

Journal of Urban Ecology: Linking and promoting research and practice in the evolving discipline of urban ecology

Mark J. McDonnell

Australian Research Centre for Urban Ecology (ARCUE), Royal Botanic Gardens Melbourne, School of BioSciences, The University of Melbourne, Melbourne, Victoria 3010, Australia

Human settlements are unique ecosystems consisting of human-made structures and natural elements, including people, which are maintained and transformed by a complex set of interactions within and between ecological and social systems. The sheer number, size, extent, rate of growth, and degree of environmental impacts of current human settlements are unsurpassed in the history of our planet. Today, cities and towns face a multitude of formidable environmental and social challenges including air and water pollution, increasing energy demands, poor waste management, and food shortages, all of which directly impact on human health and well-being (UN-Habitat 2008). There is also growing evidence regarding the influence of urbanization on cultural values and social cohesion (Thiagarajah et al. 2015; van Tran 2015). In addition, the creation and expansion of urban environments have led to a significant degradation of native habitats resulting in the reduction of local, regional, and global biodiversity (McDonald, Kareiva, and Forman 2008; Seto, Güneralp, and Hutyra 2012). New ‘novel ecosystems’ have been created that exhibit unique species compositions and ecosystem processes that may have only nominal resemblance to historic or existing ecosystems (Kowarik 2011; Mascaro et al. 2013). These issues are not restricted to our larger cities of a million residents or more, they are also occurring in less populated, but growing, periurban areas and small villages and towns especially in developing countries (Elmqvist et al. 2013). The effects of ongoing human actions in the form of urbanization and climate change currently threaten the quality of life, and the economic and social stability of human societies around the globe (UN-Habitat 2011).

Our planet has advanced into what Haughton and Hunter (1994) refer to as the fifth and most current stage of human–ecosystem relationships in which cities are more economically and environmentally interconnected and their impacts have grown from local and regional phenomena to global in scale. The

actions of humans, of which many reside in cities, are now unequivocally affecting climatic conditions, stratospheric ozone levels, and the health of our land, rivers, and oceans. To effectively address and mitigate the social and environmental challenges associated with the urbanization of our planet, we need to promote and advance the transdisciplinary discipline of urban ecology. The new Open Access *Journal of Urban Ecology* has been established to provide a much needed focal point for publishing the diverse array of new research results, conceptual frameworks, designs, plans, policies, and vital debates that are being developed by urban ecology academics, professionals, and students from around the world. Because the journal is Open Access, it will provide much needed access to this information by readers from developing countries where the need for this information is the most pressing, as well as increasing access within the ranks of non-academic urban ecology practitioners. Thus, the *Journal of Urban Ecology* will provide a unique, universally recognized, and accessible ‘home’ for the evolving discipline of urban ecology. This single Open Access point of reference will facilitate the exchange of new knowledge and ideas about the structure and function of urban ecosystems as well as the development of new design, construction, and management practices required to create green, liveable, healthy, biodiversity rich, and resilient cities and towns in the future.

The evolving discipline of urban ecology

Urban ecology arose in the early 1970s as a subdiscipline of ecology and has continued to develop into a distinctive science over the last 30 years (Weiland and Richter 2009; McDonnell 2011). As the science of urban ecology has evolved, researchers have utilized concepts, terminology, approaches, methodologies, and tools from a variety of other ecological, social, and physical

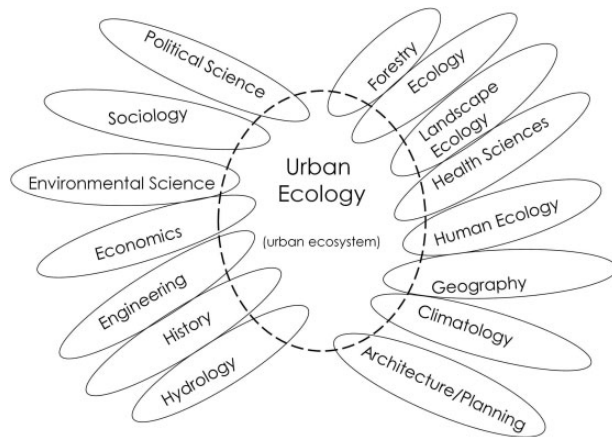


Figure 1. A diagrammatic representation of the many disciplines that contribute to the evolving discipline of urban ecology. It is important to note that each discipline has its own conceptual frameworks, paradigms, methodologies, text books, and journals. They all provide essential information and knowledge that enhances our understanding and management of urban ecosystems and are thus key components of the developing transdisciplinary discipline of urban ecology.

