Journal of Land Use Science

ISSN: 1747-423X (Print) 1747-4248 (Online) Journal homepage: http://www.tandfonline.com/loi/tlus20

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To cite this article: Daniel Müller (2016) Research frontiers in land use science, Journal of Land Use Science, 11:6, 619-622, DOI: 10.1080/1747423X.2016.1242924

To link to this article: http://dx.doi.org/10.1080/1747423X.2016.1242924

JOURNAL OF LAND USE SCIENCE, 2016
VOL. 11, NO. 6, 619–622
http://dx.doi.org/10.1080/1747423X.2016.1242924

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EDITORIAL

Research frontiers in land use science

Land-use science provides critical advances for better understanding land use in light of global economic and environmental changes. The eminent importance of land-use science for global sustainability therefore attracts substantial attention of academia, media, and decision makers (Müller & Munroe, 2014; Rindfuss et al., 2008; Turner, Lambin, & Reenberg, 2007). The *Journal of Land Use Science* aims to broaden the scientific basis for better understanding complex land systems and, in that way, to contribute knowledge that allows steering land use toward more sustainable pathways. The Journal attempts to fulfill this mission by featuring scholarship stemming from geography, economics, sociology, forestry, environmental sciences, and other disciplines that have 'land' as a central theme in the study of coupled human–natural systems.

This issue brings together an array of manuscripts that feature emerging research perspectives in land-use science, including contributions that advance the state-of-the-art in land-use science and pinpoint research gaps for future inquiry. We specifically invited contributions that shed light on terminology, the modeling of complex land-use systems, and substantiate understudied research issues that deem more attention from the land-use science community and will receive more priority from the *Journal of Land Use Science* in the future.

The issue takes off with an article by Patrick Meyfroidt (2016) that, I believe, will become seminal reading for land-use scientists. Meyfroidt illuminates issues surrounding the terminology used in causal and quasi-causal analysis of land-use science. Land scientists often aim to provide causal explanations of the observed land-use outcomes, yet the theoretical foundations to establish causality and the terminology to explain underlying causes have long been a weak spot. The lack of theory and imprecise use of terminology have often reduced the scientific value, impaired the ability to compare results, and limited the policy relevance of land-use analyses. The review by Meyfroidt in this issue intelligibly fills this gap and provides a clear-cut and coherent basis for analyzing and interpreting the causes that lead to changes in behavior of complex land systems, characterized by feedbacks, nonlinearities, and path dependence. I particularly encourage readers to carefully investigate Table 1 in the review of Meyfroidt (2016) that contains, in condensed form, the long-awaited clarification of terminology and should, become standard knowledge of land-use scientists. Bringing land-use science closer to true causality, and being clear about the wording of the results of analysis, will improve the ability to generalize from findings and thus strengthen the significance of results for policy and management.

Molly Brown (2016) examines interconnections between land use, environmental change, and the three dimensions of food security, that are food availability, access, and utilization. Her article sheds light on the ability of remote sensing data to support several aspects of the multifaceted dimensions of food security. She emphasizes that satellite remote sensing is crucial to understand resource availability, particularly in countries characterized in part by subsistence-oriented farming where agricultural production is essential to household-level food security, such as throughout large parts of Africa, as demonstrated by Brown's empirical examples. Improved information on land-cover change in combination with data on spatially explicit nutritional status can help identify areas where vegetation changes influence nutrition through affecting ecosystem services provided by the land. Finally, Brown shows how monitoring vegetation growth can be linked to food availability and thus to identify consumption gaps. Her contribution vividly calls for more empirical research that integrate contemporary remote sensing with data on elements of food security.

