Towards a normative land systems science

Jonas Ø. Nielsen, Ariane de Bremond, Rinku Roy Chowdhury, Cecilie Friis, Graciela Metternicht, Patrick Meyfroidt, Darla Munroe, Unai Pascual, and Allison Thomson

Abstract

Science should provide solutions for societal transformations towards sustainability in the face of global environmental change. Land system science, as a systemic science focused on complex socio-ecological interactions around land use and associated trade-offs and synergies, is well placed to contribute to this agenda. This goal requires a stronger engagement with the normative implications of scientific practice, research topics, questions and results. We identify concerns as well as three concrete steps for land system science to more deeply contribute in normative issues. In particular, we encourage land system scientists to discuss explicitly the normative questions, values, perspectives and assumptions already present in our research, as well as to identify key normative research questions to contribute to societal transformations.

Highlights

- Normative positions are increasingly required of sustainability science
- Land system science is well placed to engage in normative discussions being a systemic science focusing on trade-off and synergies
- Three specific steps towards a more normative land system science are suggested

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Introduction

Land systems are characterized by rapid, widespread, and profoundly uneven processes of intertwined social and environmental transformation, often at large scales and with severe consequences for ecosystems and people. These effects are reflected in a range of phenomena, such as land-related impacts on and consequences of climate change [1,2], collapsing biodiversity and perturbation of natural resources on which people depend [3], food and water system instabilities [4], and global land grabs that further disenfranchise already marginalized social groups [5,6].

The sustainability challenges resulting from such social-environmental changes require substantial, coordinated and transdisciplinary partnerships to develop awareness of these problems, to enhance the policy relevance of that understanding, and to actively foster transformative solutions by decision-makers at multiple scales [7,8,9]. To contribute to this sustainability science agenda, research requires a more explicit and articulated engagement into normative dimensions [e.g. 10]. That is, in addition to supporting research *on* sustainability, scientists are increasingly acknowledging the need for research *for* sustainability. This is evident, for instance, in the scientific engagement with achieving the UN's 2030 Agenda for Sustainable Development [e.g. 10,11*,12,13,14*,15].

Here we argue that land system science finds itself at a juncture where, along with addressing persistent knowledge gaps about the processes, outcomes and feedbacks of land-use change, we should more actively engage with and reflect on potential normative implications of the different steps of our research, from problem framing to results including how our own norms as positioned subjects influence this process. This process and engagement is particularly important in light of the sustainability challenges mentioned above, and also because our data and science do not speak for themselves. This requires land system science to more readily engage in ongoing deliberations in policy and practice arenas about how to transform research insights into actionable solutions for sustainability transformations [14,16,17**].

Land system scientists work with multiple, diverse actors, as well as their interests and viewpoints, as subjects, participants, partners and audience, to discover causes and consequences of land system change at multiple scales; and research on land systems has provided many insights regarding the complexity of factors driving land system change and the ubiquitous trade-offs of such changes [e.g. 18]. As an example, the scientific discussion around land-sharing vs. land-sparing, or intensification vs. extensification [e.g. 19,20] illustrate the mounting scientific evidence that can inform debates about multiple land system trajectories, but that simultaneously exposes the diversity of positions possible when discussing land system futures. Consequently, there is a need to approach the question of normativity through all stages of research. In this paper, we hence suggest normativity as *a process, not an endpoint*, where being normative involves a continued reflection on what, if anything, is normative about as well as in our research, who decides that and why are certain analyses presented.

Articulating normative positions in land system science requires engaging with such discussions to identify (normative) values, perspectives, assumptions, questions and outcomes of our research, but also to develop a more targeted engagement with the policy dimensions and potential implications of our research findings for people and for the planet. What, for example, are the societal and policy implications of our findings including trade-offs and synergies and who wins and loses from different land related options? As such, being normative is not about deciding universal values and goals. Nor is it necessarily a matter of deconstructing terms and discourses in order to expose the power of language. Rather we see it as a reflexive collaborative process acknowledging, deliberating on, and learning from the evolution of concepts, underlying values and assumptions, and shared

understandings that guide our research [21**] and how, in the end, to operationalize our findings for more sustainable and just land-use options for current and future generations.

Tackling land system change – wicked problems and normativity

Ours is not an appeal for a fundamental redefinition of the "identity" of land system science; land system science already exposes issues inherently resistant to clear definitions and easily identifiable scientific and/or political solutions requiring normative judgments. Land system changes are inherently complex, representing 'wicked problems' characterized by a diversity of values, worldviews, interests and decision-making powers, making final resolutions and generalizable solutions that apply in all cases very difficult to identify or achieve [22,23**,24]. Cross-scalar interactions between human and biophysical components create feedbacks and nonlinear responses, where uncertainty regarding benefits, risks and unintended consequences are rife, and impacts can vary across multiple and diverse social actors [e.g.25]. Land systems are thus characterized by mismatches among spatial, temporal, and administrative units and scales. Consequently, land systems science research efforts to tackle sustainability issues, including what this term actually implies, have laid bare many temporal, spatial, human and biophysical trade-offs, including which communities and interests are met by land change [e.g. 26] which also irremediably connects with interpretations of justice, through the lenses of researchers, policy makers and society at large.