disciplines (Alberti 2008; McDonnell, Hahs, and Breuste 2009; Niemelä et al. 2011; Forman 2014; Douglas and James 2015). There is little doubt that urban ecology is closely aligned to the relatively new discipline of landscape ecology and the long-established discipline of geography (Wu 2008; Breuste, Niemelä, and Snep 2008; Forman 2014; Douglas and James 2015). Today, the science of urban ecology utilizes a unique mixture of approaches, frameworks, study locations, and methodologies that differentiates it from other disciplines, although there is still significant blurring at the boundaries (Fig. 1). Because of this fusion of disciplines, it is difficult to concisely define urban ecology, although a number of urban ecologists have identified the components and boundaries of the discipline (Collins et al. 2000; Sukopp 2002; Alberti 2008; Wu 2008; Niemelä, Kotze, and Yli-Pelkonen 2009; McDonnell 2011). Wu (2014) recently defined urban ecology as ‘... the study of spatiotemporal patterns, environmental impacts, and sustainability of urbanisation with emphasis on biodiversity, ecosystem processes, and ecosystem services. Socioeconomic processes and urban planning practices profoundly influence urbanisation patterns, and thus contribute to, but cannot alone constitute, the scientific core of urban ecology’.

Thus, similar to the discipline of ecology that integrates components of a diversity of biological (e.g., morphology, physiology, and behaviour) and physical sciences (e.g., soil, climate, and water) in the study of ecosystems, urban ecology integrates the components of not only the biological and physical sciences but also the social sciences in the study of urban ecosystems (Grimm et al. 2000; Alberti 2008; Douglas and James 2015; Fig. 1). Therefore, urban ecology is evolving as an amalgamation of several disciplines focused on understanding the ecological and human dimensions of the structure and function of urban ecosystems. The exact collection of disciplines involved and the level of integration that occur will depend on the questions being addressed or the design, management, and building tasks at hand. As students of urban ecology are educated more broadly and more activities are carried out by inter- and multi-disciplinary teams of urban ecology professionals in the future, the existing boundaries between the ecological and social science disciplines will begin to dissolve.

Urban ecology is still relatively young and it will continue to evolve and expand as an inter- and transdisciplinary discipline (Alberti 2008; Wu 2008; McDonnell 2011; Douglas and James 2015).

Current status

Books and journal articles are one measure of the state of the development of a discipline. Beginning in the 1980s to today, there has been a slow but steady stream of multidisciplinary edited books published that drew together experts on the ecological, physical, and social dimensions of the field of urban ecology. The chapters in these books provide an excellent overview of the research questions, methods, and analyses being developed by urban ecologists. These edited volumes include Bornkamm, Lee, and Seaward (1982), Sukopp, Hejný, and Kowarik (1990), McDonnell and Pickett (1993), Breuste et al. (1998), Marzluff, Bowman, and Donnelly (2001), Marzluff et al. (2008), McDonnell, Hahs, and Breuste (2009), Niemelä et al. (2011), and Douglas et al. (2011). One of the first urban ecology text books was published by Alberti (2008), which has recently been followed by a spate of new volumes including Adler and Tanner (2013), Francis and Chadwick (2013), Forman (2014), and Douglas and James (2015). Over the last 20 years, there has also been a number of books published on specific urban ecology topics such as urban habitats (Gilbert 1989; Wheeler 1999), urban wildlife (Adams, Lindsey, and Ash 2006), urban forestry (Bradley 1995; Carreiro, Song, and Wu 2008; Konijnendijk 2010), urban environmental education (Berkowitz, Nilon, and Holweg 2003), urban climates (Wilson 2011), urban design and planning (Spirn 1984; Hitchmough 1994; Platt, Rowntree, and Muick 1994; Sukopp, Numata, and Huber 1995; Forman 2008; Müller, Werner, and Kelcey 2010; Pickett, Cadenasso, and McGrath 2013), sustainable cities (Newman and Jennings 2008), and healthy cities (Frumkin, Frank, and Jackson 2004).

