is a topic, as Copper describes it, "that respects no spatial, temporal or discipline boundaries" (2002, p. 126). This is because, as Bentivegna et al. suggest (2002), success or failure in any development situation is dependent on integration across the various urban decision-making and professional disciplines to link socio-economic and technical dimensions as well as planning, property, design and construction. As Uiterkamp and Vlek have pointed out (2007), since the late 1980s sustainability research has been a focus of both the natural environmental sciences (physics, chemistry, and biology) and a wide range of environmental sub-disciplines in psychology, sociology, economics, law, and philosophy. Thus, they argue, the quest for sustainability has increased the need for multidisciplinary research. As Robinson reiterates (2004, p. 378),

> *"What is needed is a form of transdisciplinary thinking that focuses on the connections among fields as much as on the contents of those fields; that involves the development of new concepts, methods and tools that are integrative and synthetic, not disciplinary and analytic; and that actively creates synergy, not just summation."*

Elkington's (1998) notion of 'the triple bottom line' suggests that equal weight should be given to the social, economic and environmental components of sustainable development. Giddings et al. argue that the division of sustainable development into these three separate sectors has been shaped by the alienation of much of human life from the environment, as well as the separation between production and consumption (Giddings *et al.* 2002). They suggest this does not produce an integrated or principle based outlook (p. 195):

> *"we cannot pretend to separate the impacts of our actions into distinct compartments. There is a need to overcome the barriers between disciplines to an interdisciplinary or even trans-disciplinary view of the world. Sustainable development, to have long-term meaning, will be an integrated and principle based outlook on human life and the world we live in."*

Thus, as Deakin et al. discuss (2002, p. 104), 'post-Brundtland' it has been recognized "most forcefully" that a 'trans-disciplinary' approach is key to a fully integrated assessment of sustainable urban design (Deakin *et al.* 2002). Boulanger et al. also suggests that an analysis of the most challenging sustainability issues reveals that an interdisciplinary approach is central to sustainable development decision-making (Boulanger and Bréchet 2005). Copper presents a wheel of ten cognate disciplines involved in research on sustainable cities; these are Architecture, Planning, Law, Economics, Sociology, Psychology, Medicine, Ecology, Materials Science and Engineering. Although Cooper suggests that the closer disciplines are, "the more likely they are to share a common parentage and so the more open their boundaries are likely to be to each other." Thus, in the international project on sustainable urban development that Cooper reports on, the three disciplines most represented fall within an arc formed by engineering, architecture and planning. In the case study we shall consider now – the Victoria Laboratory of Urban Ecologies – we shall also see an interdisciplinary approach that also has a focus on sustainable urban development.

VICTORIA LABORATORY OF URBAN ECOLOGIES: A CASE STUDY

The former part of this paper has reviewed the area of urban ecologies and identified two critical gaps in urban ecologies research - . The latter part of this paper will use the Victoria Laboratory of Urban Ecologies (VALUE) as a case study. The School of Architecture and Building at Deakin University created the Victoria Laboratory of Urban Ecologies (VALUE) in 2010. This initiative has the objective of integrating scientific knowledge within the School and the University. In addition, VALUE aims to bridge science, society and policy, by establishing channels of partnership between the research centre and other key groups, organizations and institutions in the region (Leao, 2010).

Four Research Teams

The expertise of the 25 researchers in VALUE covers a wide range of specialties, with teams formed around four themes: Urban and Regional Ecology, Cultural Ecology, Construction Ecology, and Architectural Sustainability. VALUE is thus designed to, and indeed it might be argued, informed by the need for significant integration for new knowledge production towards sustainable development in the built environment. As we shall see now, the knowledge production within and between these teams is fundamentally trans-disciplinary in nature.

The Urban/Regional Ecologies research team has research expertise in geographic information science; stakeholder management; and design encouraging environmental awareness in children. The current research projects conducted by the team include Bellarine Peninsula, Vision 2, Peoplemap, and Regional Growth and Climate Change. The aims of these projects are to integrate natural and social sciences in the study of the ecosystem of Geelong Region, and develop models for the coupled human-natural system.

The Cultural Ecologies research team is interested in the study of social and cultural issues related to the built environment. The research expertise of the team covers migration and architecture, war and destruction/construction, low energy and solar energy systems, architectural history, culture and architecture, sustainable urban growth, and architectural education. The current projects conducted by the team include sustainability in coastal housing development and the production of migrant architecture.