Biodiversity conservation and forest fire management, for example, resist simple solutions due to the complexity and divergence of values and interests among diverse human and non-human stakeholders [23**,27]. Mansfield et al. [28**] illustrate how differing stakeholder worldviews complicate reforestation efforts in the coalfields of Appalachian Ohio. In this case, six different types of socio-ecological forests co-exist in the narratives of different stakeholders, in a manner where no forest can be decisively argued to be 'better' or more 'natural' than another. The question of how to reforest the coalfields then becomes a normative or political one, concerned with which actions and policies are beneficial or harmful to the survival of particular types of forest and the socio-ecological interests attached to these [28**].

Recognizing political implications and the role of normativity does therefore not require entirely novel research practices within land system science nor giving up scientific objectivity. Rather, it allows us to contribute to the illumination and solution of wicked social-ecological problems by addressing win-lose questions and socio-ecological trade-offs associated with, for example, different forest management pathways. The goal is not to deliver a single best solution regarding the 'right' kind of forest or other land-use outcomes – indeed, we should acknowledge that the identification of pertinent issues also reflect positioned perspectives on what count as important (by whom and for whom). Rather, participating in such discussions with systemic science-based insights provides land system science with an opportunity for transdisciplinary and transformative collaboration. By helping to elucidate the consequences and cascading impacts of land-based options for stakeholders and by laying out why we highlight these, land system science may help enable the enlistment of scientific insights and specific priorities in decisions taken, providing social actors as well as land system science with a source of legitimacy [23**]. As such, land systems science can gain valuable partnerships relevant to a sustainability science mainly concerned with solutions to social-ecological crises and play a constructive role in the current push towards making science a more active process of intervention in social-ecological transformations [15,16].

Land system science as normative science

Being a systemic science, the scientific insights contributed by land system science thus lend themselves well to normative discussions, but are also often in themselves the product of (often implicit) normative scientific and political processes. Insights from land system science on issues such as the governance of land resources, how certain concerns are prioritized (and why), and how to meet divergent demands on land systems, are often informed by underlying normative perspectives and assumptions that lead to prioritization of questions held by individual researchers and research communities. The UN's 2030 Agenda for Sustainable Development is likewise a normative selection of shared issues closely connected to negotiated political agendas interpreted through different lenses as real world problems. Acknowledging this in pursuit of objective science is a key challenge for land system science and an important step towards more seriously making the move from mainly understanding and diagnosing land system changes towards addressing the implications of such understandings for sustainable and just land-use solutions (17**, 29*].

There is no single answer as to how land system scientists could use their findings *for* sustainable solutions, or become more engaged in openly discussing the normative aspects of them, while simultaneously acknowledging the socio-political processes involved in determining which normative questions are to be addressed in the first place. In this light, we propose that to more explicitly deal with a land system science *for* sustainability, three general normative dimensions are useful to reflect upon:

1. *What are the different values and perspectives that underlie land system research?* Identifying underlying values and norms is required in order to explore how these manifest in our work. Values such as prizing healthy ecosystems, fostering social justice, equitable distribution of costs and benefits of land-use across stakeholders, resilience, the right to food or to food sovereignty, and biodiversity conservation are prevalent in land system science research. Trade-offs, for example, among food security, land rights, and biodiversity conservation frequently require identifying which of these objectives ought to be prioritized – especially as each maps differently onto human wellbeing, ecosystems and their services. Answering such questions requires that researchers make explicit the implicit values embedded in their choice of research questions, priorities, and/or approach – i.e., research focusing on biodiversity conservation absent evaluation of the associated food security trade-offs prioritizes, at least implicitly, the former against the latter. Dialogue on normativity within land system science could be fostered by making these values, priorities and perspectives and the particular research questions associated with them more explicit, and openly discussed and debated in our work. This will also help identify the research questions requiring deliberation of our normative positions. Normative issues are not equally relevant for all questions and modes of research (see further discussion in Dimension 3 below) but going through this exercise will expose that many, often assumed, objective questions within land systems science have normative aspects within them.
2. *What are the assumptions regarding how "best" to achieve prioritized goals*? In contrast to point 1 above, such assumptions reflect judgements about different options for reaching (normative) goals, such as food security for smallholder farmers. Indeed, much land system science research, e.g. in the land sparing versus sharing debate, or on specific land uses such as precision farming, organic agriculture, or agroecology, may build on insufficiently questioned assumptions that some options, practices or systems are superior to others. Establishing land tenure security for smallholders is, for example, often assumed to be the best way to secure their food security despite some evidence to the contrary [30]. Questioning

widely held assumptions about land system processes and their relation to prioritized solutions will help land systems scientists to identify normative assumptions and judgements in their research. This can facilitate a questioning of research findings, the design of new research exploring alternatives, as well as a more informed engagement into how we as positioned scientists influence our research findings. Considering these three aspects is highly important, if we want to make legitimate normative claims about how best to achieve various land-use related goals that intersect with just and sustainable futures.