This diverse array of urban ecology texts provides researchers, practitioners, and students with a strong intellectual foundation regarding the current concepts, paradigms, methodologies, and state of knowledge of the discipline as well as some of its limitations and controversies. The future development of the discipline though is highly dependent on the publication of new research and the ongoing appraisal of the soundness of existing research in peer-reviewed journals. A recent examination of the ISI Web of Science database has revealed the number of published papers in the field of urban ecology has grown from 1,103 in 2001 to over 5,000 in 2013. The bulk of the research reported in these publications comes from Europe, North America, and Asia/Oceania. By comparison, relatively little urban ecology research has been published from Africa and South America as well as developing countries in general. The top fifteen journals that published urban ecology papers accounted for less than 20 per cent of all the papers published in the field, which indicates urban ecology papers are spread widely across a range of journals. Hence, unlike many other scientific disciplines, this analysis indicates urban ecology does not have a universally recognized journal or collection of journals in which academics, practitioners, and students publish their research findings and ideas. Because the breadth and scope of this work is currently captured across an array of journals, the *Journal of Urban Ecology* has been established to promote the exchange of information and ideas between ecological and social scientists, health professionals, and built environment practitioners, which include architects, planners, engineers, landscape architects, land managers, and policy makers.

Future challenges

Currently, there is an unprecedented world-wide demand for relevant socio-ecological information, principles, and concepts required to guide innovative resilient urban development and management (Steiner 2002; Cadenasso and Pickett 2008; Nassauer and Opdam 2008; Pickett, Cadenasso, and McGrath 2013). The science of urban ecology as a discipline has grown significantly over the last 30+ years, but in many respects, it is still in its infancy. However, there is little doubt whether the discipline of urban ecology is very healthy as indicated by recent thought-provoking publications on topics such as the status of the science of urban ecology (Pickett et al. 2011; Tanner et al. 2014; Wu 2014); urban green infrastructure (Felson, Bradford, and Terway 2013; Niemelä 2014); landscape design and planning (Desouza and Flanery 2013; Gagné et al. 2015); landscape resilience and sustainability (Kennedy et al. 2012; Pickett et al. 2013, Childers et al. 2014); ecosystem services (Ahern, Cilliers, and Niemelä 2014; Wurster and Artmann 2014); urban ecosystem health (Tzoulas et al. 2007; Su, Fath, and Yang et al. 2010; Douglas 2012); evolution of organisms in urban environments (Marzluff 2012; Alberti 2014; Donihue and Lambert 2014; Gil and Brumm 2014; McDonnell and Hahs 2015); continuum of urbanity (Pickett and Zhou 2015); and urban agglomerations (Qureshi, Haase, and Coles 2014).

For a variety of reasons, the discipline of urban ecology is currently unable to satisfy the growing demand for spatially and temporally pertinent academic and practical knowledge about urban ecosystems that is being called for by environmental conservationists, architects, planners, engineers, landscape architects, land managers, and policy makers. To achieve its full potential, the discipline of urban ecology needs to continue to mature and develop as other scientific disciplines have in the past by encouraging and supporting the publication of new ideas, methodologies, data, and analytical techniques as well as the critical assessment of existing information and approaches regarding the study, design, and management of urban ecosystems. To assist the discipline in achieving its potential, the *Journal of Urban Ecology* will encourage and promote the publication of research papers on urban climate, urban sustainability, soils, vegetation, animals, ecosystems, green spaces, parks, people's use of the environment, planning, management, and policy making as well as papers that address such topics as green architecture, smart growth, progressive planning, water conservation, and the creation of efficient and environmentally friendly urban infrastructure.

To place the *Journal of Urban Ecology* at the vanguard of the evolving discipline of urban ecology, the editors will also be actively encouraging the publication of papers that (1) fill existing and still to be discovered knowledge gaps, (2) facilitate the integration of social and ecological science research, and (3) bridge the communication gap between scientific knowledge and its practical application to facilitate the creation of a truly actionable science of urban ecology. The editors will be actively seeking manuscript submissions from urban ecology researchers, practitioners, and students on these three themes. Under each theme listed below, I have included a few examples of the specific areas of research we would like to promote. There are no doubt more topics that need to be addressed and I encourage our readers to contact me with specific research areas you feel are currently underrepresented in the discipline which could be promoted by the *Journal of Urban Ecology*.