The Construction Ecologies research team seeks to investigate the dynamic interdependent structure and behaviour of resource systems that support the built environment life cycle supply chains. The research expertise of the team covers construction management, risk management, concrete noise barriers, lightweight structures, and building information modelling. The current projects of the team include sustainable infrastructure construction and construction supply chain teams and waste.

The Architectural Sustainability research team investigates the environmental performance of buildings and urbanised areas. The expertise of the team covers glass architecture, natural ventilation in buildings, urban heat islands, urban design, and building performance measurement. The current projects of the team include an analysis of the environmental performance of sport facilities, environmental performance of health facilities and contextual influences on comfort and energy performance in offices.

Collaboration in VALUE transcends discipline boundaries via two mechanisms of collaboration: 'Multidisciplinary' and "Inter-disciplinary'. Via these two mechanisms, a number of projects are being pursued; some of which have a discipline specific focus and some of which transcend disciplines, but most of which have sustainable development as a prime or subsidiary focus.

Multidisciplinary Collaboration in VALUE

Multidisciplinary collaboration occurs when the four discipline teams work in series and in parallel without stepping outside of their discipline boundaries. For example, Peoplemap project is a recently finished study by the Urban and Regional Ecologies team. It used multidisciplinary approaches to elicit and broadcast community voices. The process is based on a *vox populi* format in that a trained interviewer randomly invites people from the street to answer prepared questions. There were 166 people from Geelong Region who participated in the interviews. The interview data was analysed using the technique of thematic analysis, and the results were presented using a geographic information system. The project demonstrates the multidisciplinary collaboration of social science methodology in combination with geographic information science (Xu & Elkadi, 2011).

The Sustainability of Housing Development project is a recently completed project by the Cultural Ecology team. It aimed to develop a multi-criteria approach to evaluate the sustainability of housing development. The research combined qualitative and quantitative methods, using a geographic information system as a platform. Three housing precincts in Geelong region were chosen as the sites, and five criteria have been identified: Greenhouse gas emissions, resource use, housing equity and diversity, character, and community connectivity.

Interdisciplinary Collaboration in VALUE

'Interdisciplinary' collaboration occurs when the four discipline teams work together through the development of shared perspectives to construct common theoretical positions, conceptual frameworks, or methodological approaches. This happens via, firstly, peer review, in which teams assess research across the themes, or secondly, via short-life inter-disciplinary teams working to produce new knowledge by collaborating in dynamic research in which discipline boundaries become permeable and are therefore transcended. For example, a recent ARC-funded Linkage project has been developed by members from three teams: urban/regional ecology, cultural ecology, and architectural sustainability. The project is titled: *'Sea change' communities: Inter-generational perception and sense of place*. The research is proposed to quantify factors that determine the 'character' of two historic Victorian coastal towns that have been affected significantly over recent decades by the sea change phenomenon. It will evaluate the effectiveness of local planning scheme provisions to preserve character, and will explore the impact of the measured changes with generational- and gender-specific focus groups to determine the differences in their perceptions and responses to the changes.

Another example of interdisciplinary collaboration is the development of a recently commenced project known as Vision II. Vision II has been developed by members from the urban/regional ecologies, cultural ecologies, and construction ecologies teams. It is a 12-months project that considers the reinvigoration and re-imagining of the city centre of Geelong by engaging stakeholders from public and private sectors with the aid of computer modelling. Five steps are involved in the project: (1) to identify key stakeholders and key issues regarding Central Geelong reinvigoration; (2) To model the current situation of Central Geelong by using GIS & 3D modelling; (3) To develop alternative scenarios for Central Geelong reinvigoration; (4) To assess the alternative scenarios by using GIS & 3D modelling and from the key stakeholders' perspective; and (5) To propose an optimal scenario for Central Geelong reinvigoration (Yang & Elkadi, 2011). The project is jointly supported by the Victorian Government, Deakin University, the City of Greater Geelong and the Committee for Geelong; and the Victorian Government has approved $150,000 to fund the project.

CONCLUDING THOUGHTS

Recent projects identified by VALUE teams, both multidisciplinary and interdisciplinary, address two critical gaps in urban ecologies research. The Peoplemap project combines social science methodology (e.g., interviews and survey) and geographic information science; the 'sea change' communities project integrates social science methodology with natural science. The Vision II project not only integrates social science into urban ecologies research, but also contributes to urban ecological modelling. Therefore, through multidisciplinary and interdisciplinary collaboration, VALUE is able to develop cutting-edge research projects and addresses research issues at the edge of urban ecologies, thus advance our knowledge of urban ecologies.

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