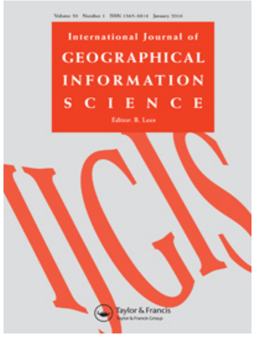

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Space, time, connectivity and conflict in biological landscapes: the fourth special issue on spatial ecology

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Introduction

Spatial ecology and the spatial sciences in general are increasingly applied to support evidence-based policy and environmental management decisions in an era of global change. The effects of global change agents – climate change, land-use change, novel species, and altered biogeochemical cycles and disturbance regimes – play out over multiple spatial and temporal scales. International and multilateral agencies are calling for spatially explicit information in support of policy and management supporting biodiversity, ecosystem services and sustainable environmental management. Conservation and environmental planning can no longer be restricted to a static landscape but must explicitly account for temporal dynamics.

This is the Fourth Special Issue on Spatial Ecology in the International Journal of Geographical Information Science, following from previous issues in 2011, 2012 and 2014 (Skidmore *et al*. 2011, Laffan *et al*. 2012, 2014). The papers in this special issue contribute to the points listed above, with a particular focus on dynamics in space and time.

A cross-cutting theme in this issue is human–wildlife interactions and conflicts in space and time (Loraamm and Downs this issue, Saito *et al*. 2016, Zengeya and Murwira 2016), a topic also covered in previous special issues (David Walter *et al*. 2011, van Langevelde and Grashof-Bokdam 2011). Further linkages between humans and ecological processes are assessed by Fagúndez and Izco (2016), who explore the use of toponyms as a means of identifying historical vegetation types.

Cost-path analysis continues to be widely used in spatial ecology to represent landscape connectivity (Adriaensen *et al*. 2003, Lyon *et al*. 2010, Greenberg *et al*. 2011, Etherington 2012, Hanke *et al*. 2014, Hohl *et al*. 2014, Bishop-Taylor *et al*. 2015). In this respect, papers in the special issue summarize important applications in the design of wildlife corridors (Loraamm and Downs this issue) and methodological improvements in the characterization of uncertainty (Etherington and Perry 2016).

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Species distribution models are prominent in spatial ecology (Beltrán *et al*. 2014, Bino *et al*. 2014, Ficetola *et al*. 2014, Mateo Sánchez *et al*. 2014, McCue *et al*. 2014, Peters *et al*. 2014, Sillero and Gonçalves-Seco 2014). Here, authors address habitat and range dynamics by using multi-temporal remote sensing and projections of future range shifts (Girma *et al*. this issue, Saito *et al*. 2016).

With many regional scale studies in this special issue, and one global-scale study (González Vilas *et al*. 2016), we note that both fine-scale and cross-scale spatial ecology constitute innovations in tools, methods and concepts. Spatial ecologists are examining, among other things, genetic connectivity, isoscapes, thermal landscapes, and extreme events with tools and data ranging from next generation sequencing and spatial downscaling to unmanned aerial vehicles (UAVs) and Lidar. Further investigations into the effects of scale and more cross-scale studies are something that we hope to see more of in the future. The UAVs are of particular relevance and their use in spatial ecology will increase as technologies around them and their sensors develop. We anticipate applications in local area management as well as monitoring and inventory surveys and, as swarms of UAVS fly autonomously, data over larger areas at fine resolution will become available.

Spatial ecology progresses owing to the growing availability of spatially explicit biodiversity data (Chee and Elith 2012, González Vilas *et al*. 2016, Williams and Belbin 2016). This is equally the case with satellite time series data (de Bie *et al*. 2012, Watts and Laffan 2014). Three papers in this issue use such data to track habitat dynamics and forest trends using innovative methods (Girma *et al*. this issue, Green and Ahearn 2016, Zengeya and Murwira 2016).

Spatial ecologists are well acquainted with big data because remotely sensed and other geospatial data have always been big in terms of data volume and the need to mine them with machine-learning approaches. Biodiversity and other data supporting spatial ecology are increasingly being aggregated into data repositories or registries. A looming transition in scientific publishing is the move to publish this data, both to incentivize data sharing and support scientific reproducibility (Tenopir *et al*. 2011, Costello *et al*. 2013). Spatial ecologists should be among the leaders of this change.

Further, as new data become available, new tools, methods and web services are developed to use them, greatly increasing the range of questions that can be asked by researchers (Etherington 2012, Etherington *et al*. 2015, Etherington and Perry 2016, Green and Ahearn 2016, Williams and Belbin 2016).

Spatial ecology is a developing field with many open questions (Skidmore et al. 2011, Laffan et al. 2012, 2014), and this series of special issues continues to demonstrate the possibilities and best practice of the field.

Disclosure statement

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