1. Filling existing and yet undiscovered knowledge gaps

- Studies from developing countries and the Southern Hemisphere (e.g., Cilliers et al. 2014).

- Studies on urban saltwater and freshwater aquatic ecosystems (e.g., Paul and Meyer 2001; Chapman and Underwood 2009).
 - Mechanistic studies explaining the distribution and abundance of organisms in urban environments (e.g., McDonnell and Hahs 2013).
 - Globally comparative studies designed to identify confirmed generalizations (i.e., basic principles) that can be used to underpin urban conservation, building, and management strategies (e.g., McDonnell, Hahs, and Breuste 2009; Borer et al. 2014).
 - Ecology of urban soils and below ground processes (e.g., Global Urban Soil Ecological Education Network; <http://globalsoilbiodiversity.org/?q=node/111>; Accessed 19 May 2015).
 - Ecology of linear infrastructure such as roads, railways, and pipelines (e.g., van der Ree et al. 2011; van der Ree, Smith, and Grilo 2015).
 - Examination of cities as hybrid ecosystems (e.g., <http://www.thenatureofcities.com/author/marinaalberti->; Accessed 19 May 2015).
- ### 2. Better integration of the social and ecological sciences
- Ways to fill information and practice gaps between ecology and design (e.g., Rouse and Bunster-Ossa 2013; Felson, Bradford, and Terway 2013; Bunster-Ossa 2014; Grose 2014).
 - Utilizing urban design experiments (e.g., Felson, Bradford, and Terway 2013).
 - Making connections between urban ecology, landscape design, and art (e.g., Gandy 2013).
 - Incorporation of human perception of urban ecosystems into research, planning, and management (e.g., Fuller et al. 2007; Kabisch, Qureshi, and Haase 2015).
 - Incorporation of urban resilience and sustainability ideas and concepts in research and practice (e.g., Ahern 2013; Andersson et al. 2015).
 - Urban ecosystem services (e.g., Gómez-Baggethun and Barton 2013; McPhearson, Kremer, and Hamstead 2013).
 - The role of citizen science and public participation in gathering information and guiding decisions (e.g., Cooper et al. 2007).
- ### 3. Bridging the communication gap between scientific knowledge and practice
- Overcoming tensions that arise through differences in cultural perceptions, philosophies, and goals within the scientific and resource management communities themselves and other groups within urban areas (e.g., Gandy 2015; Hofstad 2015).
 - Redress scale mismatches between science and practice in urban landscapes (Gagné et al. 2015).
 - Promoting and engaging actionable science (e.g., Palmer 2012).
 - Linking urban ecology and practice with education (e.g., ecology in action; <http://www.esa.org/tiee/vol/v3/experiments/crosstown/abstract.html>; Accessed 19 May 2015).
 - Integration of new ecological and social knowledge into governance and policy (e.g., Wilkinson et al. 2013; Douglas 2014).

Summary

The discipline of urban ecology is growing rapidly to meet the ever increasing demand for academic knowledge and practical solutions to mitigate the negative impacts of global urbanization. The *Journal of Urban Ecology* has been created to help

coordinate the collection and dissemination of this emerging knowledge by providing a forum for new types of publications that currently do not fit in the existing journals but which are essential if we are to succeed in our goal of contributing to the creation of liveable, healthy, green, biodiversity rich, resilient cities, and towns in the future. We look forward to your contributions to our new Journal.