Nick Magliocca and Erle Ellis (2016) outline a new research program that examines the prospects to simulating evolutionary processes in a generic agent-based model framework in what they call a 'virtual laboratory approach.' The proposed model intends to generate knowledge of how different types of land systems coevolved with different types of societies. The model structure can provide theory-driven context of how human societies have shaped the Earth's surface for long time scales, ranging from several generations to centuries to millennia. Magliocca and Ellis set up a set of basic hypotheses on sociocultural niche construction that allow reproducing the broadly varied anthroecological forms and dynamics of human landscapes. Ultimately, the virtual laboratory approach attempts to move LCS toward a 'generative social science' mode of inquiry in which the emergence, dynamics, and spatial patterning of anthropogenic landscapes (anthroecological change) are explained from first principles of agent objective-seeking behavior (Epstein, 1999; Grimm & Berger, 2016). The dynamic linking of land-use changes with sociocultural changes can provide important insights for land-use science by allowing to develop and improve theory that holds up against empirically testable assumptions.

The next paper deals with warfare and civil strife that are, unfortunately, all too common around the globe and unlikely to vanish. However, the impacts of warfare on land-use systems have thus far received little attention, despite their abrupt and profound effects on land-system properties. Matthias Baumann and Tobias Kuemmerle (2016) present a review of the effects of warfare and armed conflict on land system properties. They exploit a meta-analysis of literature and a spatially explicit data set on conflict events. The results demonstrate the potentially long-lasting reconfiguration of land use following such shock events. However, the effects are not unidirectional and result in varying land-use responses, including abandonment or expansion in some cases, intensification or dis-intensification in others. They also demonstrate how warfare can affect places afar from the actual conflict zone, for example, by stimulating largebring forward land-use science migration waves or by changing trade patterns through export barriers or sanctions. The review thus makes a clear-cut case of the great value of research that links land use with shock events.

B. L. Turner (2016), in his commentary, convincingly argues how land-use science can, and should, step up its efforts to examining urban sustainability problems. He proposes that human–environment interactions in urban systems can successfully be addressed by marrying land-system architecture with the landscape mosaic approach from landscape ecology. Labeled as land 'architecture-mosaic approaches,' Turner provides sturdy arguments how such novel interlinked approaches can bring forward land-use science by addressing sustainability issues in 'city-scapes.' In that way, he argues, the land-use community can widen its reach and extend its impact within the initiatives that address global sustainability issues.

Along similar lines, Eleanor Stokes and Karen Seto (2016) argue that land-use science can and should play an increasing role in analyzing urban land systems, and to do so need to acknowledge the specificity of urban land systems that differ fundamentally in their systemic characteristics from non-urban systems. Stokes and Seto, akin to Turner (2016), propose making use of the landscape architecture approach to stimulate engagement in assessing how the configuration of urban areas affects carbon emissions and the ability to adapt to climatic changes. This is utterly relevant because urban areas already contribute about 70% of global energy-related carbon emissions, with an increasing tendency as urban areas are prone to further increase in extent in the future. Such research is particularly urgent in smaller urban areas in developing countries where most future urban growth will take place, yet where statistical data are scarce and often of poor quality. Stokes and Seto make a compelling case that land-use science can and should play an influential role in addressing urban emissions and urban vulnerability to climate change through its long-standing use of spatially, and increasingly temporally, explicit methods applied to terrestrial human–environment systems. However, methods and frameworks from non-urban systems cannot simply be applied to urban areas because human–environment interactions in urban systems can be distinctly different. Therefore, land-use science has to 'to create new methodologies for studying disaggregated within-urban spatial variation.' The *Journal of and*

Use Science invites contributions along these lines in order to strengthen knowledge of how the spatial configuration of urban areas affect carbon cycles, urban vulnerability, and the adaptive capacity of humans and fauna and flora in urban systems.