3. *What should be the key research questions of a normative agenda in land system science?* Following from the previous two dimensions, this point highlights the opportunities arising from normativity as an integral part of the research process from beginning to end. A transparent reflexive deliberation that focuses on identifying underlying values and normative perspectives (Dimension 1) and assumptions (Dimension 2) within a given area of land system science research can lead to the formulation of normatively salient research questions, as well as richer interpretation of findings for policy makers and other stakeholders. It will also help us identify questions not necessarily requiring normative deliberations. Existing examples from land system science of commonly identified and shared normative research questions are "How can meat consumption be reduced?"; "Can agroecology feed the world?"; and "How can supply chains be made more sustainable for ecologies and people?" Identifying such questions will foster discussions pivoting around which are the most urgent to address, and why, when and where, and how then to proceed. A process that in turn facilitates the identifications of, for example, the most appropriate stakeholders to address for issues identified.

We propose that reflecting upon these three dimensions may help the land system science community identify if, to what extent, and how normative foundations, perspectives, assumptions and questions frame their research. Engaging with these three steps will, in other words, inherently push land system science towards being more normative or at least force the community to engage in a more structured discussion of when this is needed and how best to proceed. Such a discussion will also better reveal reasons why not all researchers in sustainability science, including land system science might wish to take this step. Normative deliberation is, as mentioned above, not equally important for all land system science questions and topics, which is one reason for such a position. In a recent survey among scientists engaged in Future Earth, the umbrella framework in which the Global Land Programme uniting many land system scientists is situated, more fundamental objections were revealed [31**]. Reservations about the actual responsibility of researchers for the implementation of scientific knowledge in society was dominant. Positivist and post-positivist scientists alike often stated that discussions of norms and values belong to the public sphere, and that scientists should not act as political actors but rather strive for impartiality to the largest extent possible. Indeed the potential loss of scientific objectivity by engaging with policy makers was explicitly raised as counterproductive to a normative agenda as science in this process risk being see as one opinion among many (11*,12,14*). A second reservation among scientists captured in the same survey centred on the need for humility about the capacity of scientific research to provide solutions for sustainability challenges, and therefore not privilege science when it comes to making societal decisions about how to solve such challenges.

Clearly it is our societies, collectively, that must fully engage and participate in decisions about the planet we want [32], yet we argue that to address sustainability challenges scientists must engage more deeply with normative challenges despite their reservations [31**]. Land system science has extensive knowledge, data and theories to contribute to policy debates, for example about issues such as the appropriate levels of land-use intensity (e.g. agricultural intensification and disintensification)

[17**,33**]. In addition, it is becoming increasingly hard to maintain that data and research speak for themselves without scientists taking an active stance about what data are sought, in communicating them and discussing their implications (e.g. 10,11*,12,14*,34]. Reflecting upon if, where, when, how and why to be more explicit about the implications of our research findings would help us better identify the appropriate stakeholders, policy makers, types of knowledge or fora in which to share and further catalyse our research. This reflection, in turn, could facilitate the desired engagement of stakeholders in the co-design and co-production of research questions and findings, as well as in the development of viable solutions [9,17**].

Conclusion

Research *for* sustainability is needed. The global environmental crisis and associated social implications and high-level societal goals, including the implementation of the UN's 2030 Agenda for Sustainable Development, require transformative social, economic and environmental decisions. Land system science is well placed to partake in this normative move. Founded on a systemic understanding of land-use and -cover changes, land system science revolves around understanding wicked sustainability problems resisting clear-cut solutions. Therefore, land system science does not need to restructure its fundamental scientific principles including that of objectivity, but rather, that it must engage in discussions concerning if, but also how and why, to become more normative regarding the implications of our findings for social-ecological sustainability challenges related to land.

In this paper, we have proposed three concrete steps to move land system science in this direction. The first two steps focus on identifying already present normative values, questions, perspectives, and assumptions in land system science and how these might hinder and facilitate a more normative science. The third step, then, highlights that a more deliberate and cohesive effort concerning which overarching normative research questions and goals land system science should strive to tackle might be necessary. As such, there is a clear opportunity for, and responsibility of, individual researchers, and supporting networks to help facilitate this process by explicitly addressing normative questions, supporting deliberation on the roles of science in sustainable development and evaluating candidate approaches. This paper therefore lays down a clear challenge to the land science community. For if this community is to remain an "interdisciplinary community of science and practice fostering the study of land systems and the co-design of solutions for global sustainability" [35], the normative implications of our work need to be increasingly and more integrally woven into land systems research practice.

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