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References

- Adams, C. E., Lindsey, K. J., and Ash, S. J. (2006) *Urban Wildlife Management*. London: Taylor and Francis.
- Adler, F. R., and Tanner, C. J. (2013) *Urban Ecosystems: Ecological Principles for the Built Environment*. Cambridge, UK: Cambridge University Press.
- Ahern, J. (2013) 'Urban Landscape Sustainability and Resilience: The Promise and Challenges of Integrating Ecology with Urban Planning and Design', *Landscape Ecology*, **28**: 1203–12.
- , Cilliers, S., and Niemelä, J. (2014) 'The Concept of Ecosystem Services in Adaptive Urban Planning and Design: A Framework for Supporting Innovation', *Landscape and Urban Planning*, **125**: 254–9.
- Alberti, M. (2008) *Advances in Urban Ecology: Integrating Humans and Ecological Processes in Urban Ecosystems*. New York: Springer.
- (2014) 'Eco-Evolutionary Dynamics in an Urbanizing Planet', *Trends in Ecology and Evolution*, **30**: 1–13.
- Andersson, E., et al. (2015) 'Cultural Ecosystem Services as a Gateway for Improving Urban Sustainability', *Ecosystem Services*, **12**: 165–8.
- Berkowitz, A. R., Nilon, C. H., and Holweg, K. S., eds (2003). *Understanding Urban Ecosystems: A New Frontier for Science and Education*. New York: Springer-Verlag.
- Borer, E. T., et al. (2014) 'Finding Generality in Ecology: A Model for Globally Distributed Experiments', *Methods in Ecology and Evolution*, **5**: 65–73.
- Bornkamm, R., Lee, J. A., and Seaward, M. R. D., eds (1982) *Urban Ecology: The Second European Ecological Symposium*. Oxford: Blackwell Scientific Publications.
- Bradley, G. A. (1995) *Urban Forest Landscapes: Integrating Multidisciplinary Perspectives*. Seattle, WA: University of Washington Press.
- Breuste, J., Feldmann, H., and Uhlmann, O., eds (1998) *Urban Ecology*. Berlin: Springer-Verlag.
- , Niemelä, J., and Snep, R. P. H. (2008) 'Applying Landscape Ecological Principles in Urban Environments', *Landscape Ecology*, **23**: 1139–42.
- Bunster-Ossa, I. (2014) 'Reconsidering Ian McHarg: The Future of Urban Ecology', *Planning*, **80**, 30–5.
- Cadenasso, M. L., and Pickett, S. T. A. (2008) 'Urban Principles for Ecological Landscape Design and Management: Scientific Fundamentals', *Cities and the Environment*, **1**: Article 4. <http://digitalcommons.lmu.edu/cate/vol1/iss2/4>
- Carreiro, M., Song, Y.-C., and Wu, J. (2008) *Ecology, Planning and Management of Urban Forests*. New York: Springer.
- Chapman, M. G., and Underwood, A. J. (2009) 'Comparative Effects of Urbanisation in Marine and Terrestrial Habitats', in McDonnell, M. J., Hahs, A. K., and Breuste, J. H. (eds) *Ecology of Cities and Towns: A Comparative Approach*. pp. 51–70. Cambridge: Cambridge University Press.
- Childers, D. L., et al. (2014) 'Advancing Urban Sustainability Theory and Action: Challenges and Opportunities', *Landscape and Urban Planning*, **125**: 320–8.
- Cilliers, S., et al. (2014) 'Sustainable Urban Landscapes: South African Perspectives on Transdisciplinary Possibilities', *Landscape and Urban Planning*, **125**: 260–70.
- Collins, J. P., et al. (2000) 'A New Urban Ecology', *American Scientist*, **88**: 416–25.
- Cooper, C., et al. (2007) 'Citizen Science as a Tool for Conservation in Residential Ecosystems', *Ecology and Society*, **12**: 11.
- Desouza, K. C., and Flanery, T. H. (2013) 'Designing, Planning, and Managing Resilient Cities: A Conceptual Framework', *Cities*, **35**: 89–99.
- Donihue, C. M., and Lambert, M. R. (2014) 'Adaptive Evolution in Urban Ecosystems', *Ambio*, **44**: 194–203.
- Douglas, I. (2012) 'Urban Ecology and Urban Ecosystems: Understanding the Links to Human Health and Well-Being', *Current Opinion in Environmental Sustainability*, **4**: 385–92.
- (2014) 'The Political Filter in the Local Implementation of Initiatives Relating to Urban Ecology', *Landscape and Urban Planning*, **125**: 312–9.
- , and James, P. (2015) *Urban Ecology: An Introduction*. Abingdon, UK: Routledge.
- Douglas, I., et al. eds (2011) *The Routledge Handbook of Urban Ecology*. Milton Park, UK: Routledge.
- Elmqvist T., et al. eds (2013) *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities*. Dordrecht, The Netherlands: Springer.
- Felson, A. J., Bradford, M. A., and Terway, T. M. (2013) 'Promoting Earth Stewardship through Urban Design Experiments', *Frontiers in Ecology and the Environment*, **11**: 362–7.
- , et al. (2013) 'Involving Ecologists in Shaping Large-Scale Green Infrastructure Projects', *Bioscience*, **63**: 882–90.
- Forman, R. T. T. (2008) *Urban Regions: Ecology and Planning Beyond the City*. Cambridge: Cambridge University Press.
- (2014) *Urban Ecology: Science of Cities*. Cambridge: Cambridge University Press.
- Francis, R., and Chadwick, M. (2013) *Urban Ecosystems. Understanding the Human Environment*. Milton Park, UK: Routledge.
- Frumkin, H., Frank, L., and Jackson, R. (2004) *Urban Sprawl and Public Health: Designing, Planning, and Building for Healthy Communities*. Washington, DC: Island Press.
- Fuller, R. A., et al. (2007) 'Psychological Benefits of Greenspace Increase with Biodiversity', *Biology Letters*, **3**: 390–4.
- Gagné, S. A., et al. (2015) 'A Simple Landscape Design Framework for Biodiversity Conservation', *Landscape and Urban Planning*, **136**: 13–27.
- Gandy, M. (2013) 'Entropy by Design: Gilles Clément, Parc Henri Matisse and the Limits to Avant-Garde Urbanism', *International Journal of Urban and Regional Research*, **37**: 259–78.
- (2015) 'From Urban Ecology to Ecological Urbanism: an Ambiguous Trajectory', *Area*, **47**: 150–4.

