Urban Morphology and the sustainable provision of Ecosystem Services

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300-word FindaPhD summary
Nature provides ecosystem services in cities as well as in the countryside. To understand how these urban services come about, and whether they are resilient in the face of rapid environmental and social change, we must understand the ecological and cultural driving forces that explain how the vegetation in any particular urban morphology came about. This project aims to combine urban morphology and ecosystem services perspectives to further our understanding of the relationships between the historical development of cities and the quality and quantity of ecosystem service provision. The project will diagnose the spatio-temporal structure of the green infrastructure that provides urban ecosystem services in chosen case study areas. GIS, and environmental informatics more generally, will be used to develop high-level products from remote sensing datasets. Quantitative models of ecosystem service provision will be developed and critiqued through social science theory in order to situate them in a socio-cultural context. Such a project challenges the student to couple the best of disciplinary knowledge in environmental science and urban studies with transformative interdisciplinary working, and so build a unique set of research skills. We encourage students interested in urban ecosystem services or urban morphology to contact us with a view to developing a research proposal.

Introduction: Why this topic is important
Human well-being is inextricably linked to the provision of goods and services by the rest of the living planet, and this does not change just because most humans now live in cities [1]. When speaking of the goods and services provided by the living planet, we mean products of ecosystems that are used by humans [2]. There are a surprising number of such ecosystem services, ranging from reduction of atmospheric pollution from traffic [3], to spiritual feelings induced by being in nature. Even within urban areas the non-human living environment provides substantial support to human activities, support which is only now beginning to be recognised [4, 5]. In trying to understand and quantify the support given by nature to people in cities, attention has moved from individual elements (trees, ponds, gardens, parks, etc) to the urban forest as a whole, because most of ecosystem services accrue from urban nature acting as a network or system, that is, from the combination of nature elements to form green infrastructure. Therefore, to understand how the ecosystem services in a city came about, and how resilient they are likely to be, we must understand urban forms in their socio-cultural contexts (Figure 1).
One of the most powerful ways of revealing how and why urban forms emerge is urban morphology [6]. Differences in the physical character of the various parts of cities are fundamental to the way in which people relate to places. Understanding how this physical character has taken shape, reflecting the endeavours of past and present societies, depends on uncovering regularities and recurrent patterns in the ways cities develop. Urban morphologists have demonstrated, for example, that fluctuations in the speed of city growth have left major imprints in patterns of vegetation, building and movement within the city [7].

*The aim of this studentship is to combine urban morphology and ecosystem services perspectives to further our understanding of the relationships between the historical development of cities and the quality and quantity of ecosystem service provision.*

**Method: How we propose to tackle the problem**

The problem we have set ourselves is quintessentially interdisciplinary [8]; to make progress we need to couple the best of disciplinary knowledge in environmental science and urban studies with transformative interdisciplinary working. Fortunately, we have begun to build the tools necessary for such ambitious research. Recently published, our *Designing Resilient Cities* [9] sets out a method that explicitly links benefits (e.g., ecosystem services) to interventions made in the name of sustainability (“sustainability solutions”) and then subjects these solution-benefit pairs to a stringent resilience test based on futures-thinking. We have already applied this method in the context of ecological interventions in urban regeneration [10], including the urban forest [8, 11].

Underpinning our interdisciplinary work will be discipline-based research following two strands. The exact balance between these strands will depend on the skills, previous experience, and research programme of the student.

To quantify the delivery of ecosystem services the student will build green-infrastructure layers into their geographical information system (GIS), using remote sensing data such as from lidar (laser-ranging), which captures green infrastructure at centimetre-scale spatial resolution. Looking at the present spatial distribution of ecosystem services in selected case study areas, and relating this
distribution to urban morphology, the student will assess both the historical development of the ecosystem service provision, and its likely resilience in the face of an uncertain future [9].

Outcomes: What’s in it for you

Gain a unique set of interdisciplinary research skills. This project involves diagnosis of the spatio-temporal structure of the green infrastructure that provides urban ecosystem services. Your research will require skills in state-of-the-art GIS and in environmental informatics more generally, particularly the generation of higher-level products from remote sensing datasets. You will build quantitative models of ecosystem service provision whilst also engaging with social science theory in order to critique your GIS and other model products and situate them in a socio-cultural context. Such multi- and interdisciplinary agility is increasingly recognised as vital when tackling the most pressing problems of our age.

Develop collaborative links with local government, non-governmental organisations, and industry. This studentship follows on from the recent Urban Futures1 (UF) research project, which developed strong and enduring links with a broad community of urban practitioners, ranging from developers, through architects, planners and local government, to government regulators such as the Environment Agency. We will involve the student with these stakeholders at every opportunity, increasing the student’s awareness of the concerns of practitioners and, of course, getting the student known amongst potential employers.

Join a winning team. You will join the University of Birmingham School of Geography, Earth & Environmental Sciences. The School has very well-established training and support structures in place, to make sure that your time at Birmingham is fruitful and happy. You will receive training to complement your undergraduate skills and begin to move beyond those skills to explore the frontiers of both ecology and urban morphology.

Who should apply

This unfunded studentship is available to those who have or expect to graduate with a good degree in Geography, Environmental Science, Biology (especially Ecology), Planning, Landscape Architecture or associated disciplines. Students of the physical sciences with a strong interest in environmental questions are also encouraged to apply. You must have demonstrable potential for creative, high-quality, PhD research and relish problem-solving. An eagerness to develop a deep and broad skill set in both geographical information systems and scientific method is essential. We encourage students who are developing research proposals for PhD topics to contact us with a view to tailoring the programme above to the research agenda of your funding agency. Some opportunities for funding for international students are listed at http://www.birmingham.ac.uk/international/students/finance/scholarships/index.aspx.

Further Reading


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1 www.urban-futures.org/