Last, but certainly not least, Xiangzheng Deng and Zhihui Li (2016) review the evolution of land-use science in China, both from a methodological perspective and in terms of observed land changes in the past. China is a particularly intriguing case for land scientists because the Chinese economy developed in record speed from a society based on agricultural production and organized in a collective system to a country characterized by massive export-oriented industrial development, including the largest rural to urban migration waves observed in human history. The impressive economic development went in hand with cropland contraction, particularly in more marginal areas, as has been seen over the course of economic development in many other countries. Deng and Li also emphasize the value of land-use scenarios for foreseeing alternative future developments that allow anticipating the likely impacts of diverse future policy and growth pathways on land system characteristics. They conclude that developing more comprehensive scenarios need to be developed for China that better integrate different disciplinary perspectives and thus contribute to improved forecasts for policy and land management.

In sum, the articles featured in this special issue elucidate on theoretical advances in land-use science, propose theory-building modeling advances, and reveal emerging new research topics that warrant better attention by academia. I believe, we were able to compile a set of great contributions in this issue. I truly hope that the issue will not vanish in the depth of the World Wide Web but will be taken up by land scientists, so that they provide more useful analysis, novel insights, and tackle topics of societal relevance that help to contribute to better understanding of complex land systems. I trust that this issue also motivated other land scientists to submit relevant and high-quality manuscripts, so that the *Journal of Land Use Science* will fulfill its mission to contribute its share to help tackling the global sustainability challenges that lie ahead.

Disclosure statement

No potential conflict of interest was reported by the author.

References

Baumann, M., & Kuemmerle, T. (2016). The impacts of warfare and armed conflict on land systems. *Journal of Land Use Science*, *11*(6), 672–688. doi:10.1080/1747423X.2016.1241317

Brown, M. E. (2016). Remote sensing technology and land use analysis in food security assessment. *Journal of Land Use Science*, *11*(6), 623–641. doi:10.1080/1747423X.2016.1195455

Deng, X., & Li, Z. (2016). Historical trajectories and spatially explicit scenarios of land-use and land-cover changes in China. *Journal of Land Use Science*, *11*(6), 709–724. doi:10.1080/1747423X.2016.1241312

Epstein, J. M. (1999). Agent-based computational models and generative social science. *Complexity*, *4*(5), 41–60. doi:10.1002/(SICI)1099-0526(199905/06)4:5<41::AID-CPLX9>3.0.CO;2-F

Grimm, V., & Berger, U. (2016). Structural realism, emergence, and predictions in next-generation ecological modelling: Synthesis from a special issue. *Ecological Modelling*, *326*, 177–187. doi:10.1016/j.ecolmodel.2016.01.001

Magliocca, N. R., & Ellis, E. C. (2016). Evolving human landscapes: A virtual laboratory approach. *Journal of Land Use Science*, *11*(6), 642–671. doi:10.1080/1747423X.2016.1241314

Meyfroidt, P. (2016). Approaches and terminology for causal analysis in land systems science. *Journal of Land Use Science*, *11*(5), 501–522. doi:10.1080/1747423X.2015.1117530

Müller, D., & Munroe, D. K. (2014). Current and future challenges in land-use science. *Journal of Land Use Science*, *9*(2), 133–142. doi:10.1080/1747423X.2014.883731

Rindfuss, R. R., Entwisle, B., Walsh, S. J., An, L., Badenoch, N., Brown, D. G., … Verburg, P. H. (2008). Land use change: Complexity and comparisons. *Journal of Land Use Science*, *3*(1), 1–10. doi:10.1080/17474230802047955

Stokes, E. C., & Seto, K. C. (2016). Climate change and urban land systems: Bridging the gaps between urbanism and land science. *Journal of Land Use Science*, *11*(6), 698–708. doi:10.1080/1747423X.2016.1241316

Turner, B. L., II. (2016). Land system architecture for urban sustainability: New directions for land system science illustrated by application to the urban heat island problem. *Journal of Land Use Science*, *11*(6), 689–697. doi:10.1080/1747423X.2016.1241315

Turner, B. L., II, Lambin, E. F., & Reenberg, A. (2007). The emergence of land change science for global environmental change and sustainability. *Proceedings of the National Academy of Sciences*, *104*(52), 20666–20671. doi:10.1073/pnas.0704119104

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