- Gil, D., and Brumm, H. (2014) *Avian Urban Ecology*. Oxford: Oxford University Press.
- Gilbert, O. L. (1989) *The Ecology of Urban Habitats*. London: Chapman and Hall.
- Gómez-Baggethun, E., and Barton, D. N. (2013) 'Classifying and Valuing Ecosystem Services for Urban Planning', *Ecological Economics*, **86**: 235–45.
- Grimm, N. B., et al. (2000) 'Integrated Approaches to Long-Term Studies of Urban Ecological systems', *BioScience*, **50**: 571–84.
- Grose, M. J. (2014) 'Gaps and Futures in Working between Ecology and Design for Constructed Ecologies', *Landscape and Urban Planning*, **132**: 69–78.
- Haughton, G., and Hunter, C. (1994) *Sustainable Cities*. London: Jessica Kingsley Publishers Ltd.
- Hitchmough, J. D. (1994) *Urban Landscape Management*. Sydney: Inkata Press.
- Hofstad, H. (2015) 'Handling Tensions in the 'Everyday Landscape' Moving beyond the Development Conservation-Conservation Conflict?', *Environment and Planning C: Government and Policy*, **33**: 358–75.
- Kabisch, N., Qureshi, S., and Haase, D. (2015) 'Human-Environment Interactions in Urban Green Spaces—A Systematic Review of Contemporary Issues and Prospects for Future Research', *Environmental Impact Assessment Review*, **50**: 25–34.
- Kennedy, C., et al. (2012) 'Sustainable Urban Systems: An Integrated Approach', *Journal of Industrial Ecology*, **16**: 775–9.
- Konijnendijk, C. (2010) *The Forest and the City: The Cultural Landscape of Urban Woodland*. The Netherlands: Springer.
- Kowarik, I. (2011) 'Novel Urban Ecosystems, Biodiversity, and Conservation', *Environmental Pollution*, **159**: 1974–83.
- Marzluff, J., et al. eds (2008) *Urban Ecology: An International Perspective on the Interaction Between Humans and Nature*. New York: Springer.
- Marzluff, J. M. (2012) 'Urban Evolutionary Ecology', in Lepczyk, C. A., and Warren, P. S. (eds) *Urban Bird Ecology and Conservation. Studies in Avian Biology*, No. 45, pp. 287–308. Berkeley, CA: University of California Press.
- , Bowman, R., and Donnelly, R. (2001) *Avian Ecology and Conservation in an Urbanizing World*. Norwell, MA: Kluwer Academic Publishers.
- Mascaro, J., et al. (2013) 'Origins of the Novel Ecosystems Concept', in Hobbs, R. J., Higgs, E. S., and Hall, C. (eds) *Novel Ecosystems: Intervening in the New Ecological World Order*. pp. 45–57. Oxford: Wiley-Blackwell.
- McDonald, R. I., Kareiva, P., and Forman, R. T. T. (2008) 'The Implications of Current and Future Urbanization for Global Protected Areas and Biodiversity Conservation', *Biological Conservation*, **141**: 1695–703.
- McDonnell, M. J. (2011) 'The History of Urban Ecology', in Niemelä J., et al. (eds) *Urban Ecology: Patterns, Processes, and Applications*, pp. 5–13. Oxford: Oxford University Press.
- , and Hahs, A. K. (2013) 'The Future of Urban Biodiversity Research: Moving Beyond the "low-hanging fruit"', *Urban Ecosystems*, **16**: 397–409.
- , and — (2015) 'Adaptation and Adaptedness of Organisms to Urban Environments', *Annual Review of Ecology Evolution and Systematics*, Vol 46 (in press).
- , and Pickett S. T. A. eds (1993) *Humans as Components of Ecosystems: Subtle Human Effects and the Ecology of Populated Areas*. New York: Springer-Verlag.
- , Hahs, A. K., and Breuste, J. (2009) *Ecology of Cities and Towns: A Comparative Approach*. Cambridge: Cambridge University Press.
