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Editorial

Interactions between Food Security and Land Use in the Context of Global Change

William J. McConnell [1,*] and Andrés Viña [2,3]

1 Center for Global Change and Earth Observations, Michigan State University, 1405 South Harrison Road, East Lansing, MI 48823-5243, USA
2 Center for Systems Integration and Sustainability, Michigan State University, 1405 South Harrison Road, Suite 115 Manly Miles Bldg, East Lansing, MI 48823, USA; vina@msu.edu
3 Geography Department, University of North Carolina, Chapel Hill, NC 27599-2200, USA
* Correspondence: mcconn64@msu.edu

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Increases in human population and per-capita consumption are putting enormous pressure on land resources. About 38% of the Earth's land area is being used in agricultural production [1], with about half (ca. 31%) of the remaining land being under forest cover [2] and the other half being less suitable for agricultural production due to edaphic, topographic and/or climatic factors. Despite the fact that over the last three decades the world food production has doubled [3], about 1 in 9 people in the world is still undernourished [4]. This poses the global challenge of increasing food security without exacerbating serious environmental problems, such as loss of biodiversity [5], greenhouse gas emissions [6], soil degradation [7], and alteration of hydrological cycles [8], among many others. While these issues are of global relevance, we recognize that they are local in nature since their effects are felt locally, while the actions on the land are performed by local actors whose decisions are driven not only by global [9,10], but also by regional [11] and local [12] forces.

Given the great heterogeneity of sociocultural, economic and ecological conditions, it is quite challenging to develop sound theoretical propositions, to identify appropriate empirical approaches for testing them, and to synthesize across the myriad actions on the land, the factors influencing them, and their individual and aggregate consequences. The maturing science of land change [13,14] has emerged to provide such a foundation, and the undertaking is central to the mandate of the Global Land Programme (GLP), which continues a long tradition of producing generalized knowledge on land change [15]. The papers presented in this Special Issue arose from a symposium organized at the GLP's 3rd Open Science Meeting in Beijing, reporting mainly on projects supported by the Belmont Forum call on Food Security and Land Use Change, and organized by the GLP North American Nodal Office. Normally, as editors, we would seek to provide some level of synthesis from the findings presented herein, as a contribution to the effort to generate generalized knowledge. However, we find ourselves hampered in this endeavor by two issues that are emblematic of the land change field as a whole.

First, while the Special Issue consists of a very small sample of the rapidly growing literature on land change, the contributions nevertheless address a wide array of land systems and focal processes, including agricultural intensification through the lens of telecoupling [16], the socioeconomic impacts of increasing production of a single crop commodity [17], spatial co-occurrence of food insecurity and biodiversity [18], increasing food security through the use of conservation agriculture [19], assessing whether food production can meet future needs [20,21], and developing strategies for modeling land use, food production and trade [22]. Furthermore, the studies address these issues across several continents (i.e., South America, Europe and Asia) and concern varying agricultural systems (i.e., focusing on the production of vegetables or grains, with the latter destined either for direct human consumption or for livestock production).

The second main issue hampering synthesis concerns the conceptual foundations of land change studies, specifically the ways in which key concepts are defined and employed. This includes not only the terms used to describe the contexts in which changes occur, or the causal factors and consequences of those changes, but even the core concepts of land use and land cover. While 'land' arguably constitutes a universal construct, with a stable, uncontroversial meaning across disciplines and cultures, the compound forms 'land use' and 'land cover' are too often conflated [23,24] despite a long and well established distinction between them [25–27].

These terms convey a large range of understandings not only among land change scientists and modelers, but also among different land change actors. While the more inclusive term 'land change' does obviate the quite ungainly 'land use and land cover' terminology, it arguably exacerbates the conflation of these quite different, yet intimately related, concepts. Meanwhile, other compound forms (which often constitute the central object of inquiry) are understood and utilized in different ways, for different purposes and in an inconsistent manner. These include a range of descriptive land-related categories associated with use (e.g., food production landscapes), change (e.g., landscape change, landscape transformation, land degradation, land cover conversion), ownership (e.g., land holding, land allocation, land speculation, land expropriation), and quality (e.g., land suitability, land degradation).

The lack of a unified conceptual framework has consequences beyond the maturation of a scientific discipline, as it also has legal, social and ethical connotations. Thus, as land change scientists, it is imperative that we develop a clear and unified conceptual framework that formalizes our analysis of the changes in the land surface, its drivers, and its consequences. A more formal, thoughtful, clear and—perhaps more important—systematic use of land-related concepts will allow not only better comparisons and syntheses, but also a clearer identification and implementation of policy prescriptions that improve both human livelihoods and environmental outcomes. We, therefore, conclude with a plea for such a conceptual formalization.

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