- McPhearson, T., Kremer, P., and Hamstead, Z. A. (2013) 'Mapping Ecosystem Services in New York City: Applying a Social-Ecological Approach in Urban Vacant Land', *Ecosystem Services*, **5**: 11–26.
- Müller, N., Werner, P., and Kelcey, J. G. (2010) *Urban Biodiversity and Design*. Oxford: Blackwell Publishing Ltd.
- Nassauer, J. I., and Opdam, P. (2008) 'Design in Science: Extending the Landscape Paradigm', *Landscape Ecology*, **25**: 633–44.
- Newman, P., and Jennings, I. (2008) *Cities as Sustainable Ecosystems Principles and Practices*. Washington, DC: Island Press.
- Niemelä, J., Breuste, J. H., Guntenspergen, G., McIntyre, N. E., Elmqvist, T., and James, P. (2011) *Urban Ecology. Patterns, Processes and Applications*. pp. 9–24. Oxford: Oxford University Press.
- (2014) 'Ecology of Urban Green Spaces: The Way Forward in Answering Major Research Questions', *Landscape and Urban Planning*, **125**: 298–303.
- , Kotze, D. J., and Yli-Pelkonen, V. (2009) 'Comparative Urban Ecology: Challenges and Possibilities', in McDonnell, M. J., Hahs, A. K., and Breuste, J. (eds) *Ecology of Cities and Towns: A Comparative Approach*. Cambridge: Cambridge University Press.
- Palmer, M. A. (2012) 'Socioenvironmental Sustainability and Actionable Science', *Bioscience* **62**: 5–6.
- Paul, M. J., and Meyer, J. L. (2001) 'Streams in the Urban Landscape', *Annual Review of Ecology Evolution and Systematics*, **32**: 333–65.
- Pickett, S. T. A., and Zhou, W. (2015) 'Global Urbanization as a Shifting Context for Applying Ecological Science Toward the Sustainable City', *Ecosystem Health and Sustainability*, **1**: 1–15.
- , Cadenasso, M. L., and McGrath, B. (2013) *Resilience in Ecology and Urban Design. Linking Theory and Practice for Sustainable Cities*. Dordrecht, The Netherlands: Springer.
- , et al. (2011) 'Urban Ecological Systems: Scientific Foundations and a Decade of Progress', *Journal of Environmental Management*, **92**: 331–62.
- , et al. (2013) 'Ecological Science and Transformation to the Sustainable City', *Cities*, **32**: S10–20.
- Platt, R. H., Rowntree, R. A., and Muick, P. C. (1994) *The Ecological City: Preserving and Restoring Urban Biodiversity*. Amherst, MA: The University of Massachusetts Press.
- Qureshi, S., Haase, D., and Coles, R. (2014) 'The Theorized Urban Gradient (TUG) Method—A Conceptual Framework for Socio-Ecological Sampling in Complex Urban Agglomerations', *Ecological Indicators*, **36**: 100–10.
- Rouse, D. C., and Bunster-Ossa, I. F. (2013) *Green Infrastructure: A Landscape Approach*. Chicago, IL: American Planning Association.
- Seto, K. C., Güneralp, B., and Hutyra, L. R. (2012) 'Global Forecasts of Urban Expansion to 2030 and Direct Impacts on Biodiversity and Carbon Pools', *Proceedings of the National Academy of Sciences of the United States of America*, **109**: 16083–8.
- Spirn, A. (1984) *The Granite Garden: Urban Nature and Human Design*. New York: New York Basic Books.
- Steiner, F. R. (2002) *Human Ecology: Following Nature's Lead*, 237 pp. Washington, DC: Island Press.
- Su, M., Fath, B. D., and Yang, Z. (2010) 'Urban Ecosystem Health Assessment: A Review', *Science of the Total Environment*, **408**: 2425–34.
- Sukopp, H. (2002) 'On the Early History of Urban Ecology in Europe', *Preslia*, **74**: 373–93.
- , Hejný, S., and Kowarik, I., eds (1990) *Urban Ecology: Plants and Plant Communities in Urban Environments*. The Hague: SPB Publishing.

- Sukopp, H., Numata, M., and Huber, A., eds (1995) *Urban Ecology as the Basis of Urban Planning*. The Hague, The Netherlands: SPB Academic Publishing.
- Tanner, C. J., et al. (2014) 'Urban Ecology: Advancing Science and Society', *Frontiers in Ecology and Environment*, **12**: 574–81.
- Thiagarajah, J., et al. (2015) 'Historical and Contemporary Cultural Ecosystem Service Values in the Rapidly Urbanizing City State of Singapore', *Ambio* (in press) DOI: 10.1007/s13280-015-0647-7
- Tzoulas, K., et al. (2007) 'Promoting Ecosystem and Human Health in Urban Areas Using Green Infrastructure: A Literature Review', *Landscape and Urban Planning*, **81**: 167–78.
- UN-Habitat (2008) *The State of the World's Cities 2010/2011: Bridging the Urban Divide*. United Nations Human Settlements Programme. London: Earthscan.
- (2011) *Cities and Climate Change: Global Report on Human Settlements 2011* United Nations Human Settlements Programme. London: Earthscan.
- van der Ree, R., Smith, D. J., and Grilo, C., eds (2015) *Handbook of Road Ecology*. Oxford: Wiley-Blackwell.
- , et al. (2011) 'Effects of Roads and Traffic on Wildlife Populations and Landscape Function: Road Ecology is Moving Toward Larger Scales', *Ecology and Society*, **16**: 1-9.
- Van Tran, K. (2015) 'The Value of Community Cohesion among Vietnamese Students in Era of Urbanisation and Globalisation', *Social Indicators Research*. (in press) DOI 10.1007/s11205-015-0935-4
- Weiland, U., and Richter, M. (2009) 'Lines of Tradition and Recent Approaches to Urban Ecology, Focussing on Germany and the USA', *GAIA*, **18**: 49–57.
- Wheater, C. P. (1999) *Urban Habitats*. New York: Routledge.
- Wilkinson, C., et al. (2013) 'Urban Governance of Biodiversity and Ecosystem Services', in Elmqvist, T., et al. (eds) *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities*. pp. 539–87. Dordrecht, The Netherlands: Springer.
- Wilson, W. G. (2011) *Constructed Climates: A Primer on Urban Environments*. Chicago, IL: University of Chicago Press.
- Wu, J. (2008) 'Toward a Landscape Ecology of Cities: Beyond Buildings, Trees, and Urban Forests', in Carreiro, M., Song, Y.-C., and Wu, J. (eds) *Ecology, Planning, and Management of Urban Forests*. pp. 10–28. New York: Springer.
- (2014) 'Urban Ecology and Sustainability: The State-of-the-Science and Future Directions', *Landscape and Urban Planning*, **125**: 209–21.
- Wurster, D., and Artmann, M. (2014) 'Development of a Concept for Non-Monetary Assessment of Urban Ecosystem Services at the Site Level', *Ambio*, **43**: 454–65.